National Research Council
Construction Technologies
Institute

WC 084 Coordinator, Italy

International Council for Building Research and Innovation, Working Commission 084

Georgia Tech College of Architecture

USA

CIB W 084
"Building Comfortable and Liveable Environments for All" Meeting

May 15- 16, 2008, Georgia Institute of Technology, Atlanta, Georgia, USA

ACKNOWLEDGEMENTS
The Organizing Committee thanks the reviewers who supported our papers:

Marcus Ormerod
SURFACE Inclusive Design Research Centre
University of Salford

M.Ormerod@salford.ac.uk

Ann Heylighen,
Dept. Of Architecture, Urbanism & Planning, K.U.
Leuven, Belgium
Ann.Heylighen@asro.kuleuven.be

Maria Kele
National Federation of Disabled Persons' Associations, Hungary
mariakele@googlemail.com

Marco Padula, Ricercatore,
CNR ITC US di Milano
padula@itc.cnr.it

Greger Sandstrom
KTH School of Architecture,
greger.sandstrom@jm.se

Rita Pomposini
CNR ITC Unità di Roma
rita.pomposini@itc.cnr.it

Silvio Sagramola
INFO – Handicap, Luxembourg
silvio.sagramola@pt.lu

Rita Newton,
University of Salford
R.Newton@salford.ac.uk

Wolfgang Preiser
University of Cincinnati, USA
wolfgang.preiser@uc.edu

Jan Paulsson,
Chalmers University, Sweden
jan.paulsson@2d-p.se

Fiorenza Scotti
University of Trieste (Italy)
scotti@univ.trieste.it

Maria Vittoria Giuliani,
CNR ISTC, Roma (Italy)
Vittoria.giuliani@istc.cnr.it

Valerie Fletcher,
Adaptive Environment, Boston, USA
vfletcher@adaptiveenvironments.org

Jorge Garces,
University of Valencia, Spain
jordi.garces@uv.es

Proceedings were prepared by CNR ITC: L. Biocca and A. Morini were in charge of the editing, while F. Buffone elaborated the layout

INDEX

VISITABILITY IN NEW HOME CONSTRUCTION: GEORGIA'S BEST OUTCOMES HAVE UNIVERSAL APPEAL

Rebecca Stahr
ASID, CAPS, CAASH
LifeSpring Environs, Inc.
Atlanta, USA
lifespring.env@mindspring.com

Keywords: Visitability, housing construction, EasyLiving Home^{cm}, basic home access

Abstract

On release, the movie, "2001: A Space Odyssey," conjured ideas that life exchange from another planet seemed possible. Presently, housing technology has not promoted universal home visitation between the human race, let alone other planets.

Technology has escalated leap years. Communication travels faster than the speed of life. Even well into the 21st century, is it possible that the most intelligent race on earth still hasn't mastered the simple act of visiting his neighbor equilaterally? Man has conquered outer space, why can't he conquer his neighbor's doorstep?

Georgia commands the nation's most concerted effort to change history by making every home visitable. The voluntary EasyLiving Home^{cm} program, the nation's first certification for visitable housing, has over 1000 certified new construction homes with basic access features for all to visit. A new Remodeled Home category is being added.

Whether voluntary or mandated visitable housing, new construction or remodeled homes, it is necessary for the fastest growing population of the 21st century to have these choices for quality of life. Builders and Remodelers of this century face enormous challenges to make homes for the most civilized society on the planet worthy of this assumption. Georgia's examples can provide a constellation of opportunities for this century, and beyond. Visitabilty doesn't have to be rocket science. Learn how visitable programming can create stellar housing in any community.

If anyone has ever seen or heard the movie, "2001: A Space Odyssey," notions of what life might be life in this year conjured thoughts that life from other planets just might inhabit Earth. Forty or fifty years ago, when humans first explored outer space, this was the thrust of a new frontier. Pop culture echoed this sentiment as credence was given to this possibility, while extraterrestrial elements were acknowledged in television shows, movies, comic strip publications and, sometimes even reportedly physically seen in remote towns such as Roswell, New Mexico.

Since that time, many explorations through the solar system aroused promise that life might even exist on other planets. Theories populate, but still proof of other world habitation is yet to be established.

2001, seven years in the distance, and planet Earth is yet to experience the validity of life on other planets. However, the US Space Program has made great strides in research and becoming familiar with expectations and conditions of other planets. As a world leader, US achievements in this arena are unparalleled. On Earth, conditions in our homes wane.

Comparatively speaking, the modern housing evolution paralleled the space exploration movement. At the end of World War II, veterans returned to the US in such great numbers that a new dimension of housing emerged. The American subdivision was born in Levittown, New York. As returning soldiers rejoined or started new families in great numbers, the result was a baby boom, and the rest is history. Today, as a result of these masses of soldiers returning to jumpstart their lives through marriage and subsequent children, the 78.5 million Baby Boomer population is a testament to the largest social phenomenon in US history affecting housing, and soon to be government, politics, health care, education, etc.

The houses built to provide shelter to these newly formed families were built to the model scale of suiting a 6' 1" male, 225 pound, able-bodied male who was easily able to reach high wall mounted cabinets, and climb steps often to second floor bedrooms and basements – at that time the population majority.

Fast forward to 2008. There is a vastly different scenario with the results of today's population demographic. The majority of single family home owners no longer fit the profile of the young, strapping WWII returning vet. The new population majority is fastly approaching the over 50 age and beyond, with 34.5 million over 65+ population expected to double in size by 2030. The fastest growing population is the 85+ segment, while the 100+ population is increasingly gaining momentum.

As the average home owner of the future is slated to be a single, older woman that lives alone, homes that currently exist, and those that are being built, are not suited physically to enhance, sustain, and promote quality of life for living in a home of choice for a lifetime. The majority of the US housing stock is over thirty years old.

To complicate issues, the majority of the population demographic wishes to remain independent in their own homes, rather than move elsewhere because their home does not support their aging needs of declining abilities. [1]

The dilemma exists of how to supply the need of an exponentially growing older population with housing in which they wish to remain, while ensuring their health, safety and welfare in a home that will promote quality of life, rather than one that inhibits a goodness of fit, efficiency and comfort.

The irony is that as the population ages and needs for the home to better support these changes, homes continue to be built larger with a multitude of levels without regard to the longevity of an occupants' ability to navigate and successfully live successful in such residences.

Over the years, technology has advanced so that robots can operate a home's utility without the necessity of human control. Home design and construction achievements such as disappearing large screen flat screen televisions, recessed movable walls, and automatic or remote control music and lighting systems all add additional excitement and entertainment to a home's livability. Yet, the basic access function of physical livability of a home has not changed since WWII vets returned home to raise those children that now occupy these tech-savvy homes.

It doesn't take a rocket scientist to determine that there is something self-defeating about this picture of the current state of housing in the US. Is it possible that the most intelligent race on earth still hasn't mastered the simple act of visiting his neighbor equilaterally?

Man has conquered outer space, why can't he conquer his neighbor's doorstep? Basic access to homes is an ongoing debacle that too many housing professionals have chosen to overlook due to poor judgment, unawareness, or ignorance.

Aside from the convenience of basic access that makes single family homes a pleasure to live in and enjoy, it is a sensible choice that does not complicates life for people of all ages and abilities.

For instance, a no step entry of ½" threshold or less allows baby carriages, furniture, appliances or wheelchairs through a home entry with ease, while eliminating any exclusivity to visitors who may find a higher threshold difficult to perform the simple act of entering or exiting a space. As a safety issue, this basic access feature could mean life or death for individuals with a mobility issue in the even of a fire where quick departure from a home is necessary and impediments could threaten escape. We can put man on the moon, but ½" or higher in a home entryway cannot be improved to promote universal access?

Typical reasons given by housing and construction providers claim accessible thresholds require too much cost, are not possible to prevent moisture from penetrating a home, and require too much effort to achieve. Those that have incorporated no step thresholds find they do not necessarily cost more, can be crafted to eliminate moisture penetration and, once understood how to achieve, make a home more saleable, create greater value and resale opportunities by opening a home's potential attractiveness to new markets.

Once everyone is included in a home's easy access, maneuverability from space to space is also important to allow all to visit and enjoy a home's features. Door widths wider than 32" to allow passage for wheelchairs, large items or a mother carrying children or groceries makes good sense for people of any age. Emergency gurneys should be able to clear any door passage within a home to assist anyone in the event that medical aid is needed for someone with health issues. But in many of yesterday's and today's homes, doors that are just 24" wide prevent some of life's basic activities from happening.

Even average size people find narrow doors inconvenient, not to mention the increasingly growing population segment battling obesity or a care giver supporting a loved one through a home to provide necessary intervention when unexpectedly needed.

At the very least, the basic activities of daily living on the main level of any home should be a requirement for any decent form of life to exist. Animals in their zoo habitats expect no less. Yet in today's McMansions still being built on a daily basis, 24" wide door widths, multiple floor elevation changes restrict the normal course of activities of daily living to some degree for everyone. One of the most degrading limitations of basic access is a home where easy access and passage are allowed, but to restrictions exist on use of the necessary facilities. Anyone who has ever experienced the discomfort of having to be ill in public without privacy to respond to the normal forces of bodily functions, or was in need of personal care without access to quarters permitting solace or accomplishment of the most sensitive issues of life can fully appreciate what human rights can truly be.

Anyone growing up in a home where bathrooms were shared by multiple family members can relate to limited bathroom access strictly from a time convenience issue. But, not being able to have bathroom privileges at all because of its absence or inaccessible features is deplorable.

Winston Churchill said, "We shape our houses, and then they shape us." Even well into the 21^{st} century, is it possible that the most intelligent race on earth still let's the home structure dictate what and how a person will live in it, versus people determining how he home will serve the persons living in the home.

Georgia's EasyLivng Home[cm] program comes to the rescue. In the early 2000's a group of activists and home builders fought over whether access features to deliver visitability should be legislated or prevented from being included in new home construction. After untold heated arguments, the groups actually joined forces, along with independent living, city planning, disability, social policy and medical groups to form a coalition that together agreed that basic home access could be voluntarily accepted by new home construction builders because it brought value and good sense to society. The three basic access features included and promoted in the program are:

A. One no-step entry with a threshold of less than ½" high from a firm, accessible route into any home entry.
B. All interior passage doors with 32" or greater clear space on the home's main level
C. A full bed and bath with enough maneuverable space at each critical fixture area on a home's main level that also provided adequate space for other living needs

The program was initially accepted widely in the Atlanta area, the coalition's headquarters, but has since spread to other Georgia towns. Currently the program is being replicated in other states, with Texas, New Hampshire, and Virginia registered with EasyLivi+ng Homes[cm.] Upcoming states include Tennessee, Delaware, Kansas, Missouri and South Carolina showing interest. The media has favored the program as being news worthy, often featuring homes with the three basic access features, as well as testimonials of homeowners that enjoy living in these homes. Builders registered with the program find their homes sell faster with these features, and are able to highlight the homes to greater marketing advantage over the competition. Because EasyLiving Homes[cm] accommodates people of all ages and abilities, the features introduce universal design to the menu of choices that homeowners have when planning new homes. They often recognize the value and convenience that going beyond basic access provides. In 2006, the Universal Design Alliance, a coalition member, created and produced the South's first EasyLiving Home[cm] that was also a Universal Design Demonstration Home. Open to the public for three weeks, over 1000 people toured the 6300 square foot home with over 38 universal design features, including the three EasyLiving Home[cm] basic access features. Not only was the response overwhelmingly positive, but a research tool implemented during the home's tenure proved that people of all ages preferred the presented features. See Table 1, 2, and 3.

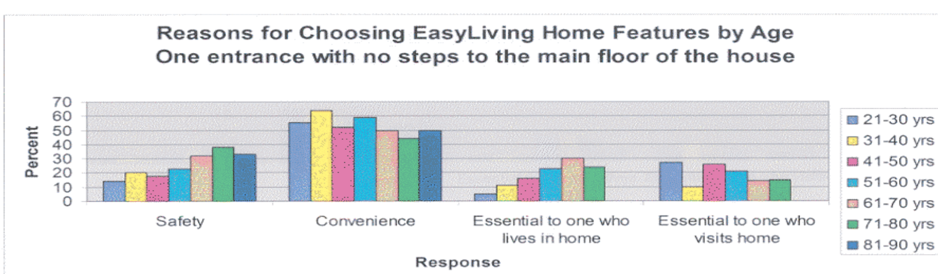


Table 1 *Livable Lifetime Show House Research Toola, 2006*

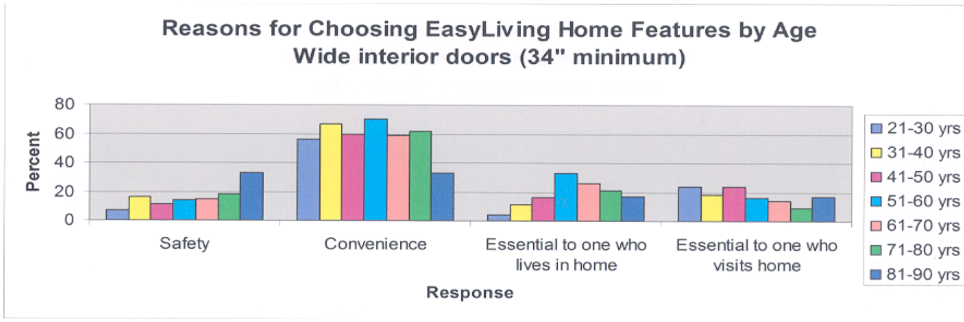


Table 2 *Livable Lifetime Show House Research Toolb, 2006*

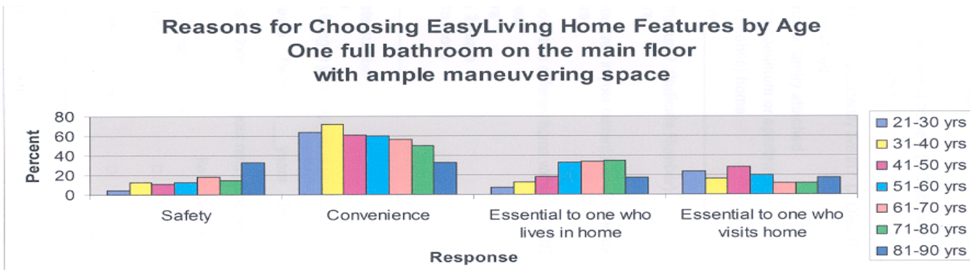


Table 3 *Livable Lifetime Show House Research Tool c, 2006*

To date, this project is still getting media coverage through book publications, conference presentations, and workshops and seminars. The photos impact everyone through the assertion that access is beautiful and seamless when done correctly. Builders and Remodelers recognize their opportunities to translate the techniques accomplished in the demonstration home within their own products.

With the overwhelming acceptance of EasyLiving Home ^{cm} features by the public, a new category of program participation is being developed for Remodelers to be unveiled soon.

Over 1000 certified new construction homes in Georgia, with hundreds and thousands more to follow due to program replication in other states, visitability will surely become a stellar attraction in society’s housing in the near future.

As the US continues its exploration in Outer Space, progress will continue to be made on the home front with each new EasyLiving Home ^{cm} that is certified. Homes of the future will continue to include all the new technology bells and whistles to delight people of all ages. But, as our country ages, people continue to work longer, and personal and family time becomes more precious, quality of life will take on deeper and higher meaning. Knowing that three basic access features developed for the EasyLiving Home ^{cm} program will be delivering five star living for millions of people for decades to come is a far better reward than any technological “bell or whistle” one could ever hope to experience. But perhaps the proof will be, in time, when we do start to witness life from other planets making their presence known here on Earth, it will be evident that no McMansion could have lured them here. They will undoubtedly have heard about our great housing protocol where on Earth, every home is visitable, for any visitor in the universe.

References

He. W. Sengupta, Michael Velkhoff, V.A., and DeBarros, K.A. (2005). *65+ in the United States:2005.* U.S. Census Bureau, Current Population Reports, P23 – 209, Washington, D.C.: U.S. Government Printing Office, 2005, pg.13

ACCESS FOR PEOPLE WITH DISABILITIES IN NEW ZEALAND THE DESIGN STANDARD AND ITS RELATIONSHIP WITH THE BUILDING LEGISLATION'

Hamish Kenneth Handley
Senior Adviser, Building Standards Group
Department of Building & Housing
Wellington, New Zealand
hamish.handley@dbh.govt.nz

Keywords: 'people with disabilities' 'standards' 'New Zealand building code'

Abstract

A design Standard for access for people with disabilities in buildings was produced in New Zealand in 1985. At that time there was no national building code and the Standard was adopted under the existing Disabled Persons Community Welfare Act. The Act listed the buildings required to be accessible, and this list includes almost all buildings except housing.

The Building Act of 1991 established the foundation for a national building control regime and a national Building Code. The Act stated that buildings must make 'reasonable and adequate provision' for people with disabilities in those buildings listed in the Disabled Persons Community Welfare Act. The Standard was given the status of a means of compliance with the Code. Consequently, access matters were brought directly into the mainstream of building and construction.

The Act also had provisions for upgrading access and facilities for people with disabilities whenever an existing building underwent a change of use or an alteration.

Amendments to the legislation and the Standard have been made since 1991, but the fundamental relationship has remained unchanged. A feature of the relationship is that the building legislation has been accepted as providing compliance with the human rights legislation.

The first comprehensive design standard in New Zealand for access for people with disabilities in buildings was published in 1985. It was entitled NZS 4121:1985 'Code of practice for Design for Access and Use of Building and Facilities by Disabled Persons'. There had been an earlier and simpler version of NZS 4121, published in 1971, that provided guidance for accessible facilities without giving full design information. The Standard's requirements centred on wheelchair users but it also contained provisions for people with visual, hearing and ambulant disabilities.

The Disabled Persons Community Welfare Act

New Zealand is governed by its Parliament on a national basis. There are no state or federal legislative bodies, although territorial local authorities have powers under national legislation to make bylaws and set planning standards.

The first legislation in New Zealand to require accessible buildings was the Disabled Persons Community Welfare Act of 1975. NZS 4121:1971 was cited in the Act as a 'means of compliance'. At that time there was no national building code and NZS 4121 had been adopted on a variable basis by the territorial local authorities responsible for building controls. The concept of providing access for people with disabilities was relatively new and met with a certain amount of opposition from designers and building owners. There was also reluctance by some territorial local authorities to accept the concept of the new Standard. The citing of the Standard in legislation gave it a national status that was not possible by any other enforcement mechanism.

The Disabled Person Community Welfare Act listed the buildings that must be acceptable in its section 25. The list was extensive, going from (a) 'Land, sea and air passenger terminals' to (i) 'police stations' to (m) 'medical and dental surgeries" and on to (z) 'Industrial buildings employing more than 10 persons'. These were considered to be 'buildings to which the public are to be admitted, whether on payment or otherwise.'

Effectively the list included all buildings except private houses and apartments and small industrial buildings. Presumably the Government of the day considered that people working in small industrial buildings always needed to be physically able to do their work.

The Disabled Persons Community Welfare Act also contained provision for upgrading the access in existing buildings. The Act used the term 'major

reconstruction' to define when upgrading would be required. Disputes over what constituted major reconstruction could be referred to the Department administering the Act for resolution.

The Building Act 1991

The Building Act of 1991 set the administrative framework for a national building code to be administered and enforced by the territorial local authorities. One of the stated principles of the Act was to:

Provide, both to and within buildings to which section 25 of the Disabled Persons Community Welfare Act 1975 applies, means of access and facilities that meet the requirements of that Act to ensure that reasonable and adequate provision is made for people with disabilities to enter and carry out normal activities and processes in those buildings.

Under the Act, all building work throughout New Zealand had to comply with the Building Code. Neither territorial authorities nor government agencies could put in place building controls (such as codes of practice) that required higher levels of performance than the Building Code.

The clear statement about access and facilities for people with disabilities in the Act has meant that there has been no conflict with the Human Rights Act in terms of how buildings are constructed. The Building Act and Code are accepted as setting the appropriate standard. This has been a very importance result because some countries have a situation where buildings constructed in accordance with the building code have been appealed as inadequate under the human rights legislation.

Including access requirements in the new 'building' legislation meant that access for people with disabilities was given equal importance to all the other building requirements. Previously, with access in social welfare legislation, it did not have the same impact on the building industry.

The Building Code & the compliance documents

The Building Code was contained in Regulations issued under the Act. The Act provided for a building code 'prescribing the functional requirements for buildings and the performance criteria with which buildings must comply in their intended use'. In other words, this was to be a performance-based building code.

The Code contained 35 clauses, covering the range of building performances necessary to meet New Zealanders' expectations of building performance. A

deliberate decision was made not to have a separate 'people with disabilities' clause in the Code. Consequently, access provisions were included in 9 of the Clauses, the major ones being D1 'Access Routes' and G1 'Personal Hygiene'. Other Clauses contained requirements for accessible lifts and accessible reception counters, as two examples. 'Acceptable solutions', or means of compliance documents, were produced for all the Code clauses. The solutions produced for access and facilities for people with disabilities followed closely the requirements of NZS 4121:1985. The intention was that the acceptable solutions would have essentially the same requirements as the Standard but in a more 'bare bones' form, without the comment and explanations.

The requirements of the Standard were reviewed, however, and accessible toilets in the relevant compliance document were increased in size from 1500 x 1700 mm to 1600 x 1900 mm as it had become apparent that the original size was too small for easy use. The 'accessible stair' landing length was reduced from 1200 mm to 900 mm as longer landings consume an appreciable amount of space in plan even though they can be advantageous for emergency egress of people with disabilities.

The Building Act 1991 & the Standard

The Act gave a formal status to the Standard as a compliance document by way of an amendment to s25 of the Disabled Persons Community Welfare Act. The amendment to the latter Act stated that NZS 4121 'and any amendments thereof' shall be 'deemed to be one of the documents establishing compliance with the building code'. This was the only Standard referenced in the Act and its status in this regard was a reflection of the importance of the Standard to the disability sector.

The Code & the Standard

The new Code generally followed NZS 4121 in terms of where and when facilities and access should be provided. The 9 clauses with performance requirements for people with disabilities reflected the various provisions already being made by the Standard. One of the major changes was in the requirements for lifts in buildings. The Standard contained the requirement that:

in the case of a two-storey building where the gross floor area of the upper floor is less than 400 m^2, or a three-storey building where the gross aggregate floor area of the upper floors is less than 500 m^2, a lift need not be provided.

However, lifts were required in buildings of 4 or more storeys and in buildings of 2 or 3 storeys that were used for public reception area of banks or central and local government offices, medical and dental consulting rooms, and public libraries.

The Building Code contained a lift requirement based on 'design occupancy'. The reason for the different approach from the Standard was that it was considered more logical to have the lift requirement based on numbers than on area. In practice, there is no real difference when a particular building use is factored into the calculation. The Code said a lift is to be provided when:

buildings are two storeys high and have a total design occupancy of 40 or more persons on the upper floor, or

buildings are three storeys high and have a total design occupancy of 50 or more persons on the upper floors

Design occupancy is determined using the fire design occupant density figures. On this basis, an office building with a design occupancy of 40 will usually have an area greater than 400 m^2. Having two methods of deciding the need for a lift is quite useful though. There are sometimes buildings with a very low occupancy on a large upper floor where a lift would be superfluous, such as some types of industrial building.

Upgrading existing buildings

Making new buildings accessible, in terms of following the means of compliance documents, should be relatively easy from a design and construction point of view (although mistakes are still made and very few buildings are 'perfect'). Existing buildings can be more difficult. The upgrading of existing buildings is a very important part of making a country's building stock accessible for people with disabilities.

The Building Act 1991 contained requirements for upgrading when a building 'consent' was issued by the territorial authority for alterations or the building underwent a change of use. In both these situations, the territorial local authority had to be satisfied that:

the building will comply with the building code for means of escape from fire, and for access and facilities for use by people with disabilities [for buildings covered by s25], as nearly as is reasonably practicable, to the same extent as if it were a new building

The territorial local authorities took some time to understand their decision-making role in regard to upgrading. This sort of decision can be difficult to make because providing access and facilities in an existing building may entail more cost for the owner. The Building Industry Authority (the BIA), which administered the Building Act and Code in the 1990's, made a number of formal 'determination decisions' in regard to what upgrading was 'reasonably practicable'
when the owner and the territorial authority could not agree. Most of these involved the installation of a lift in a two storey building.

An upgrading decision appealed to the Courts (involving fire upgrading) gave useful guidance to what was meant by 'reasonably practicable'. The judge said that it was a 'weighing exercise', balancing the advantages (in terms of access or fire safety) against the 'sacrifices' the building owner would need to make. The BIA in its determinations followed this approach, by looking at the potential benefits for people with disabilities, such as a wheelchair user being able to work on an upper floor, balanced against the 'sacrifices'. The specific improvements to the access should be appropriate to the type of building. Sacrifices can include loss of space or the inconvenience of a ramp, as well as the cost of undertaking the work. What is reasonably practicable is not the same as what can physically be done in construction terms, because almost anything can be constructed if money is no object.

Over the 15 year period since the Act came into effect, access in older buildings in New Zealand has improved markedly. There are, for example, few shops where wheelchair access is not available from the footpath. Some of the old bank and insurance buildings, with a flight of steps, provide difficulties. However, often when a new lift is installed in these buildings, it can be taken down to footpath level.

A review of the Standard was undertaken over 2000/2001 by a committee convened by Standards New Zealand. The new version was entitled NZS 4121:2001 'Design for access and mobility – Buildings and associated facilities'.

The committee representation included the disability sector, the professional architects, local government officials, commercial property owners, and the BIA.

The new version of the Standard followed the format of the 1985 version and changes were mainly in the form of:

- more comment explaining the need for particular requirements
- a whole section on accessible accommodation, including motel kitchens
- a new section on outdoor public spaces. Most of this section follows general Universal Design principles.
- more complete consideration of those with a visual disability and of new hearing assistance technologies.
- inclusion of the relevant parts of the Building Act and Building Code as an Appendix.
- an Appendix dealing with upgrading existing buildings

The lift requirement method for two and three storey buildings, based on the area of the upper floors, was unchanged.

While the new version of the Standard was being finalised, the BIA undertook a review of the Building Code 'personal hygiene' compliance document to ensure it would have identical construction details as the Standard.

The Building Act 2004

A new Building Act was promulgated in 2004 to replace the 1991 Act. The new Act was developed to cover new issues, such as sustainable buildings, and to better allocate responsibilities for building work. The provisions relating to access for people with disabilities were carried over almost without change from the 1991 Act to the new Act. A 'person with a disability' is defined in the Act and the definition includes 'a physical, sensory, neurological, or intellectual disability'.

The status of NZS 4121 as a means of compliance with the Building Code remained the same. The fact that neither the disability sector nor Parliament saw a need to make changes to the structure of the legislation relating to access to buildings was a strong endorsement of the effectiveness of the original legislative provisions. See Table 1 below for a summary of the access provisions of the Act.

In developing the new Act, a Universal Design approach could have been taken instead of the 'access for people with disabilities' focus. However, the argument was accepted that the empowerment achieved through the building legislation for people with disabilities should not be diluted by an 'access for everyone' approach.

The 2004 Act abolished the former Building Industry Authority and established a new Department of Building and Housing (the DBH). A section in this Department is responsible for administering the Act and Code. The Department has set up an access advisory panel, with members from the disability sector, government, territorial authorities, and architects to provide advice on access matters. It also answers queries from the building industry and territorial authorities about the provision of access and facilities, particularly the upgrading of existing buildings. The DBH undertakes determination decisions in a similar manner to the former BIA and these can be seen on its website, www.dbh.govt.nz

The Future

No particular changes to the Building Act or the Code in relation to access are being considered at the moment, but a general review of access and compliance is planned for the coming year which may identify areas for improvement. Suggestions have been made for some minor amendments to NZS4121:2001 but there is a strong view that the Standard is best left unchanged as then it becomes more familiar to the building industry.

The need for housing to be accessible to some extent, or to be easily modified, is being discussed. The UK requirements provide a good reference point in this regard and some level of accessibility for housing is receiving support. Houses and private apartments are not covered by Schedule 2, although the Schedule does refer to buildings 'to which the public are to be admitted, whether for free or on payment of a charge'. Most apartment buildings, even the common areas, are not open to the public.

Building Act 2004	Provision of access & facilities for people with disabilities
s3 Purpose	buildings are to have attributes that contribute to the physical independence of people who use them
s4 Principles	reasonable and adequate provision to be made for people with disabilities
s112 Alterations	when an existing building is altered, its provisions for people with disabilities must be upgraded to new building standards 'as nearly as is reasonably practicable'.
s115 Change of Use	when an existing building has a change of use, its provisions for people with disabilities must be upgraded to new building standards 'as nearly as is reasonably practicable'.
s118 Access	reasonable and adequate provision to be made by way of access and facilities in any building to which the public are to be admitted for people with disabilities expected to visit or work in that building and carry out normal activities and processes.
s119 NZS 4121	NZS 4121 is to be taken as a compliance document

s120 Access symbol	International Symbol of Access to be displayed[1]
Schedule 2	Buildings to which the requirement for access and facilities for people with disabilities applies

Table1 *Building Act access provisions*

[1] The International Symbol of Access is the stylised symbol of a person in a wheelchair, used around the world to indicate accessible facilities. It was adopted by the World Conference of Rehabilitation International in 1969

TOWARDS INCLUSION: A CRITICAL APPRAISAL OF LEGISLATION AND THE NATIONAL BUILDING REGULATIONS IN SOUTH AFRICA

Catherine Karusseit
University of Pretoria, South Africa
catherine.karusseit@up.ac.za

Amanda Gibberd
Gauge, South Africa
info@gauge.co.za

Keywords: South Africa, constitution, legislation, building standards, inclusive environments

Abstract
Since the demise of Apartheid in 1994 South Africa has undergone tremendous transformation, both political and societal. Evidence of this is South Africa's constitution, which was adopted in 1996 and is considered to be one of the most progressive in the world. Its essence is rooted in the qualities of equality and diversity. Yet, despite the inclusive nature of changes made to the Constitution and related legislation, the National Building Regulations, in particular Part S, Facilities for disabled persons, has eluded revision and remains a discouragingly exclusive document. This paper documents the inclusive nature of South Africa's new Constitution and related legislation. Against this context Part S of the National Building Regulations is critically appraised. Research is conducted by means of a literature review and interviews with relevant experts, thereafter, the pertinent documentation is critically analysed. Finally recommendations are made in the endeavour to achieve a built environment that is truly inclusive.

1. Introduction
Our buildings, neighbourhoods and cities are cultural artefacts shaped by human intention and intervention, symbolically indicate to society the place held by each of its members. According to Weisman (1994: 1-2) access to space is fundamentally related to social status and power, and changing the allocation of space is inherently related to changing society. Space is, thus, a social construct; the spatial arrangements of our buildings and communities reflect and reinforce the nature relations in society. This is particularly evident in South Africa, since the democratic elections in 1994 our country has undergone a number of changes politically and socially. Architecture is a means to express this change, from an exclusive society to one that is inclusive. Deplorably, only a handful of the buildings designed and constructed since 1994 have truly embraced and reflect the inclusive nature of our Constitution. This can be attributed to a number of factors, the most glaring being that the National Building Regulations (NBR) and Part S of the South African Standard Code of Practice (SABS 0400) was last revised, pre-democracy, in 1990. The result is a dis-juncture between the new Constitution and its associated Acts and the NBR and SABS 0400.

This paper documents the inclusive nature of South Africa's new constitution and related legislation. Against this context Part S of SABS 0400 is critically appraised. Research is conducted by means of a literature review and interviews with relevant experts, thereafter, the pertinent documentation is critically analysed. Finally recommendations are made in the endeavour to achieve a built environment that is truly inclusive.

2. Legislative provisions in acts other than the National Building Regulations and Building Standards Act

South Africa's Constitution, *one law for one nation* (Constitution 2004)*,* is considered one of the most progressive in the world. In essence it is rooted in the qualities of equality and diversity. People with disabilities are referred to specifically.

2.1 Constitution of South Africa, 1996

The Constitution was first adopted on 8 May 1996 and amended on 11 October of the same year by the Constitutional Assembly. It was signed into law on 10 December 1996. The process of drafting the Constitution involved as many South Africans possible and took two years. The Constitution is, thus, an integration of ideas from ordinary citizens, civil society and political parties represented in and outside of the Constitutional Assembly (Constitution 2004).

2.2 Bill of Rights and Legislative Acts

Chapter two of the Constitution contains the Bill of Rights. The sections of the Bill of Rights (Constitution 2004), as well as, legislative acts other than the NBR and National Building Standards Act, that pertain to the built environment listed in Table 01 below:

Legislation	Year	Title	Premise
Bill of Rights	1996	Section 7 Rights	-enshrines the rights of *all* South Africans, affirming the values of human dignity, equality and freedom.
		Section 9 Equality	-everyone is equal before the law. -the state may not unfairly discriminate on one or more grounds, including disability.
		Section 10 Human Dignity	-everyone has inherent dignity and the right to have their dignity respected and protected.
		Section 24 Environment	-everyone has the right to an environment that is not harmful to their health or well-being.
Act	1993	Occupational health and safety Act (Act No 85 of 1993)	-affects all employers, people in employment, and people not in employment but who are affected by the employer's undertakings, which includes people with disabilities. -thus an employer's responsibilities in terms of section 8(1) are to provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.
Act	1998	Employment equity Act (Act No 55 of 1998)	-to achieve equity in the work place by*:* (a)promoting equal opportunity and fair treatment in employment; and (b)implement affirmative action measures to redress the disadvantages in employment experienced by designated groups.

			-people with disabilities are included in the definition of "designated groups" in the Act. (Employment Equity Act, 1998: 12-14)
Act	2000	Promotion of equality and prevention of unfair discrimination Act (Act No 4 of 2000)	-addresses the wider aspect within which sites, complexes and buildings should be made usable by people with disabilities. Section 9 states that no person may unfairly discriminate against any person on the ground of disability, including – (a)denying or removing any supporting or enabling facility necessary for their functioning in society; b)contravening the code of practice or regulations of the South African Bureau of Standards that govern environmental accessibility; c)failing to eliminate obstacles that unfairly limit or restrict persons with disabilities from enjoying equal opportunities or failing to take steps to reasonably accommodate the needs of such persons. (Promotion of Equality and Prevention of Discrimination Act 2000: 7)
White Paper	1997	Integrated National Disability Strategy	-is government's thinking on what it can contribute to development of people with disabilities and to promote and protect their rights (de Villiers 1997: i) - the vision is *a society for all,* people with disabilities form a natural and integral part of such a society, which is in line with the human rights vision of the United Nations (de Villiers 1997: 18) (South Africa has recently signed the United Nation's Convention on Disability). -key policy areas were identified and policy objectives, strategies and mechanisms for action were developed -legislation is seen as crucial, thus there is a need for revision and amendment of existing legislation, so that ultimately it should comply with and give substance to Constitutional requirements (de Villiers 1997: vi).

Table 01: Bill of Rights and Legislative Acts pertaining to the built environment.

3. National Building Regulations and the South African Standard Code of Practice 0400

The purpose of Part S *Facilities for disabled persons* of the NBR and its associated SABS 0400 guidelines is a document to be used by a local, state or national government to control building practice, through a set of statements of acceptable minimum requirements of building performance (SABS stakeholders workshop 2007). The document is structured into Parts dealing with various aspects of a building. Each Part contains a section with the relevant regulations (stated in legal language), which are then followed by *deemed-to-satisfy* guidelines.

The White Paper, compiled in 1997, already then, recognised that the standards prescribed by the NBR require review. Yet change has been slow to be realised, which is due to a number of factors. In order to revise any Part of the NBR and SABS 0400 the following steps have to be taken: stakeholders are consulted, then feasibility and impact studies are conducted, thereafter the proposed amendments are published in the government gazette and finally the amendment is legislated. Geszler (2008), technical advisor on building regulations at the SABS, commented that this process is cumbersome and hampers the uniformity of implementation.

This is one of the reasons Part S has not changed, it is a logistical one and has nothing to do with the changes in legislation. The regulations were published as a total document, where the whole document had to be revised and changed in order to update any single part. It has taken this length of time within the SABS to agree to publishing the different Parts separately so that they can be updated separately.

Changes to NBR are also assessed in terms of financial implications to building costs with the stipulation that they should not increase building costs. Stated in the Preface of the SABS 0400 (1990: 3) "...[as] these regulations were originally introduced as a long-term anti-inflationary measure it is obvious that they should not increase the overall cost of building." In this regard, it was inferred from comments by Geszler (2008) that a revised and more rigorous Part S would result in elevated building costs. This misconception would certainly impede the drive for revision and change. Moreover, this is unfounded since the contrary is clearly stated in the White Paper (1997: 30) that purposely designing inclusively only increases over building costs by 0.2% which are regained in the long term.

The SABS 0400 was last revised in 1990, in the mean time the NBR as a whole is currently being updated and split into its constituent parts. This has presented the opportunity to bring in changes to Part S guidelines/standards, which has been in the process of revision since 2000, if only due to the SABS processes. Although the regulation itself is not being changed, the wording can be re-interpreted in the light of the new Constitution. As a result a new version of Part S, to be part of the new South African National Standard (SANS) 10400, has been drafted. The draft still needs to be approved by the Department of Trade and Industry (DTI), before it can be deemed to be in compliance with the requirements of Part S of the NBR; issued in terms of the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977). This part of SANS 10400 will cancel and replace the corresponding parts of the first revision (SABS 0400) and absorb the SABS 0246.

3.1 Part S

Part S of the SABS 0400 includes the regulations and *deemed-to-satisfy* standards/guidelines, which are standards setting out national requirements for an accessible built environment. Part S is the construction industry's reference-point on access for people with disabilities, whether adults or children. Part S is critically appraised below (c.f. 4).

3.2 0246

The SABS 0246 *Accessibility of buildings to disabled persons* was compiled in 1993 as voluntary guidelines/standards in to be consulted as a supplement to the SABS 0400 Part S.

The SABS 0246 establishes the minimum design requirements for access to and circulation in buildings and related facilities.

4. Critical appraisal of SABS 0400 Part S

This section adopts an unpublished paper by Gibberd (2006) as a point of departure and examines the SABS 0400 Part S, in the light of the preceding discussion (c.f. 2 & 3), as they apply to people with disabilities and explains the legal anomalies.

4.1 Defining the population (S1)

The common misconception is that Part S of the Building Regulations is the only part that affects people with disabilities. However, other parts also relate to environmental access for people with disabilities: Parts D (Public safety), Part J (Floors), Part K (Walls), Part M (Stairways), Part N (Glazing), Part O (Lighting and Ventilation), Part P (Drainage), and Part T (Fire Protection).

Currently, Part S gives no direct definition of disability. It does not distinguish between adults and children. It is inferred within the Regulations that a person with a disability is a person who falls into one of the following categories of people: in wheelchairs, who are able to walk but unable to use stairs and with impaired vision. South African statistics, from 1996 and 2001, demonstrate that whilst many people relate disability to wheelchair use, and commonly solely to people with paraplegia, (who are only a fraction of the wheelchair-using population), this is inaccurate. The Part S should highlight the fact that other groups of people with disabilities have problems with the built environment, and have just as much right to experience non-discrimination, according to the Constitution (c.f. 2), as people with paraplegia.

4.2 The application of Part S (S1)

Part S applies to 79% of building occupancy categories. Within the exclusions, there is one particular exception (SABS 0400 1990:151), which is written in such a way that it is extremely nebulous. This regulation infers that if a building, of any type, is designed to be high enough off the ground, and the relationship of its height from the ground with its surface area is calculated and found to be more than the total surface area then no facilities for people with disabilities need be included. This loophole contravenes section (c) of the *Promotion of equality and prevention of unfair discrimination Act* (c.f. Table 01).

4.3 The *deemed-to-satisfy* guidelines (S2)

The *deemed-to-satisfy* guidelines introduces guidelines/standards with the commentary that even though people with disabilities should be able to play a full role in society, "...economic considerations may make it difficult to provide the facilities in all buildings. This fact has been acknowledged in the regulations in the form of an exemption from the requirements in the case of certain buildings..." (SABS 0400 1990: 152). This commentary provides most designers with all the motivation they require to disregard environmental access whenever they choose to do so. It also is seen to validate the misconception that including access features into the design of a building increases the building costs (c.f. 3).

4.4 Facilities to be provided under Part S (S2)

Part S requires that certain facilities should be provided to make a building accessible, but the scope leaves some significant gaps. This includes scope to create access through any door, not necessarily the main entrance. Thus segregated entrances to buildings, which is a form of architectural apartheid, appears to be legal in post-apartheid South Africa.

Another requirement indicates that seating must be provided for people in wheelchairs in an auditorium; but there is no requirement that they must be able to see what is taking place. Yet another suggests that if less than 20 toilet facilities are provided, none have to be accessible to people in wheelchairs, even though they are able to get into the building.

The standards given in the SABS 0400 are minimum's, however design practitioners, developers and the construction industry typically apply them as maximums. This is problematic in that the standards are grossly outdated and have seemingly been compiled with a lack of understanding of the problems encountered by people with disabilities in the built environment.

It is the SABS 0246 that supplies practitioners with sound design principles (although here too a number of recommended dimensions are still the minimum) on access for people with disabilities, that when applied are not only advantageous to the user with a disability but to the entire diverse population of South Africa. However, the existence of this document is not widely known amongst practitioners. The SABS 0246 provides a more comprehensive, detailed and illustrated document than the SABS 0400. A number of areas not covered by the SABS 0400 are included: lighting, signage, controls for use by people with disabilities, signals and warnings for people with impaired sight or hearing and additional notes and diagrams on the design and layout of a wheelchair accessible water closet.

4.5 SABS legal clarification

Although the standards/guidelines of the SABS 0246 are more inclusive than Part S, the SABS 0400 legal clarification indicates that where conflict arises between other SABS standards and its *deemed-to-satisfy* requirements, the *deemed-to-satisfy* requirements prevail, even though they are more outdated than other SABS standards.

4.5.1 Legal clarification in relation to government buildings

The SABS provides the following legal clarification with regard to government buildings, according to the NBR and Building Standards Act 103 of 1977, the state may be exempted from the provisions of SABS 0400 if the Minister of Trade and Industry, in concurrence with the Ministers' of Defence, Law and Order, and Justice, is of the opinion that the erection of any building or class of building by or on behalf of the State is in the interest of security of the country. The State may also be exempted by virtue of economic considerations, necessity or expediency, either generally or in any particular case.

4.5.2 The status of Human Rights legislation

The aforementioned exemption does not hold if an Act of Parliament has made another SABS Code of Practice mandatory (Standards Act 29 of 1993, Section 31 (1) a). Most construction practitioners are currently *not* aware of *The promotion of equality and prevention of unfair discrimination Act* (c.f. Table 01). Although the legal status of this Act is still being tested, recent court cases that have been heard in equity courts have resulted in people with disabilities being awarded compensation for inaccessible buildings and apologies proffered by the offending party. It would appear that the Constitution and this Act are indeed taking precedence over the NBR and its associated acts.

4.6 Enforcement

Enforcement of the NBR is controlled at a micro level by the local building council and their inspectors, however, Geszler (2008) stated that these inspectors often lack the skills to make sound judgements. The White Paper (de Villiers 1997: 30) concurs, "...unfortunately these regulations have been badly administered and monitored." In this regard the White Paper (de Villiers 1997: 30) lists a number of specific problem areas that need to be addressed, including planning professionals who fail to understand and implement the specific details required in providing a barrier-free environment and developers who do not have clear policies on environmental access.

4.7 SANS 10400

Although the proposed SANS 10400 (c.f. 3) is yet to be legislated, the draft document was evaluated in the light of the failings of its predecessor. In relation to Part S, there is no change in the regulation itself and unfortunately the ambiguous nature of application has been not addressed. However, an inclusive definition of disability has been outlined, along with other definitions relevant to the design of an inclusive environment. The meaning of the standard is brought in line with the Constitution and the Promotion of Equality and the Prevention of Unfair Discrimination Act. In addition, the current *deemed-to-satisfy* guidance will be removed and be replaced with the more comprehensive and accessible SABS 0246.

5. Recommendations

It is evident from this study and as it is stated in the White Paper (de Villiers 1997:30) Part S of the SABS 0400 urgently requires review. The document is outdated, seemingly compiled with a lack of understanding of the real needs of people with disabilities and not in line with inclusive nature of the Constitution. The following recommendations are made:

- that the regulations be revised in terms of loopholes and ambiguities, and at the same time be brought in line with the Constitution and associated legislation.
- that the more comprehensive and accessible SABS 0246 replace the guidelines/standards of Part S of the SABS 0400.
- that the SABS 0246 too be revised in terms of international standards, such the United Kingdom and Australia.
- that the procedure of revision include an intensive and thorough process of consultation with all the relevant organisations of and for people with disabilities.
- that process of revision include the study of international precedents in terms of their experiences and resultant standards.
- that the public, professional practitioners, construction industry and developers be made aware of the revised standards, the legal implications in terms of the Constitution and be given an understanding of the real needs of people with disabilities.

6. Conclusion

It is essential that Part S of the SABS 0400 be revised if our built environment is to reflect the political and social change it is currently experiencing. The needs of people with disabilities must understood and appreciated, thus the standards should be aligned with the inclusive nature of our Constitution and the Bill of Rights. In this way our buildings, landscape, neighbourhoods and cities might symbolically indicate to society the rightful place of people with disabilities in our society.

7. References

Geszler, D. 2008. Personal interview at the South African Bureau of Standards, Pretoria on 11 February 2008.

Gibberd, A. 2006. Building regulations Part S. Unpublished paper.

Constitution. 2004. http://www.info.gov.za/documents/constitution/1996/96explan.html (Accessed 4 August 2006).

Weisman, LK. 1994. *Discrimination by design: a feminist critique of the man-made environment.* Urbana: University of Illonois Press.

Employment Equity Act. 1998. *Government Gazette*. 19 October 1998, p 2, 12 &14.

Promotion of Equality and Prevention of Discrimination Act. 2000. *Government Gazette*. ND, p 1 & 7.

SABS stakeholder's workshop. 2007. Unpublished agenda.

De Villiers, S (ed). 1997. *White Paper on an Integrated National Disability Strategy.* Cape Town: Rustica Press.

SABS 0400. 1990. *South African standard: code of practice for the application of the National Building Regulations*. Pretoria: The council of the South African Bureau of Standards.

EUROPEAN LEGISLATION ON PEOPLE WITH DISABILITIES

Kyriakos Papaioannou
Dept. of Civil Engineering
Aristotle univeristy
Thessaloniki Greece

Keywords: Accessibility, Directive, disabilities, Guide, harmonization, legislation

Abstract

The Treaty establishing the European Community and in particular, Article 13 thereof provides for equal rights for all citizens of the European Union. In addition,

The Community Charter on the fundamental social rights of workers of 9th December 1989 stipulates in point 26 "All disabled persons, whatever the origin or nature of their disabilities, must be entitled to additional concrete measures aimed at improving their social and professional integration. These measures must concern, in particular, according to the capacities of the beneficiaries, vocational training, ergonomics, accessibility, mobility, means of transport and housing.

The Council Decision (2001/903/EC) of 3 December 2001, proclaimed the year 2003 as the European year of people with disabilities. It was therefore expected that the profile of the problems facing people with disabilities has been raised by a number organized events during that year.

The Council Recommendation 86/379/EEC on the employment of disabled people in the Community identified 'disabled people' to include all people with serious disabilities which result from physical, mental or psychological impairments.

The 2000/78 Directive, in Whereas Clause 6, recognizes the importance of combating every form of discrimination and this specifically includes elderly and disabled people. In particular, Article 2(ii) of the Directive obliges any employer or any person to whom this Directive applies to take appropriate measures in line with the principles contained in Article 5 in respect of persons with a particular disability.

The Employment Guidelines for 2000 agreed by the European Council at Helsinki on 10 and 11 December 1999 stress the need to foster a labour market favorable to social integration to combat discrimination against groups such as persons with disability.

CEN/CENELEC Guide 6 (Edition 1) Guidelines for standards developers to address the needs of older persons and persons with disabilities, has been published by the European Committee for Standardization (CEN) in January 2002. This document has also been published by the International Organization for Standardization (ISO) as PD ISO/IEC Guide 71: 2001 with the same title.

The Construction Products Directive (CPD) 89/106 is based on compliance with "essential requirements". It is not included any special requirement on the "accessibility for all".

There is not also described any requirement in the Directive 89/654 "Health and Safety at the workplaces"

An "Accessibility for All" harmonized European Standard or Code on design, construction and use of buildings should be developed including provisions on means of escape in emergencies for disabled people. Even this scope seems not very easy to be realized among the European countries which have many differences in the levels of economy, culture and

traditions, it is absolutely necessary for EU to produce at least a European Guidance Document in this topic.

1. A EUROPE ACCESSIBLE FOR ALL

The European Union decided some years ago that 2003 would be the European Year of People with Disabilities. An accessible built environment is a key for a society based on equal rights, and provides its citizens with autonomy and the means to pursue an active social and economic life. An accessible environment means that a person will be able to **seek employment**, **receive education and training**, and **pursue an active social and economic life.**

There is not at the moment a European Directive for disability. On November 2006 it was presented to the European Parliament a manual with the title "The Build-for-all reference manual". On the other hand, 2007 has considered by EU "The Year of Equal Opportunities for All" covering discrimination on grounds of

- racial or ethnic origin
- religion or belief
- disability
- age
- sexual orientation

For the above five items there are only two European Directives:
The Employment Equality Directive 2000/78/EC
The Racial Equality Directive 2000/43/EC
United Nations (UN) and World Health Organization WHO (1996 &2004) have taken important Resolutions on rights and dignity of persons with disabilities. In that direction ISO has issued the ISO/IEC Policy Statement 2000 specifically "*Addressing the Needs of Old Persons and People with Disabilities in Standardization Work",* to promote **Universal Design** and **Accessible Design**
On 2002, according to the Vienna Agreement, the two main International Standards Organizations ISO and CEN/CENELEC issued the following two Guides which are technically identical to each other:
ISO/IEC Guide 71 (2002)
CEN/CENELEC Guide 6 (2002)
These include a procedure for Standards, matrices of analysis, factors to be analyzed and design proposals. They are used mainly for Standardization but it could be also be helpful for buildings design. A detailed reference to these Guides will follow in this paper

The European Union committed itself to modernizing and reinforcing social cohesion and social protection as a key to deliver more and better growth by 2010.It should be promoted a dynamic, positive, approach to accessibility with a clear objective:
Implementing an "accessibility agenda" by 2010, which is the target date set by the **Lisbon European Council** when it launched its strategy.
With that objective the following principles should be taken in mind:

- **Accessibility is a concern for everyone, not only for a minority with physical disabilities.**

- **Accessibility should be dealt with in a global and integrated way**, covering all policy areas (construction, health and safety at the workplace, Information and communication technologies, public procurement, education etc.).
- **Accessibility policies can only be designed and implemented with the participation of the people and of the NGOs which represent them**.
- **Accessibility is a key to sustainable development**, because it enhances the **quality of life**, and makes the urban environment more **liveable**.

1.1 Accessibility to the built environment

Accessibility means firstly that **everybody should have equal access to the built environment**, i.e.:

- The **buildings**. They can be *public*, either run by the public service (such as museums, post offices, hospitals, employment agency…) or run by a business (shops, restaurants, offices etc). They may be *private* dwellings. Special attention should be paid to *historical buildings*, where experience shows that they too can be made accessible without compromising their architectural or historic integrity.
- **The Built environment**: the streets, roads, pavement, footways, the signage, the open spaces and recreational areas, like parks and playgrounds. Accessibility for all means that these areas are safe, convenient and enjoyable for everybody. Transport facilities belong to the built environment.
- The **"virtual environment"**. In our knowledge-based societies, the built environment increasingly includes electronic devices and equipment such as access pads, environmental controllers, automated vending machines, alarms etc. Information and communication technologies are a key element of accessibility to the built environment.

"*Accessibility to the built environment*" includes "*universal design"* and "*design for all"*.
Universal design means: "*The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design*."
The main principles of the "*Design for all"* :
*1. The objective is the provision of environments which are convenient, safe and enjoyable to use by
everyone, including people with disabilities.*
2. The Design for All principles rejects the division of the human population into able-bodied and disabled people.
3. *Design for All includes supplementary provisions where appropriate*."

2. ACCESSIBILITY FOR ALL: A KEY FOR AUTONOMY, INCLUSION AND SUSTAINABLE DEVELOPMENT

2.1 Promoting accessibility for people with disabilities and for a diverse and ageing society

Accessibility to the built environment matters to a large number of groups and people within our societies. Over a quarter of the EU population may face accessibility problems on a daily basis, ranging from doorsteps that are too high to poorly designed stairs.

- ***People with permanent and temporary disabilities.***
- ***Older people***.

- ***Young children, parents and carers***

EU-15 countries (% of overall population) *(source Eurostat)*

	TODAY	**2040**
People reporting a physical, sensory or mental disability *Among them reporting "severe" disability*	23%(1999) *8% (1999)*	
People over 75	7.5%	14.4%
Children under 5	5.3%	4.5%
Persons reporting a temporary impairment in their daily life (in the past two weeks)	13.4%(1996)	

The figures cannot be added due to possible overlaps between different categories (e.g.: 45% of people over 75 report a disability)

2.2 Promoting growth and employment
2.3 Delivering a sustainable built environment

3. THE CURRENT SITUATION IN THE EU

"Accessibility for all" is an intrinsic part of the agenda agreed at the Lisbon European Council, in 2000, which aims at Europe's economic and social renewal by 2010. This is why 2010 is the target date which should be set for the implementation of a broad range of measures.

An effective legal framework is crucial in seeking to achieve accessibility for all. Policies dealing with accessibility issues are mostly the responsibility of Member States (building regulations, disability policy, transport, spatial planning etc.). The debates within the Commission have shown that an overwhelming majority of the member states wishes that this should remain so. However, those national policies must comply with basic EU principles, in particular the rights enshrined in the Charter of Fundamental Rights and they cannot undermine EU policies (Internal market, competition etc.).

There are few studies – if any - which present a comprehensive and up-to-date overview of Member States' legislation and practices (standards, guidelines…). There is not even a repository where this information could be accessed. In some Member States, accessibility policies are under the responsibility of federal entities or local authorities, which increases the difficulties in collecting the relevant information. It is therefore necessary to build a network of **"accessibility information centers"** across Europe, including the acceding countries, based whenever possible on existing structures.

A first tentative study ***"Accessibility Legislation in Europe,*** Status Report by the Toegankelijkheidsbureau v.z.w. Hasselt and LIVING Research and Development s.p.r.l. Bruxelles, shows that accessibility legislation differs widely in scope and structure across countries.

3.1 European Legislation

The **Treaty** establishing the European Community and in particular, **Article 13** provides for equal rights for all citizens of the European Union. In addition, The **Community Charter** on the fundamental social rights of workers of **9th December 1989** stipulates in point 26 "All disabled persons, whatever the origin or nature of their disabilities, must be entitled to additional concrete measures aimed at improving their social and professional integration.

These measures must concern, in particular, according to the capacities of the beneficiaries, vocational training, ergonomics, accessibility, mobility, means of transport and housing.

As an example of the level of importance accorded to this subject, the Council Decision **(2001/903/EC) of 3 December 2001**, proclaimed the year **2003 as the European year** of people with Disabilities. It can therefore be expected that the profile of the problems facing people with disabilities was raised by number organized events during that year. The Council Recommendation 86/379/EEC on the employment of disabled people in the Community identified 'disabled people' to include all people with serious disabilities which result from physical, mental or psychological impairments. Such impairments may be long lasting or permanent, they also may be of a temporary nature such as women in the advance stages of pregnancy or persons with fractures requiring them to use wheelchairs or walking aids.

The **2000/78 Directive, in Whereas Clause 6**, recognizes the importance of combating every form of discrimination and this specifically includes elderly and disabled people. In particular, Article 2 (ii) of the Directive obliges any employer or any person to whom this Directive applies to take appropriate measures in line with the principles contained in Article 5 in respect of persons with a particular disability.

Article 5 of the Directive covers the provision of reasonable accommodation for disabled persons. This specifically covers the need for employers to take appropriate measures, where needed in a particular case, to enable persons with a disability to have access to the place of work unless such measures would impose a disproportionate burden on the employer.

The Employment Guidelines for 2000 agreed by the European Council at Helsinki on 10 and 11 December 1999 stress the need to foster a labour market favorable to social integration to combat discrimination against groups such as persons with disability.

All such measures are supported by the Council Resolution of **17 June 1999 (OJ C186, 02/07/1999**. P 0003-0004) on equal employment opportunities for people with disabilities. This Council Resolution builds upon the previous **Council Resolution dated 20 December 1996** on equality of opportunity for people with disabilities.

It is clear from this, that the rights and needs of persons with disabilities must be considered at all times and in all areas. In considering the overall needs of older persons or people with disabilities, one must take cognizance of the available published guidance.

CEN/CENELEC Guide 6 (Edition 1) ***Guidelines for standards developers to address the needs of older persons and persons with disabilities,*** has been published by the European Committee for Standardization (CEN) in **January 2002**. The Guide has been prepared under Mandate M/283 given to CEN/CENELEC and ETSI by European Commission and the European Free Trade Association (EFTA).This document has also been published by the International Organization for Standardization (ISO) as **PD ISO/IEC Guide 71: 2001** with the same title.

In the Introductions contained in both the Guides, three particular points are relevant to this discussion. They are:

a. It is an important goal for the whole of society that all people have access to products, services (*including Hotels*), workplaces and the environment. The issues of accessibility to and the usability of products and services have become critical with the increasing percentage of older persons in the world's population. Whilst not all-older persons have disabilities, the prevalence of disability or limitations is highest among this demographic group.

b. The needs and abilities of people change as they advance from childhood to old age and the abilities of individuals in any particular age group vary substantially. It is important to recognize that functional and cognitive limitations vary from the comparatively minor, such as mild hearing loss or use of spectacles only to read, to blindness, deafness or the inability to move part or all of one's body. It should be noted that although some of these limitations may be minor in nature, in combination, as in the case of ageing, these can pose a significant problem.
c. This Guide is intended to be part of the overall framework that Standards bodies can use in their efforts to support the need for more accessible products and services. The **ISO/IEC Policy Statement 2000** - addressing the needs of older persons and people with disabilities in standardization work, sets out the principles for ensuring the needs of older persons and persons with disabilities are incorporated in the standards-making process, providing justification on humanitarian and economic grounds. The ISO Guide supplements the ISO/IEC Policy Statement by identifying problem areas, which need to be considered when drafting standards, recognizing the constraint that standards should normally not be design-restrictive. Both Guides are intended for those involved in the preparation and revision of International and European Standards but also contains information, which may be useful for others, such as manufacturers, designers and service providers.
The Scope of both the Guides suggests that while some people with very extensive and complex disabilities may have requirements beyond the level addressed in these Guides, a very large number of people with minor impairment which can be easily addressed by relatively small changes of approach in standards, thereby increasing the market for the product or service.

The CEN Technical Committees CEN/TC293 (Technical help for handicapped persons) and CEN/TC315 (Installations for spectators are working on disabilities issues. However, there is not any coordination at CEN/CLC level. It follows below a short reference to the national initiatives and the state of the legislation in some member states of EU.

3.2 European Union member states

_France was reviewing its 1975 laws on compensation and social coverage and has also taken measures on access to certain services. Specifically the current legislative situation
Is as follows:

- Act 2005-102 (2005 02 11) Disability Law
- Government Order 2006-555 (2006 05 17) On building accessibility
- Decrees of building ministry (2006 08 11)
- Accessibility for domestic buildings
- Accessibility for public buildings
- Accessibility for work places (draft)
- Revision of the French Building Code

The timetable for the ongoing developments is:

- All new buildings since 2007/01/01
  exemption owner self built home for own use (no renting, no sale)
- Existing public buildings it will be completed before 2015/01/01

- Existing domestic building applicable under conditions fixed in a future Decree of building ministry

  There is a severe control and penalty (45.00-75.000 €) for the violation of th this Law especially for the public buildings (fire and accessibility)

_ **Spain** has designed
- a specific action plan for people with disabilities (2003-2007)
- a new national plan on accessibility (2004-2012)
- a plan on employment for people with disabilities.

Spain has also adopted two new laws: one on equality of opportunities and non-discrimination and one on economic and inheritance rights of people with disabilities.
A Catalogue of technical anthropometric data (Guia tecnica de accesibilidad) mainly oriented to physical disability has recently issued.

_ **Germany** has implemented the new Act on the Equal Treatment of Disabled People at the same time as rolling out the implementation of earlier framework legislation.

_ **Italy** was working on developing benefits for families with people with disabilities and trying to facilitate the assessment of disabilities for administrative purposes. The Italian Parliament was discussing a governmental bill on e-accessibility to websites as well a draft law on guardianship.
The concepts of accessibility, visitability and adaptability are included in the main Building Code (D.M. 1989 no. 236). These three requirements are different extensions of code enforceability. Italy is now endeavoring to merge the 'design-for-all' concept in the legislation (D.P.R.. 1996 no. 503 and D.M 1989 no.236).

_ **Greece** has elaborated an action plan on social inclusion until 2006. Moreover, in the light of the Paraolympic Games 2004 (Athens), the Government has undertaken a set of practical improvements and institutional reforms for people with disabilities.
In the field of legislation rules for accessibility are included in the General Building Code (Official Government Journal **FEK 210 A 18.12.1985**) **(**as amended and completed by the **Law N.2831/2000).** Article 28 concerns on rules for the service of people with special needs A.M.E.A.)

_ **Portugal** has presented a new fundamental and general law on disability and chronic illness; a law on non-governmental organizations representing people with disabilities and people with chronic illnesses; a national action plan promoting accessibility (2004-2011).
_ The **Netherlands** was developing an action plan on disability policies. A new law on equal treatment came into force by the end of 2003.

_ **Finland** has adopted a brand new government plan and has produced a guide to help people with disabilities to recognize their own human rights and situations.
Besides the regulations the housing designers and planners mainly use the recommendations of the RT direction cards published by The Building Information Foundation (RTS) and

occasionally more detailed directions and recommendations including in the TTS Institute's Home Economic bulletins.

Regulations:

- G1 Housing design regulations 1994, Ministry of Environment, housing and building Department, Finland.
- E1 Fire safety of buildings, regulations and guidelines 1997, Ministry of Environment, Housing and Building Department, Finland.
- F1 Barrier-free buildings, regulations and guidelines 1997, Ministry of Environment, Housing and building department, Finland.
- F2 Safe usage of buildings, regulations and guidelines 2001 (valid since December 2001), Ministry of Environment, housing and building Department, Finland.

Recommandations, directions, expert solutions etc.:

· RT 93-10531 Need of space of the furniture, The Building Information Foundation (RTS), Finland, 1994
· RT 93-10532 Bedrooms of the dwelling, 1994
· RT 93-10533 Living rooms of the dwelling, 1994
· RT 93-10534 Service flats, sheltered apartments and dwellings for the elderly, 1994
· RT 93-10535 Dining rooms of the dwelling, 1994
· RT 93-10536 Kitchen of the dwelling, 1994
· RT 93-10543 Entrances and passages of the dwelling, 1994
· RT 93-10544 Balconies and terraces of the dwelling, 1994
· RT 93-10555 Common-use rooms of the residential buildings, 1994
· RT 09-10692 An accessible moving and activity environment, 1999
· RT 09-10047 International symbol of accessibility, 1979
· RT 09-10409 Measure of man, 1989
· RT 09-10720 Basic information of disabled persons, 2000
· RT-93-10534 Service flats, sheltered apartments and dwellings for the elderly, 1994
· RT 73-10616 Electrical installations for dwellings.

_**Sweden** has, according to its National Action Plan on Disability Policies, implemented guidelines of accessibility to national authorities, a national Programme for improving the responsive skills of public servants and elected representatives.

The main laws in Sweden are

- the BVL (Byggnadsverkslagen 1994:847: Law Concerning Technical Standards in Buildings) and
- BVF, (Byggnadsverksförordningen: SFS 1994:1215: The Law Rules Concerning Technical Standards in Buildings).

The BVF 12 provides the main rule concerning accessibility

_ **Ireland** has published a new general bill on disability which will include provisions for independent needs assessment; a bill on education for people with disabilities has been published since 2003.

_ The **UK (Great Britain and N. Ireland)** has put in place regulations to implement Directive EC/2000/78 and the final parts of the Disability Discrimination Act in October 2004.

- The BS 5588 concerning mainly Buildings Fire Safety is including issues on disabilities.

- BS 8300:2001 "Design of buildings and their approaches to meet the needs of disabled people" is a Code of Practice for the designers.

_ **Luxembourg** has passed a new law in July 2003 concerning labour regulations applicable to people with disabilities and creating an income for severely disabled persons.

_ **Austria** has issued a detailed report on the situation of people with disabilities and is preparing a new Act on the Equal Treatment of People with Disabilities.

_ **Belgium** has adopted a law on anti-discrimination, which has been implemented namely through the Centre for Equal Opportunities and with the support of the federate bodies with territorial responsibilities for the integration of people with disabilities. Disable people policy is under authority of:

- **Flemish Community** Outline Law 1975 application degrees 1977
- **Walloon Region** Walloon Code for Country planning, housing and heritage
- **Brussels Capital Area** French Community commission where a new Regional Urban Regulation (RRU) adopted since 21/11/2006
- **German –speaking community**
- **Federal State**

_ **Denmark** produced an action plan on disability and secured a budget to create 800 to 1200 new accommodations for people with disabilities to allow them to leave institutions.

4. ISO STANDARDS

ISO (the International Organization for Standardization) is a worldwide federation of standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO Technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and nongovernmental, in liaison with ISO, also take part in the work.
We shall not repeat here the contents of ISO/IEC Guide 71 (2002) which has already given for the identical CEN Guide 6.We shall give a short description for the other important ISO Standard 21542 *"Building-Accessibility and easy use of buildings"*

4.1 ISO/CD 21542.2

ISO 21542 was prepared by Technical Committee ISO/TC 059, *Building construction*, Subcommittee SC16, *Accessibility and usability of the built environment.*
That edition cancels and replaces ISO/TR 9527:1994, which has been technically revised and further developed.
ISO 21542 is a standard dealing with accessibility for all in the built environment. The underlying premise of this standard is that the built environment should be designed, constructed and managed to enable each user to approach, enter, use and exit from a building, even if their abilities vary.
The purpose of this standard is to define a built environment in which people can have independent and safe access and egress, and in which they can function and use the built environment with maximum independence in an equitable and dignified manner. These

principles are supported by Articles 9 and 11 of the UN Convention on the Rights of Persons with Disabilities (6 December 2006).

People can experience difficulties when entering, using or exiting a building or finding a particular location within the building. The built environment can present obstacles and barriers, both permanent and temporary, for all people, especially as their abilities vary.

This standard sets out the objectives, design considerations, recommendations and requirements that ISO believes will, when fully implemented, result in accessible and usable buildings.

This International Standard is a guidance document, providing users, architects, designers, engineers, builders, building owners, managers, policy makers and legislators with requirements and recommendations to create a built environment that is accessible to all.

For certain national standards bodies it might be necessary to allow for exceptions to this standard in certain circumstances. Such exceptions may result in greater or lesser requirements in accordance with and as defined by national regulations or legislation. Such exceptions shall be described in the National Foreword and in a national annex where so allowed in this standard.

This standard reflects the consensus approach reached by an international body of experts, representing a broad spectrum of interested parties.

Scope

This standard includes a range of requirements for many of the elements, components and fittings that comprise the built environment. These requirements relate to the constructional aspects of access to buildings, to circulation within buildings and to egress from buildings: the latter in the normal course of events and in the event of an emergency. An informative annex is also included that deals with some aspects of the management of buildings.

The intention of this standard is to meet the needs of the greatest feasible number of people and to accommodate the diversities of age and of human condition.

The standard contains provisions with respect to features in the external environment directly concerned with access to a building or group of buildings from the edge of the relevant site boundary or between such groups of buildings within a common site. However, the standard does not deal with those elements of the external environment, such as public open spaces, whose function is self-contained and unrelated to the use of any one specific building, nor does the standard deal with single family dwellings, other than those circulation spaces and fittings that are common to two or more such dwellings. Consideration is, at present, being given to the development and publication of additional parts to this standard to deal with the types of external environment described above and with single family dwellings.

The standard also contains, in the normative Annex A, information with respect to egress management procedures that are inappropriate for the normative sections.

For existing buildings there are options included in some paragraphs which appear as *"exceptional considerations for existing buildings in developing countries"* (see "Guidance on the Implications of the ISO Global Relevance Policy for CEN Standardization", 2005) and as *"exceptional considerations for existing buildings"* where a lower order of provisions than expected in new constructions are accepted due to technical and economical circumstances only.

NOTE. The standard is primarily written for adults with disabilities but it includes some specifications regarding the specific accessibility requirements that would suit children with disabilities. However, it is envisaged that future revisions of the standard will include more detailed requirements.

Contents (in brief)

- General design considerations
- Approach to the building
- Parking space
- Paths to the building
- Ramps
- Entrance to the building
- Horizontal and Vertical circulation
- Stairs and handrails
- Lifts
- Doors and windows
- Receptions, counters, desks and ticket offices
- Auditoriums, concert halls, sports arenas and similar seating. Conference rooms, meeting rooms. Bars, pubs, restaurants etc.
- Accessible toilets and sanitary rooms
- Accessible bedrooms, kitchen and storage areas etc.
- Noise and acoustics, Lighting, Visual contrast
- Equipment, controls and switches
- Furnishing
- Emergency systems, rescue and escape
- Orientation and information
- Signage

Annex A (informative) Management of assisted escape from buildings
Annex B (informative) Human abilities and associated design considerations

5. CONCLUSIONS-THE EU COMMISSION ACTION PLAN

An accessible built environment is a key for a society based on equal rights, and provides its citizens with autonomy and the means to pursue an active social and economic life. With an increasingly diverse and ageing society the significant objective is to promote accessibility for all. European Commission has decided to:

- Promote the exchange of information and dissemination of best practice on accessibility issues between European and other countries.
- To maximize co-operation with other international organisations or agencies. Key actors in this regard include the United Nations, including the International Labour Organisation and the World Health Organisation, the Council of Europe, the OECD, the European Agency for Safety and Health at Work, the European Standard Organisations (CEN,CENELEC, ETSI), the European Special Needs Education Agency, the European Foundation for the Improvement of Living and Working Conditions.
- Promote the principle of Design for All in all relevant Community policies on accessibility to the built environment.

- Consider the development of adequate European standards in all areas related to the built environment, including planning, design, construction and use of buildings, and safety evacuation procedures for people with disabilities.
- Review the essential requirements laid down in Directive 89/106/EEC on Construction Products to include provisions on accessibility for all and in particular, will consider a proposal to develop a 7th essential requirement on accessibility to make the Directive more effective and more precise about the needs of users with different disadvantages. This will facilitate a procedure of European harmonized Standards development. National Standards and Regulations will continue to consider the national special conditions

The EU Disability Action Plan had been defined with the time horizon of 2010 and the it was intended to proceed a first evaluation of its results in 2008

6. REFERENCES

- **CEN/CENELEC Guide 6:** *Guidelines for standards developers to address the needs of older persons and persons with disabilities* [2002]

- Communication **DIS_COM (2003) 650 final:** *Equal opportunities for people with disabilities: A European Action Plan* [2003]
- **EU-EGA Draft final Report**: *2010: A Europe Accessible for All* [2003]
- **CIB-W084** *Draft on the State of the Art regarding Accessible and Comfortable Environments for All* [2004]
- **Daniel Brionnaud**: *European Standardization- Accessibility for all* [European Meeting, Budapest 10-11 May 2007]
- **Don Christian**: *People with Disabilities* CEN-TC127 CAP [2007]
- **ISO/TC 59/SC:** *ISO/CD 21542.2* **:** *Building construction — Accessibility and usability of the built environment* [*2007*]

USER EXPERIENCES AND BEST PRACTICES: EXHIBITS AT THE GEORGIA AQUARIUM

Carrie Bruce
CATEA at Georgia Tech USA
carrie.bruce@coa.gatech.edu

Keywords: informal learning environments (ILEs), aquarium, accessibility, exhibit design, participation

Abstract

People with disabilities feel more isolated from their communities and participate in fewer activities than do people without disabilities [1]. However, drawing people with disabilities into community life does not mean creating "separate but equal" activities, but consistent with the ICF model, it means ensuring that people with disabilities can participate in civic, cultural, social, and recreational activities offered to other members of the community [2]. Participation in informal learning environment (ILE) activities depends upon access, both physical and programmatic. Design guidelines to ensure the physical access of ILEs are included in documents such as the Americans with Disabilities Act Accessibility Guidelines (ADAAG), Smithsonian Guidelines for Accessible Exhibition Design, and National Endowment for the Arts (NEA) guide, Design for Accessibility: A Cultural Administrator's Handbook [1-4]. However, there is little understanding of how to provide similar levels of programmatic access. As a result, vital informal learning opportunities that are available to the general public are not available to many people with disabilities. A majority of the information on effectiveness of accessible features in ILEs is anecdotal and provides minimal contribution for supporting existing practices or aiding in improved design criteria of exhibits. We have investigated exhibit displays and interpretation in over thirty ILEs in North America and performed an in-depth study at the Georgia Aquarium in order to gain a better understanding of accessibility practices. This paper will focus on the results of our studies, providing examples of the documented exhibit display and interpretation design practices, and information on the needs of visitors with disabilities.

INTRODUCTION

Among the common goals of informal learning environments (ILEs) such as zoos, aquaria, museums, and science centers are the education and entertainment of the visiting public. However, as the number of people with disabilities living in the community has grown, and as public environments have become more accessible to them, ILEs are faced with educating an increasingly diverse visitor population with varying physical, cognitive, communicative, and sensory needs. Thus, ILEs must understand the needs of their audiences, strive to be inclusive, and offer innovative opportunities for participation for all visitors.

The Americans with Disabilities Act Accessibility Guidelines (ADAAG) provide guidance for ILEs in promoting general facility accessibility and have resulted in improved facility access [3]. However, these requirements are primarily intended to facilitate access for people who use wheelchairs and, even then, are too general to address the core processes of exhibit design [4]. In response to the limitations of the ADAAG that would enable ILEs to provide more accessible exhibits and exhibit interpretation, the field itself has produced a number of publications, including the *Smithsonian Guidelines for Accessible Exhibition Design* [5], *Design for Accessibility: A Cultural Administrator's Handbook* from the National Endowment for the Arts [6], and *Everyone's Welcome: The Americans with Disabilities Act and Museums* from the American Association of Museums [7]. Similar to the ADAAG, these resources provide design guidelines for the physical space, covering issues such as standards for circulation route accessibility, lighting, exhibit content, and signage.

To further improve exhibit accessibility from a programmatic perspective, ILEs have incorporated audio components to provide alternative means of experiencing artifacts and their related interpretive information [8, 9]. Audio technologies or audioguides have been used in museums since the 1950's [10], evolving from basic tools like audio labels and tape recordings, to the more innovative approaches of using cell phones [11, 12], MP3s [13], and Podcasting [13]. The later technologies provide random access capabilities to enable visitors to self-direct their tour path and control information (e.g., stop, start). In addition, "audio branching" enhancements permit users to determine the depth of their exhibit information exploration. Other audio technologies have successfully included wayfinding information to enable visitors who are blind or have low vision to be more independent in navigating through exhibits [11]. However, while audio technologies have been used as a primary mode of providing access to interpretation for ILE visitors who are visually impaired, limited information exists on what type of content or audio characteristics are most useful for visitors with disabilities.

Tactile information may also be used to provide programmatic access to visitors with disabilities. There are many instances of ILEs using tactile components in exhibits for interpretation [14, 15] and research that supports the use of tactile characteristics in learning [16]. Artifacts and live plants or animals can be used to provide tactile information, but issues such as safety, logistics, durability, and size can make touching or handling actual items either impossible or very difficult. In such instances, large- or small-scale replicas or models, raised relief or embossing, or representative items may be used to convey different characteristics of an artifact, such as density, weight, size, shape, temperature, moisture, width, length, texture, and hardness. However, like audio technologies, there is inadequate information about the effectiveness of specific characteristics of tactile interpretation.

Despite the design guidelines and technological developments geared towards facilitating access to ILEs, the majority of the information on the effectiveness of these efforts is anecdotal. Consequently, there is little empirical evidence for supporting existing practices or aiding in improved design criteria of exhibits. Without sufficient evidence, clear guidance on specific design characteristics for physical space, audio technologies, tactile components, or any other alternative or supplemental exhibit feature cannot be made available. The first step toward identifying effective design practices for exhibit displays and interpretation that meets the needs of visitors with disabilities is to better understand the barriers and facilitators that are experienced in ILEs.

This paper reports on the findings from a post-occupancy evaluation that was conducted at the Georgia Aquarium to inform on effectiveness of current exhibit design by: 1) documenting the current exhibit display and interpretation design practices used at the Georgia Aquarium; 2) providing visitor feedback on the usability of exhibit displays and interpretation; and 3) discussing needs of visitors with disabilities. The resulting practice assessment data will be used to guide future research, and eventually, development of improved design of exhibits that incorporates the needs of visitors with disabilities at the Georgia Aquarium.

METHODS

Post-occupancy evaluation involves systematic evaluation of how a building meets the needs of the users. This type of evaluation is an effective process for generating information that provides experiential feedback that is useful in development of future research and design. This evaluation was conducted through touring interviews and focus groups with individuals with various disabilities.

Participants

Twenty-nine adults (15 males and 14 females) were recruited through local organizations involved in disability service provision. The participants each had at least one functional limitation, including impairments in vision, motor, hearing, speech, and cognition. Participants ranged in age from 24 to 80 years old, with a mean age of 48 years. Subjects were divided into 10 groups, with eight groups arranged homogeneously according to primary functional limitation: blindness, low vision, hard of hearing, deafness, motor impairment, cognitive impairment, and speech impairment. Two additional heterogeneous groups were comprised of individuals having vision, motor, speech, and/or hearing impairments. Each group visited two pre-identified galleries for the touring interviews and then participated in a focus group. Twenty subjects' comments were recorded during the touring interview to collect more detailed information. All 29 subjects participated in the focus groups after visiting the galleries.

Independent Variables

Description of displays, interpretation, and the surrounding environment involved systematically documenting each exhibit in the five galleries of the Georgia Aquarium. The process of categorizing exhibit features and characteristics is based on an analysis of a broad range of exhibit displays and interpretation from over 30 aquaria, zoos, art and cultural museums, and science centers around the United States and Canada. (See Table 1)

Main Exhibit Features	Characteristics
Display The animal(s), and the habitat or immediate environment of the animal.	• **Position** o Viewing height: the height at which the animal can be viewed. o Interaction height: the height at which the animal can be touched. o Distance: the how far away the display and its contents are, given that the visitor is as close as possible. • **Lighting:** the natural or artificial lighting inside the display. • **Visibility:** whether the display is visibly apparent and whether its contents can be seen, given the opacity/transparency of the display materials and the density of display contents.

Interpretation The descriptive or informational detail typically presented in *static* (delivery of "canned" facts) or *dynamic* (interactive and flexible content and style of delivery) formats through techniques such as signage, kiosks, recorded video, docents, and/or recorded audio.	• **Position** o Viewing height: the height at which the interpretation can be viewed. o Interaction height: the height at which the interpretation can be touched, activated, or controlled. o Distance: the how far away the interpretation is, given that the visitor is as close as possible. o Proximity: the distance the interpretation is from the display. o Angle: the slant of the interpretation from the horizontal or vertical plane. • **Lighting:** the natural or artificial lighting behind, in front of, or to the side that is meant to illuminate the interpretation. • **Visibility:** whether the interpretation is visibly apparent and whether its information can be seen, given the opacity/transparency of the interpretation materials. • **Readability** o Speed: the timing of interpretation or the amount of time before the interpretation changes. o Font size/type: letters/characters height, width, and style. o Color/contrast: the color or tone combination that makes the text distinguishable from the background. o Finish: surface texture or appearance. • **Graphics:** drawings, pictures, and other non-textual content. • **Information sufficiency:** the quantity, depth, and relevancy of information presented. • **Sound** o Speed: rate at which tones or speech is presented. o Gender: the male of female quality of the speech. o Loudness: the intensity of the sound.
Surrounding Environment The features and characteristics in the space around exhibits	• **Lighting:** the natural or artificial lighting that is in the surrounding area of the exhibit. • **Path** o Flooring: type, texture, and reflectivity of the surface. o Elevation changes: steps in or slope of the surface. o Width: the side-to-side passage distance in front of or around exhibit. o Color/contrast: the color or tone combination of the surface. • **Ambient sound:** the type and loudness of sounds (non-crowd) in the surrounding area. • **Fixtures and furnishings** o Physical dimensions: the height, length, width, etc. that affects how a visitor is able to interact with or use the fixture/furnishing.

	o Obstructions: physical barriers preventing view, interaction, or use. • **Crowd** o Sound: the noise produced by the crowd. o Navigation: the density and flow of the crowd in front of or around the exhibit that impacts traveling. o Viewing: the density or height of the crowd in front of or around the exhibit that impacts viewing.

***Table 1**. Features and Characteristics of Exhibits*

Procedure

To evaluate the unique barriers and needs that visitors with disabilities experienced with exhibit displays at the Georgia Aquarium, this project included two phases: 1) site documentation: the description of exhibit displays and interpretation; and 2) visitor evaluation: evaluation of exhibit display and interpretation through touring interviews and focus groups.

Site Documentation. The investigators visited the aquarium several times at the start of the study to review all exhibits according to the independent variables mentioned previously. Photographs were taken and observation of general visitors was performed to enable the investigators to become familiar with exhibit features and characteristics.

Visitor Evaluation. Exhibit features and characteristics were evaluated through two methods that gathered input from individuals with disabilities: 1) touring interviews and 2) focus groups. The touring interviews involved groups of two to four people and were completed with only 20 of the subjects. Each study group visited two of the five galleries, with each gallery being visited by two different study groups. All data was classified according to the previously mentioned taxonomy.

RESULTS

Barriers

Touring Interview Within Exhibit Analysis. The data revealed that three exhibits (out of 38), Cold Water Quest touch tank, River Scout Electric Fish, and Tropical Diver Coral Reef, had the highest number of reported barriers, accounting for 30% (n=43) of the total number of comments (n=147) about problems with exhibit access.

The Cold Water Quest touch tank exhibit had 21 comments related to barriers. Almost half of the comments (n=10) were related to the interaction and viewing height of the display. Position and readability of printed signs, sound of the crowd, and ambient sounds were mentioned as barriers four times. Physical access to fixtures and furnishings were stated as barriers in three instances. Individuals with motor impairments had problems with display viewing height (n=5), display interaction height (n=5), and fixtures and furnishings (n=3). Individuals with hearing impairments had problems with ambient sound and sound of the crowd (n=2), and the position of the printed sign (n=2). Individuals with vision impairments had difficulty with the position and readability of printed signs (n=2). Individuals with speech impairments mentioned ambient sound and sound of the crowd (n=2) as barriers.

The River Scout Electric Fish exhibit had 11 comments associated with it. Position of the printed signs and video caption were the most frequently cited barriers, being referred to in over half of the cases (n=7). In addition, problems with the viewing height of the display, readability of the printed sign, fixtures and furnishings, and sound of video (loudness) were each reported once. Individuals with motor impairments reported over 73% of the barriers (n=8) for this exhibit, indicating problems with position of printed signs and video (n=5), viewing height of the display (n=1), sound of video (loudness) (n=1), and fixtures and furnishings (obstruction) (n=1). Individuals with hearing impairments mentioned position of video (n=2) and readability of printed sign (n=1).

Tropical Diver's Coral Reef exhibit was commented on 11 times. The readability of the kiosks and the video monitor signs were mentioned on five occasions. There were four other comments related to kiosks, including two concerning position and information sufficiency, one that was categorized as interactivity of kiosk (i.e., not having the strength to activate the kiosk), and one categorized as visibility of interpretation (i.e., not knowing the kiosk was there or what it did). Two comments related to visibility of display contents were also noted. Individuals with vision impairments cited issues with readability of printed signs, kiosks, and video monitor signs (n=5) and position of kiosk (n=1). Participants in this group also provided comments related to visibility of display and kiosk (n=2) and interaction height of interpretation (n=1). Information sufficiency of kiosk (hearing impairment; n=1) and position of kiosk (motor impairment; n=1) also presented barriers.

Touring Interview Across Exhibits Analysis. The features and characteristics that individuals commented on the most were position of the printed signs (n=26), viewing height of the display (n=20), visibility of display contents (n=11), lighting for printed signs (n=11), visibility of display contents (n=11), and readability of printed signs (n=10). Position of printed signs included viewing height (n=17), proximity (n=7), distance (n=1), and angle (n=1). Comments for lighting of printed signs referred to brightness (n=9) and glare (n=2). Readability of printed signs included comments on font size and style (n=4), "other" (overall readability) (n=3), and contrast (n=3).

Individuals with motor impairments represented the only group to experience barriers with viewing height of display (n=20) and offered the greatest number of comments about the viewing height of printed signs (n=15). These individuals also experienced barriers with lighting of printed signs (n=4) and readability of printed signs (n=2). Individuals with vision impairments provided the only comments related to visibility of display contents (n=11) and the greatest number for lighting of printed signs (n=5) and readability of printed signs (n=6). This group also stated problems with position of printed signs (n=5). Individuals with hearing impairments experienced issues with position (n=2), lighting (n=2), and readability (n=2) of printed signs.

Focus Group Results. The four features and characteristics that represented the greatest number of comments about barriers during the focus groups were crowd issues (n=11), general information sufficiency (n=8), position of video (n=7), and fixtures and furnishings (n=7). Crowd issues were related to sound (n=4), navigation (n=4), and viewing (n=3) problems. Position of video comments were associated with viewing height (n=5) and interaction height (n=2). Barriers with fixtures and furnishings were noted according to physical access (to hand washing) (n=3), obstructions, (n=2), and seating (n=2).

Although greater than half (n=42) of the total number of comments (n=83) were mentioned by individuals with motor impairments, individuals with vision impairments averaged five comments per participant (compared to 3.8 for motor, 1.7 for cognitive, 1.5 for hearing, and .5 for speech). Individuals with motor impairments made comments in 76% (n=16) of the exhibit features and characteristics that were discussed in the focus groups, with the greatest issues in viewing height of display (n=4), interaction height of display (n=4), and general information sufficiency (n=4). Individuals with vision impairments experienced problems with 72% (n=15) of the exhibit features and characteristics, noting the majority of barriers in general information sufficiency (n=3), lighting (n=3), and floor plan/map (n=3). Individuals in the hearing, cognitive, and speech groups mentioned fewer barriers. The hearing group provided comments related to 28% (n=6) of the features and characteristics and stated the greatest number of barriers in graphics on printed signs (n=3), the cognitive group stated problems with 24% (n=5), and the speech group mentioned issues with 10% (n=1).

Facilitators

Touring Interview Within Exhibit Analysis. During the touring interviews, participants also provided positive feedback about the usability of design features and characteristics of exhibits. The data suggested that participants had the greatest number of positive comments (n=9) related to the Arawana and Arapaima exhibit in River Scout. This exhibit had three comments related to the readability of the video sign, three related to information sufficiency of the video sign, and three comments that were categorized as "other" referring to liking the video signs. Individuals with motor impairments provided the most positive comments (n=8) about this exhibit's features and characteristics, experiencing facilitators in all of the categories for video signs as previously mentioned.

Touring Interview Across Exhibits Analysis. The features and characteristics that produced the majority of positive comments were readability of video signs (n=7) and docents (n=11). Readability included issues related to "other" (overall readability) (n=4) and font size and style (n=3). The docent category consisted of comments about docents providing personal assistance for touching ("other") (n=4), docents' overall helpfulness and attitude ("other") (n=4), sound of docents (n=2), and information sufficiency (n=2).

DISCUSSION

The findings from this study indicate that there are several characteristics that can be barriers or facilitators to accessing exhibits at the Georgia Aquarium: 1) display, including viewing height, interaction height, and visibility; 2) interpretation, including position, readability, lighting, visibility, and sufficiency; and 3) surrounding environment, including crowd and lighting.

Display

Viewing Height of Display. Viewing height of display was a barrier for individuals with motor impairments at a number of exhibits. Specifically, some touch tank walls, waterlines, and terrestrial floors were too high or too low, making it impossible for individuals who were seated (e.g., motor impairments) to view the animals. Additionally, immersion tunnels and domes were too low or short for individuals using wheelchairs to access. Conversely, individuals reported that several of the full wall exhibits (Figure 1) provided "good sight lines" and overhead tanks enabled them to "see past the crowd."

When viewing height of the display is too high or too low, possible solutions may include bringing the person up to a higher or lower level (e.g., ramp), providing an alternate viewing method (e.g., cameras, mirrors), and raising or lowering the display or a component of the display (e.g., waterline). Other institutions have dealt with similar issues related to viewing height of the display by having portals or small windows built into the display or creating an elevated area on the side of the display (Figure 2).

Figure 1 *Pacific Barrier Reef full wall exhibit at the Georgia Aquarium*

Figure 2 *Ramp created for wheelchair access to touch tank at the Florida Aquarium*

Interaction Height of Display. Interaction height of the display was also a problem for some of the participants at all of the touch tanks as a result of the display wall being too high for individuals to reach the animals. One way that the Aquarium has tried to make the touch tanks accessible is by using portable baskets. Interaction height barriers can also be accommodated through other techniques such as tanks that are shorter as in Figure 3, or narrower and shallower as shown in Figure 4.

Figure 3 *Touch tank with wall at lower height at the Aquarium of the Pacific*

Figure 4 *Touch tank that is narrow and shallow at the Aquarium of the Pacific*

Visibility of Display. Individuals with vision impairments indicated that they had difficulty seeing or knowing which animals were in the display. Docents were available in some of the larger exhibits and found to be helpful for individuals with vision impairments, especially when they provided detailed or comparative statements (e.g., the rays look like slow moving birds as they glide through the water) about the animals.

There are multiple ways of describing the animal that is in the display, including interpretation that is presented in signs or brochures, and in some cases, audio format (which will be discussed below in the Interpretation section). However, some individuals with vision impairments prefer to learn through touch. Some institutions have tactile representations of animals for visitors to interact with, including simulated (Figure 5) or real parts of animals (Figure 6), and scale models (Figure 7).

Figure 5 *Bronze cast animal claws at the San Diego Zoo*

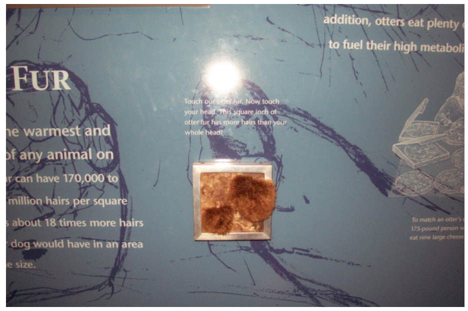


Figure 6 *Real animal fur at the Aquarium of the Pacific*

Figure 7 *Scale model of a turtle at the Shedd Aquarium*

Interpretation

Position of Static Interpretation. Participants from all impairment groups, except cognitive, noted that in every gallery there were problems with interpretation that was too high and/or too far from the display. Specific examples included Cold Water Quest (i.e., Japanese Spider Crabs: too high, Beluga Whales: too far from display), Ocean Voyager (i.e., acrylic display: too high), and River Scout (i.e., Electric Fish: too high). It is worth mentioning that individuals who use wheelchairs were able to see the kiosks in the Tropical Diver Coral Reef and Georgia Explorer because they are mounted at a shorter height and angle.

Positioning interpretation for optimal access can provide a more educational experience. Some ways to do this are placing signs closer to displays (Figure 8), lowering signs (Figure 9), and providing alternative or personal solutions (e.g., audio tours, pamphlets).

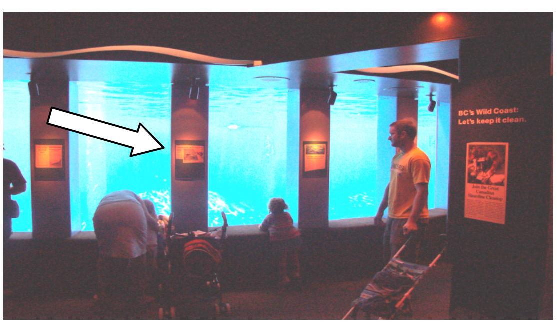


Figure 8 *Signs placed directly next to viewing windows at Vancouver Aquarium*

Figure 9 *Signs positioned at lower height at the Aquarium of the Pacific*

Readability of Static Interpretation. The font size, style, or contrast on signs and kiosks in at least eight exhibits made it difficult for some individuals to read information (Figure 10). Individuals had problems with exhibits such as the printed signs near the first view of the River Otters in the Cold Water Quest (blends in), the kiosks in the Tropical Diver Coral Reef (font size too small), and the projected signs in the Tropical Diver Jellies (too fast and poor contrast) (Figure 11). Good examples of signage that was preferred by individuals were the video panel signs in the River Scout Arawana/Arapaima area (see Figure 12) and in the Tropical Diver Coral Reef.

Figure 10 *Sign painted on rock face at the Sea Lions exhibit at the Georgia Aquarium*

Figure 11 *Projected sign on wall at Jellies exhibit at the Georgia Aquarium*

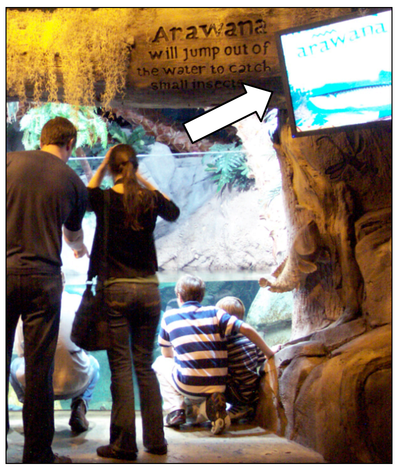


Figure 12 *Video panel signs at Arawana/Arapaima at the Georgia Aquarium*

Readability of signs and kiosks can be improved by increasing the font size, boldness and contrast, slowing down the speed of signs that change, and providing alternate formats. Some institutions have included an auditory component (Figure 13) or made the settings changes available to the user.

Figure 13 *Handheld audio device integrated into exhibit at Museum of Science Boston*

Lighting. Lighting to illuminate interpretation is closely tied to readability, but has its own impact on visual access. Lighting barriers can present as unevenness or shading, dimness (too dark), and glare. Participants noted that some signs were too dark, such as in Cold Water Quest (i.e., Japanese Spider Crabs, Sea Otters), River Scout (i.e., across from "crawl through"), and Georgia Explorer (i.e., Redhorse Sucker Fish) (Figure 14). Additionally, some signs had uneven or partially shaded lighting, as represented in Figure 15 at the River Scout Piranha exhibit, and some signs had a lot of glare, such as the Tropical Diver Garden Eels sign (Figure 16).

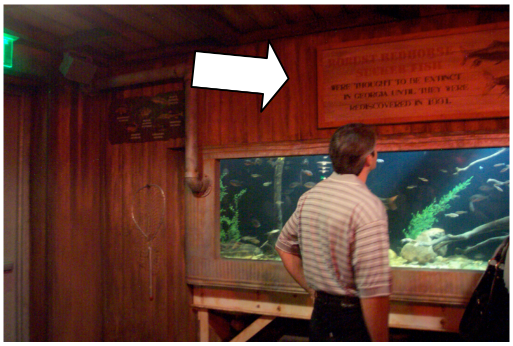


Figure 14 *Signs with low levels of lighting and low contrast at Redhorse Sucker Fish at the Georgia Aquarium*

Figure 15 *Sign with lighting that casts shadows on text at Piranhas exhibit at the Georgia Aquarium*

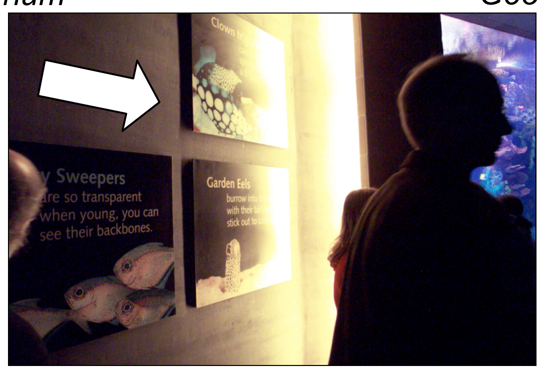


Figure 16 *Signs with lighting glare at Garden Eels and Glassy Sweepers exhibit at the Georgia Aquarium*

Interpretation that has associated lighting barriers can be made more accessible by providing unobstructed soft lighting that covers the entire surface and using non-reflective text surfaces. Some institutions use backlighting in signs to ensure better viewing from multiple angles (Figures 17, 18).

Figure 17 *Signs with backlighting at the Shedd Aquarium.*

Figure 18 *Signs with backlighting at the National Aquarium in Baltimore*

Visibility. When individuals experienced barriers related to visibility of interpretation, this indicated that they were not able to see or know what was on the sign or kiosk. For example, participants had difficulty with the Ocean Voyager Touch Panel and the Tropical Diver Coral Reef kiosks due to not knowing that they were touch-activated interpretation sources and not being able to see the information on the screens. In fact, comments included "[I] wouldn't know it was there" or "[I] wouldn't get anything out of it." Additionally, several comments were made about being able to find docents, as they typically either broadcast their voices over a speaker system, which make them hard to locate for asking one-on-one questions, or passively waited for individuals to approach them. Improving visibility of interpretation sources can be accomplished through strategies such as consistently positioning interpretation sources and informing visitors about these locations as well as including multi-sensory feedback or alternative access to information sources.

Information Sufficiency. Availability and quantity of interpretation was a barrier for individuals from almost all of the impairment groups. In some cases, participants wanted to know more about the animals than was available on signs (e.g., where they live, what they eat) and, in others, participants wanted to have information on each animal in the display. For example, several signs in River Scout only provided the name of the fish and the Tropical Diver Coral Reef kiosks had fish listed that could not be found in the tank and fish in the tank that could not be found on the kiosk.

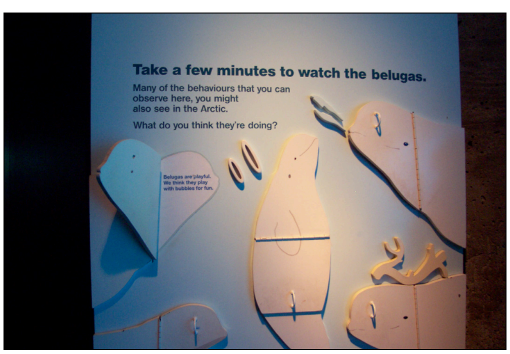


Figure 19 *A low-tech interactive sign at the Vancouver Aquarium*

Figure 20 *Visitor using a personal audio tour at the Waikiki Aquarium*

Additional interpretation can be provided in a variety of formats and strategies including audio tours, accessible menu-driven systems on kiosks, or pamphlets. A current trend is to provide layered interpretation that provides a range of information from less detailed to more in-depth information. This can be incorporated into stand-alone interactives or personal systems and may be a low-tech sign that is placed near the exhibit (Figure 19) or high-tech electronic devices that are carried around (Figure 20).

Surrounding Physical Environment

Crowd. The popularity of the Georgia Aquarium can be evidenced by having over two million visitors before the first year anniversary. Participants with vision, motor, speech, and cognitive impairments noted challenges due to crowd sound, navigation, and viewing issues Individuals with vision impairments noted the greatest number of problems with the crowd.

The Aquarium did lower the number of visitors allowed in the galleries at one time. This improved the experience for visitors, but did not solve the problem. A solution would be to advertise to visitors with disabilities that there are days or times during the day when fewer people are expected. Additionally, some of the previously mentioned suggestions for providing alternative viewing or interaction experiences may be beneficial.

Lighting. From the entrance through many of the galleries, the Georgia Aquarium had many areas with very low levels of brightness. Additionally, the walls, floors, and ceilings were often the same dark color, and there were few navigational cues for visitors with vision impairments. Problems were mentioned in exhibits at the Ocean Voyager gallery, including the large viewing window, and Tropical Diver gallery, including the Garden Eels.

Lighting issues can be improved by changing the type and quantity of light, as well as the color and texture of the surfaces it shines on. A solution could be to install path lighting where the wall and floor meet similar to the lights installed in aisles of airplanes or movie theaters.

CONCLUSIONS

As noted in the introduction, this report informs on the effectiveness of current exhibit design practices at the Georgia Aquarium by: 1) documenting the current exhibit display and interpretation design practices; 2) providing visitor feedback on the usability of exhibit displays and interpretation; and 3) discussing the needs of visitors with disabilities. It is our intention that the results of this study will provide documented evidence about the experiences of individuals with disabilities who visited the exhibits at the Georgia Aquarium.

It must be noted that there are a few key limitations of this study. The first is that the study recruited a small sample of participants. The sample was selected to include key constituents who could provide input on the exhibit design practices at the Georgia Aquarium. The study results were not intended to be generalizable to all people with similar disabilities, but it does provide preliminary data on how specific functional limitations can affect the usability of certain exhibit features and characteristics.

Secondly, individuals with hearing impairments experienced exhibits with sign language interpreters who were hired by the investigators for the purpose of the study. This created a situation where it is likely that fewer barriers were reported by these individuals. As this was the only means for participants with hearing impairments to understand what was said by the docents, as well as by other visitors during question and answer periods, it is suggested that the Aquarium explore contracting with an interpreter services. In fact, the Americans with Disabilities Act (ADA) requires that public and private entities provide auxiliary aids and services (such as interpreters) necessary for effective communication, unless it is an undue burden

Finally, the study was a broad review, not an in-depth analysis. These results are intended to not only create an awareness of usability problems, but to inform Aquarium staff and other interested investigators on future research directions. The Aquarium is a state-of-the-art facility that generally represents current design practice in the field of ILEs. However, as we experienced in this study, even the most well-intended designs may not be usable by all individuals. Usability testing that incorporates users with varying abilities throughout the design process typically leads to better outcomes. Additionally, future studies should analyze and test key characteristics of current and potential exhibits, before costly or significant changes are implemented. Moreover, a more inclusive and rigorous approach will support the development of future research objectives and ideally, change design practices by incorporating the needs of individuals with disabilities—leading to more universally designed exhibits.

REFERENCES

1. N.O.D., *Harris Survey*. 2000, Washington, D.C.: National Organization of Disability.
2. National Council on Disabilities. *Livable Communities for Adults with Disabilities*. 2004 [cited 2005 February 2]; Available from: http://www.ncd.gov/newsroom/publications/2004/pdf/livablecommunities.pdf.
3. US Access Board, *Americans with Disabilities Act Accessibility Guidelines*, Department of Justice, Editor. 2004, Federal Register.
4. Museum of Science Boston. *Universal Design (Accessibility)*. 2001 [cited 2005 May 2]; Available from: http://www.mos.org/exhibitdevelopment/access/index.html.
5. Smithsonian Institution Press, *Smithsonian Guidelines for Accessible Exhibition Design*. 1996, Washington, D.C.: Smithsonian Institution Press.
6. National Endowment for the Arts, *Design for Accessibility: A Cultural Administrator's Handbook*. 2003, Washington, D.C.
7. Salmen, J., *Everyone's Welcome: The Americans with Disabilities Act and Museums*. 1998, Washington, D.C.: American Association of Museums Bookstore.
8. Museum of Science Boston. *Universal Design (Accessibility).* 2001 [cited April, 2005]; Available from: http://www.mos.org/exhibitdevelopment/access/.
9. Association of Science-Technology Centers. *Accessible Practices.* 2000 [cited June, 2004]; Available from: http://www.astc.org/resource/access/index.htm.
10. Schwarzer, M., *Art & Gadgetry: The Future of the Museum Visit.* Museum News, 2001(July/August).
11. Giusti, E. and S. Landau, *Accessible science museums with user-activated audio beacons (Ping!).* Visitor Studies Today, 2004. **7**(3): p. 16-23.
12. Walker Art Center. *ArtOnCall*. 2005 [cited January 24, 2006]; Available from: http://newmedia.walkerart.org/nmiwiki/pmwiki.php/ArtOnCall/ArtOnCall.
13. Walker Art Center. *Gallery Audio Tours*. 2005 [cited; Available from: http://newmedia.walkerart.org/aoc/index.wac.
14. Uytterbrouck, O. *Anthropologist's Hands See Details of History* 2001 [cited January 26, 2006]; Available from:

http://www.blindcanadians.ca/publications/index.php?id=109.
15. Wildlife Conservation Society. *New Alien Stingers Exhibit*. 2003-2004 [cited January 26, 2006]; Available from: http://wcs-old.atlasworks.com/home/zoos/nyaquarium/newstingersexhibit.
16. Parente, P. and G. Bishop. *BATS: the blind audio tactile mapping system*. in *ACM South Eastern Conference*. 2003. Savannah, GA.

THE LIVINGALL PROJECT

Jon Christophersen
SINTEFByggforsk, Norway
jonchri@online.no

Keywords: Disability, integration, free movement, equal opportunities, accessibility

Abstract

Funded by the European Union, eleven partners from seven countries in Europe are currently collaborating on a project directed towards free movement and equal opportunities for all. The work started in March 2006 and runs until March 2008. Under the title "LivingAll", the project will attempt to analyse a variety of issues that influence the accessibility and openness of the global European labour market. The research involves institutional, cultural and physical aspects, actions to improve free movement, the existence and nature of barriers and how these are perceived by the users. The project plan divides the work into a total of seven work packages, of which the first four are to be completed during the first 12 month period. The paper presents the aims and objectives of the project and gives an overview of the various work packages, the research methods and findings so far.

The first work package found that legal initiatives in most of the countries are related to the general concept of non-discrimination; access to housing, communication and transport are fairly well covered. All the countries have made great efforts to develop legislation improving the right of access to employment, health and social security as well as the built environment. However, the emphasis given to employment is greater than other issues. The second work package shows that generally approved standards for planning, construction rehabilitation and life time homes exist or are emerging, but that implementation seems to be the main challenge.

Background – the Livingall project

Project administration

The project was started in March 2006 and will run for two years. It involves a total of 11 partners (see appendix 1) from eight European countries. The multidisciplinary research unit Polibienestar at the University of Valencia acts as coordinator.

An advisory committee has been appointed to oversee and assess the research activities. The committee consists of eleven experts in social policies, ICT and disabilities, representing ten European countries (appendix 3). The main function of the committee is to help the consortium to identify transnational differences and opportunities, to analyse transferability, and to select best practices in the field of social policies and techniques addressed to the free movement for disabled people.

The project is financed through EU's sixth framework program.

Aims and goals

The LivingAll project aims to increase the free movement of people with disabilities and improve accessibility to the global European labour market for everyone. In practice this involves looking into all aspects of usability and accessibility that may influence freedom of movement, including housing and the built environment, transport, social security, health and social services, education and employment opportunities. The project is thus wide ranging and will look into views and experiences of disabled people as well as central and local authority initiatives.

The intention is to try to provide decision makers with tools and methodologies for benchmarking and overcoming obstacles that will help to make free movement policies for the disabled more effective.

More specifically, three objectives have been drawn up:

1) Provide data about the extent to which people with disabilities take advantage of their rights to free movement and equal living opportunities.

2) Deliver and disseminate good practices (from the above evaluation) and benchmarking exercises for the further development of policies to support disabled people.

3) Provide the European decision makers with appropriate methodologies and tools based on evaluation of barriers and benchmarking, in order to make free movement policies for the disabled more effective.

To meet these three objectives, five operative objectives have to be reached:

a. Give a review of the main factors managing disabled people's life, focusing on three areas:

- Legal aspects, including EU general policies; national or regional regulations; standard or agreements between countries or regions.
- Technical aids that facilitate free movement for people with disabilities, particularly with regard to the cost/benefit questions
- Social initiatives or programs which contribute to free movement for people with disabilities.

b. Define communication channels and data collection procedures with the disabled community in eight European countries, with a view to

- compile information showing to what extent people with disabilities take advantage of their rights to free movement
- analyse and map the gathered data, and assess the actual status of the mobility of disabled people across Europe.

d. Select good practices that support free movement among legal, technological or social tools, present the cost/real impact relation and propose actions or solutions to present and future problems.

e. Diffuse project results and define a manual presenting the principal barriers, including good practices to overcome them (implemented solutions as well as new proposals) and guidelines for policies.

Basic concepts

To define the concept of free movement and equal opportunities for all, the project focuses on the goals of the 2004-2010 Action Plan for equal opportunities of people with disabilities[1] and on the Regulation on the coordination of social security systems when moving within the European Community consolidation[2]. The following topics, mainly used from a general point of view, can be considered the origin of the concept: Freedom of movement, equal opportunities and universal access.

Freedom of movement, mobility rights or the right to travel is a human rights concept which the constitutions of numerous states respected. It asserts that a citizen of a state, in which that citizen is present, generally has the right to leave that state, travel wherever the citizen is welcome, and, with proper documentation, return to that state at any time; and also (of equal or greater importance) to travel to, reside in, and/or work in, any part of the state the citizen wishes without interference from the state.

Equal opportunity is a descriptive term for an approach intended to provide a certain social environment in which people are not excluded from the activities of society, such as education, employment, or health care on the basis of immutable traits. Equal opportunity practices include measures taken by organisations to ensure fairness in the employment process.

Universal access refers to the ability of all people to have equal opportunity and access to a service or product from which they can benefit, regardless of their social class, ethnicity, background or physical disabilities. It is a vision, and in some cases a legal term, that spans many fields, including education, disability, telecommunications, and healthcare. It is tied strongly to the concept of human rights.

The union of these concepts leads to the concept of free movement and equal opportunities for all which involves the desire to ensure the right of the disabled people to have an independent life. Thus, the following goals, among others, have to be addressed:

a) Access to public areas such as city streets and public buildings.
b) Access to education and employment, with new and adaptive technologies.
c) Access to paid assistance care instead of being institutionalized.

Project layout

The work program

The project has been divided in to a total of seven workpackages, of which one has to do with dissemination (WP6) and one is defined as "management" (WP7). The remaining five have various forms of research content relating to the broad areas sketched out in the objectives. Each workpackage consists of a number of more detailed tasks, including data collection, development of study methods, classification systems, reviews and evaluations as well as administrative efforts. To date, only the first two workpackages have been completed, and these will be dealt with in some detail below. The other workpackages will only be covered the workpackages in outline.

---

[1] http:// europa.eu.int/comm/employment_social/disability/index_en.html

[2] Regulation 1408/71

WP1 Information regarding legal rights

This is an introductory phase of the project, where the intention is to document the rights of disabled persons to free movement in the current European context.

The workpackage is includes codes, regulations and actions plans which contribute to the free movement disabled people – whether the initiatives are on national or regional level – and the development and application of a classification system for the various initiatives. The results paragraph below goes into WP1 in more detail.

WP2 Information regarding technological means

This workpackage attempts to review and classify technical aids which contribute to the movement of disabled people. The intention is that the workpackage should include both existing aids and technical aids at the development stage. The methods and results are described in the results paragraph below.

WP3 Evaluation of the use of the free movement rights

The aim is to define communication channels and data collection procedures with the disabled community and to compile information about

- barriers that disabled persons encounter
- disabled peoples' knowledge about their rights to free movement
- to what extent disabled people take advantage of their rights to and means for free movement.

A survey has been carried out to detect how disabled people experience the environment, how they use their rights and what they know about the rights to free movement. As a basis for the survey, a questionnaire was developed and test interviews carried out. The questionnaire includes both open and pre-coded questions about barriers in the physical environment, legal problems, social and economic topics. It also asks specific questions about policy documents and national as well as EU legislation. The data collection includes quantitative and qualitative information.

The intention was to interview 100 people in each of the seven countries. The result falls somewhat short of this goal; finding such a large number of people in every country proved impossible. (It must be remembered that the population of the countries involved range from about 2 million to more than 50 million.)

The survey was carried out in December 2007 to January 2008.

WP4 Detection of main barriers

Workpackage 4 concerns the analysis of the data collected in the survey (WP3). The analysis aims to

- detect general and specific environmental barriers that prevent disabled people from being able to exercise their free movement rights.
- obtain quantitative conclusions about the extent to which people with disabilities take advantage of their rights to free movement
- gain insight into how physical, bureaucratic or social barriers are experienced

The data will be classified by type of disability and by geographical area. The result will be a barrier map representing each barrier with its specific weight according to the geographical area and the disabled typology. Attempts will be made to assess both barriers preventing or limiting movement and the real free-movement of disabled people; the actual situation, what causes or promotes movement, differences according to type of disability, age or geographical area.

The statistical data will be complemented with qualitative aspects. The result will be a list of the main barriers, giving descriptions and critical factors, a quantitative and/or qualitative analysis, geo-economical impact and other aspects that can be detected during the project. A table is planned to serve as basic material for general and specific future studies and activities, so that a realistic report about the actual situation in Europe can be compiled.

As of February 2008 the data have been coded and analysis has started but is not yet complete.

WP5 Good practices selection to cover the existing barriers

The main aims are to:

- detect general and specific environmental barriers that prevent disabled people from exercising their rights to free movement
- obtain quantitative conclusions about extent to which people with disabilities take advantage of their rights to free movement.

The task of WP5 is to link and analyse the solutions, measures and regulations collected in WP1 and WP2. The proposed method is to place the various solutions in their corresponding place according to a specific table. Then, a set of criteria will be used to quote the transferability potential of the tool or mechanism. (The criteria are not yet to be defined.) The intention is that such a systematic screening of tools and mechanisms and filtering those with weak or no transferability potential will make it possible to detect the mechanisms which are at once both most effective and have the highest transferability potential to other European regions. The criteria will be submitted to the Advisory Committee to ensure that the critical analysis and conclusions drawn from the work with the experts' panel will be based on relevant and representative criteria.

The partners in the consortium will participate in a workshop which aims to build a consensus and to approve a common position on the analysis and benchmarking results. The coordinator will prepare an extended presentation of the project results and future expectations for discussion and validation by the Advisory Committee.

WP6 Dissemination

A dissemination plan has been worked out and runs throughout the entire project. It is the intention that project results are communicated to the widest possible audience and that specific audiences who may benefit from the results are targeted. These are identified as policy makers, academic audience and researchers, entrepreneurs and the professional sector, the media and dependent persons and their families. This involves using appropriate techniques in order to reach the various target audiences, in practice:

- ✓ All national and regional associations of disabled people.
- ✓ All regional and national administrations.
- ✓ Private companies that work with specific services for disabled people.

A mutual core of information material (some of which is used in this paper) has been agreed

among the partners to ensure a common content of all national presentations. So far, information about the project has been translated and posted on various websites, including the websites of the main organisations for people with disabilities and the homepages of the various research institutions that are involved in the project.
A project website (http://www.livingall.eu/) has been set up. The site is updated continuously by the coordinator in Valencia, Spain. The website carries news about the project, decisions and results of meetings, and as the work progresses, a series of reports will be made available. Eight reports are planned:

1. Report concerning the disabled free movement at European level (WP1)
2. Compilation and classification of the national policies and action plans in Europe (WP2)
3. Compilation and classification of technical measures.(WP2)
4. Report concerning the real free movement of disabled people (WP3 – results from survey)
5. Main barriers to free movement for the disabled (WP4).
6. Results of workshop: 1st draft of good practices (WP5)
7. Manual for Guidelines (policies, actions and technologies), and selection of good practices (WP5)
8. Final Report

To conclude the project a European conference will be held in Valencia to present the project results, discuss them and propose new actions. Invitations will be issued to the various National and Regional Disabled Associations from all 25 member states, the European Commission and National policy makers, academic audience and researchers and professionals.

WP7 Management
As with WP6, the management tasks run through the entire project. Efficient management is of course necessary to ensure that the network between the partners function at all times, and to oversee the project progress in order to respect time and resources constraints and at the same time achieve the planned outcomes.

Results per 1st March 2008
Work packages no 1-3 are completed, and the first three reports listed above are completed and are being prepared for general publication.

WP1. Report concerning the disabled free movement in Europe
The subject of the first part of this workpackage is existing policies and legal positions, as expressed in official EU documents. The work therefore concentrated on compiling documents detailing opportunities, equal rights, non discrimination and accessibility for disabled people in European Member States. The compilation includes laws, regulations and policy documents, all of which are commented on and analysed briefly. Each chapter contains a table giving an overview of the relevant initiatives, their objectives and impact. (fig. 1)This is done both on a general European level and with regard to eight specific areas:
- Housing and built environment initiatives and policies
- Communication initiatives and policies
- Transportation initiatives and policies

- Social security initiatives and policies for free movement and equal opportunities
- General social support
- Health services
- Education and training initiatives and policies
- Labour and employment initiatives and policies

These eight categories are used as basis for classification methods and systems as well as for the survey questions, and form almost a backbone for the project.

Table 8. Summary of the initiatives concerning the disabled free movement at European level regarding education and training.

YEAR	NAME OF THE INITIATIVE	OBJECTIVE / IMPACT
2001	Council decision on the European year of people with disabilities 2003. (2001/903/EC)	A main goal is the right young people with of young disabled people to education.
2002	Declaration of Madrid non discrimination plus positive action results in social inclusion	Local actors should be invited to integrate the needs of people with disabilities in education.
2003	Citizens not patients: developing innovative approaches to meet the needs of disabled people. CONFMIN-IPH(2003)5	The importance of promoting education for disabled people.
2003	Prevention of disabilities linked to chronic diseases CONFMIN-IPH (2003) 7	It calls to the right to received proper education and training as part of the integration of disabled in society.
2003	Council resolution on equal opportunities for pupils and students with disabilities in education and training. (134 , 07/06/2003)	Encourages and support full integration of people with special needs in society through their appropriate education and training.
2005	Situation of disabled people in the enlarged European Union	It recognised the importance of education and vocational training to help to develop the person's potential and their individual abilities

Figure 1 *An example of how initiatives are summarised in tabulated form.*

Main findings

A wide range of measures exist, both on an overall level and for each of the eight areas. However, the emphasis given to employment is greater than other issues, probably because anti-discrimination rights in the EU first focused on equal treatment at work.

Access to housing, communication and transport are also covered well, and European guidelines and standards have been developed an agreed upon. Improvements are, however, needed in the health and social systems. The incorporation of the Open Method of Coordination in the field of social protection and social inclusion77 will imply future work on these issues, balancing the current situation among Member States.

WP1. Compilation and classification of national policies

The second part of the workpackage concerns policies and legal positions on the national rather than on EU level. The compilation includes national/government initiatives in 12 countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Norway, Portugal, Slovenia, Spain and United Kingdom.

The procedure required the partners to collect information about government and non-government initiatives related to free movement and equal opportunities for all in 12 countries, and a parallel and collaborative effort to develop a classification system and criteria for the evaluation of initiatives. The classification system was then used to analyse and classify more than one hundred and twenty national initiatives, out of a section of approximately ten per country. The criteria for the selection of the initiatives were:

a) at least one (maximum two) initiatives per each thematic area following the classification of environmental factors in the international classification of functioning, disability, and health, known as ICF (housing, communication, transportation, social security, general social support, health services, education and training, labour and employment)
b) focusing on government initiatives, but trying to include one or two non-government initiatives per country;
c) selecting the most current and relevant initiatives per country.

The resulting report is divided into one main and two additional sections. The first consists of an introductory description of the situation of different initiatives and actions related to the disabled free movement in the countries. A table summing up the initiatives per country concludes the first part of the report (fig. 2). The second part shows the compilation of government and non-government initiatives in each country (including web links in order to facilitate access to the information). The third part contains the LivingAll initiatives classification system.

	Austria	Belgium	Denmark
Housing and built environment	- **Art. 7/8 of the National Constitution (2005)** aim for the equality of all citizens. - **Federal Equality Law for disabled people (2006)** established to prevent discrimination and promote integration in the area of housing and built environment. - **Federal social office (2004)** promotes the use of free barriers standards. - **Lifehelp Austria (1967)** private institution to promote equal opportunities.	- **Decree of the Walloon Government (1999)** aiming to encouraging the projects in favour of handicapped people. - **Decree of the government of the area of Brussels-capital (2006)** stopping titles I to VII.	- **National Building code (1995)** establishes the standards for building for all. - **National coding** system for accessibility to business.
Communication	- **Federal Equality Law for disabled people (2006)** established to prevent discrimination and promote integration in the area of communication. - **Federal social office (2004)** promotes the use of free barriers standards. -**Community integration sonderpädagogik (1998)** promotes equal opportunities in communication.	- **Decree of the Walloon Government (1999)** aiming to encouraging the projects in favour of handicapped people. - **Decree of 22nd October 2203** relating to the recognition of the language of the signs.	- **The equal opportunities centre for disabled persons.(2007)** monitors developments for equalisation of disabled people.
Transportation	- **Federal Equality Law for disabled people (2006)**, established to prevent discrimination and promote integration in the area of transportation. - **Federal social office (2004)** promotes the use of free barriers standards. - **Community integration sonderpädagogik (1998)** promotes equal opportunities in transportation. -**Centres for advisory service of disabled people (1994)** they are contact points for better transportation possibilities. - **Lifehelp Austria (1967)** private institution to promote equal opportunities.	- **Decree of the government of the area of Brussels-capital (2006)** fixing the maximum number of vehicles with allowance to exploit a service of taxi. -**Royal decree of the 12 December 2001** to provide allowance for the assistance of disabled people.	-**Technical regulation on the design of passenger ships (2000)** regarding accessibility for passengers with disabilities.

Figure 2 *Excerpt of summing up table.*

Main findings

The number, range and scope of the policy instruments and actions is considerable in all of the countries, although the means and methods used vary considerably. This reflects the diversity of the problems, the comprehensive ways in which they are being addressed and the differences in the national approaches. The aims are, however much the same:

The legal initiatives in most of the countries are related to the general concept of non-discrimination. Legal measures were at fist mainly directed towards social security, general social support and health services; integration and accessibility were covered from a more general point of view. A wider aim to promote integration and equal opportunities had the effect of focusing later efforts on education and labour market, and thereafter initiatives in the fields of communication, accessible websites, legal measures regarding transportation, sheltered employment, housing issues etc.
Obviously the process varies considerably from country to country: Some do not have specific constitutional provisions regarding equality and non-discrimination, but provide laws and regulations to promote equal opportunities. Such is the case in Belgium, the Scandinavian countries in the compilation, and Slovenia. On the other hand, some of the countries have developed a specific framework or general plan to improve the quality of life and achieve independent living conditions and equal rights. This is the case in Austria, Germany, Italy, Norway and recently Portugal and Spain.
Despite the national differences, all the countries have made great efforts to develop legislation improving the right of access to employment, health and social security as well as the built environment. However, other areas such as general social support, communication or education show a wider gap between the countries. Finally, it can be observed that in some countries, like Austria and Germany, the role of non-government organisations and initiatives is more relevant and efficient than in other European countries.

WP2. Compilation and Classification of Technical Measures
This workpackage was divided into two parts
- Collecting and reviewing technologies which exist or are under development, and which may support and improve the mobility of people with disabilities and projects currently under development.
- Compiling and classifying the information, and giving an overview of the current state in the member countries.

Each partner was assigned a field of study according to his or her respective area of expertise for collection and classification:

Area of technology	Partner
Urban planning	UPIRS
Construction rehabilitation	SINTEFByggforsk and HABINTEG
Life time homes	HABINTEG
Smart homes	CNR ITC
Mobility	TUW
Disabilities care services	ISS

As a result, the report presents a systematic collection of technologies supporting the free movement of people with disabilities, using the classification system that the project has developed for this purpose. It must be remembered, however, that the field of technical tools and aids is vast. The report can therefore only serve a first level of knowledge and a starting point for further investigation.

The report presents the technologies in six chapters, as laid out in the table above. The technologies are then analysed by means of a classification system with 12 main variables. These are laid out as open questions or as multiple choice questions with a given set of answers. The variables are:

1. *Name* of the technology or project, aid, etc.
2. *Source*, giving links to web-pages with detailed information on the technology, source of supply or any other type of source
3. *General description* of the technology, project, aid, etc., and a description of the aim and function of the technology.
4. *Type of disability*, i. e. issues that will benefit from the technology (following ICF Classification (WHO, 2003), as follows:
   - □ Learning and Applying Knowledge (watching, listening, learning to read, learning to write, learning to calculate, solving problems)
   - □ General Tasks and Demands (undertaking a single task, undertaking a general task)
   - □ Communication (receiving spoken messages, non verbal messages, speaking, producing non verbal, conversation)
   - □ Mobility (lifting and carrying objects, fine hand use, walking, moving around using equipment, using transportation, driving)
   - □ Self Care (washing, caring body parts, toileting, dressing, eating, drinking, looking after one's health)
   - □ Domestic Life (acquisition of goods and services, meals, housework, assisting others)
   - □ Interpersonal Interactions and Relationships (interpersonal relationships, relating with strangers, formal and informal relationships, family relationships, intimacy)
   - □ Major Life Areas (education, remunerative employment, basic economic transactions, economic self-sufficiency)
   - □ Community, Social and Civic Life (community life, recreation and leisure, religion and spirituality, Human Rights, political life and citizenship)
   - □ Any other Activity and Participation
5. *Area of application* of the technology (following ICF Classification (WHO, 2003) regarding to the Environmental Factors, Products and Technology part.
   - □ Personal consumption
   - □ Personal use in daily life
   - □ Personal indoor and outdoor mobility and transportation
   - □ Products for Communication
   - □ Design, construction, building products and building technology for private use
   - □ Design, construction, building products and building technology of for public use
6. *Geographical scope*, i. e the area in which the technology or aid is available or is planned to be made available:
   - □ European Union
   - □ National Level (Name of the Country)
   - □ Regional level (Name of the Region)
   - □ Local level
7. *Price* (real or estimated) or typical price spread of the technology, aid etc.
8. *Standards* including detection, creation and application of requirements which contribute to raising levels of quality, safety, reliability, efficiency and interchangeability.

9. Financial aids, i. e. private and public funding available to implement the technical instruments and services classified by nature of the financial organisation: European Commission (Framework Programmes), Banks, Associations, Large and Medium Enterprises, Technological Centres, European Technological Platforms, Public Administrations
10. *Obstacles* to implementation, i.e. barriers to practical application.
11. *Other issues* which may contribute to the free movement and equal rights of the disabled, and which does not fit in other categories.

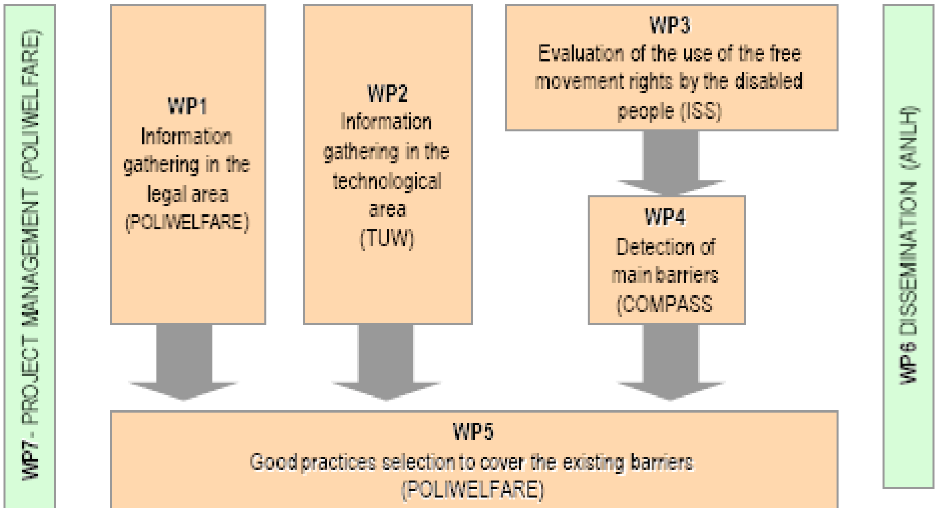
The field of technologies and technical aids is so large that giving a complete overview or everything that is available in Europe is a major project in itself, and thus outside the scope of the Livingall project. The collected data can, however, be seen as a representative cross section of available tools and products, and should serve well as a starting point for further investigation. The collection is also comprehensive enough to draw some general conclusions:

Main findings
In planning, construction rehabilitation and life time homes, generally approved standards exist or are emerging. Implementation seems to be the main challenge: Although successful in some European countries, making practical use of the standards in new construction and rehabilitation works is not necessarily an easy matter, whether it involves central or local authorities, private or public enterprises.
For care services, mobility and smart homes, a lot of suppliers offer different systems and aids. A main challenge would therefore seem to be ways to find providers of specific systems or aids in any one country, and ways to obtain information about possible government aid or other forms of financial support.

Appendix 1

Project partners
- Coordinator: Polibienestar Research Institute, University of Valencia- POLIBIENESTAR (Spain).
- Compass Sozial – und Gesundheitsverein - COMPASS (Austria).
- Spanish Society of Social and Health Care - SEAS (Spain).
- Association Nationale pour le Logement des Personnes Handicapées - ANLH (Belgium).
- Regional Department for the Environment, Water, Urban Planning and Housing- DGV (Spain).
- Council National Research Construction Technologies Institute - CNR ITC (Italy).
- Institute 'integrated study', Vienna University of Technology - TUW (Austria).
- Urban Planning Institute of the Republic of Slovenia – UPIRS (Slovenia).
- SINTEFByggforsk (Norway).
- Habinteg Housing Association Ltd – HABINTEG (UK).
- Innovaciones Sociosanitarias S. L.- ISS (Spain).

Appendix 2
Overview of workpackages



Appendix 3
Members of the advisory committee

- Miguel Angel Cabra de Luna, Fundacion ONCE, Spain
- Cveto Ursic, Directorate for Disabled Persons, Slovenia
- Camilla Ryhl, Aalborg University, Denmark
- Mirjana Dobranovic, CUPDPA, Croatia
- Tomas Kucera, Charles University in Prague, Czech Republic
- Maria Kele, MEOSZ, Hungary
- Monika Klenovec., Architect and expert, Austria
- Simon Janos, University of Miscolc, Hungary
- Henry Domanski, Polish Academy of Sciences, Poland
- Katarzyna Swiezawska-Ambroziak. ASM Market Research and Analysis Center ltd, Poland
- Marie Eve Joel, University Paris Dauphire, Paris, France

EDUCATIONAL SPACES FOR CHILDREN WITH AUTISM; DESIGN DEVELOPMENT PROCESS

Rachna Khare
Georgia Institute of Technology, Atlanta, USA,
rkhare6@mail.gatech.edu ,
rachnakhare@bitmesra.ac.in

Abir Mullick
Georgia Institute of Technology, Atlanta, USA,
abir.mullick@coa.gatech.edu

Keywords: Autism, design, guidelines, educational spaces

Abstract:
Autism is a complex developmental disability that affects communication, social abilities and imagination[3]. Apart from the triad of deficits there are associated differences in perception of senses that impairs the way of thinking and perceiving the world. This paper attempts to discuss the design development process, for educational spaces, to facilitate children with autism to respond more positively to teaching and therapies. The paper is derived from a larger study that consists of five parts (1) Establishing relation between environment and the needs of autistic children (2) Environmental design considerations to address educational and behavioural aspects (3) Design parameters that have a strong connection to autism (4) Measurement scale to evaluate design parameters (5) Design guidelines based on the evaluation of the parameters. The study has made it clear that although abilities and behavioral patterns exhibited by an individual child can vary enormously, there are considerations among most children that require special attention. These considerations provide a sensitive base, which has the ingredients to meet the needs and enhance learning. On the whole the study considers many design aspects such as observation, discussion and survey, the sole purpose of this paper is to build up a development methodology that is expected to guide environmental design for education of children with autism.

'Reality to an autistic person is a confusing, interacting mass of events, people, places, sounds and sights. There seems to be no clear boundaries, order or meaning to anything. A large part of their life is spent just trying to work out the pattern behind everything.' -A person with autism[4]

1.0 Introduction

'Universal design has most commonly been applied in connection with physical or sensory impairments and thus, at least in practice, does not specifically address the needs of individuals with significant cognitive impairments. Yet there are increasing number of people who suffer from cognitive impairment who could also benefit from environments that are more usable.' (Calkins, Sanford, Proffitt, 2001). Autism like other cognitive disabilities, because of its complex nature, has remained unrepresented in accessibility design guidelines in the past. Until recently it was considered as hopeless and incurable condition, but now with advancement in special education and understanding of enabling environments, it is clear that all people with autism can benefit from a timely diagnosis and access to appropriate

[3] http://www.actionasd.org.uk/whatisautism.html
[4] http://www.autism.org.uk/nas/jsp/polopoly.jsp?d=1062

environments, services and support. With increasing attention to autism and government funding, many researchers are studying the complex field of autism but the concerns for supportive learning environment for the children is still missing. This paper attempts to discuss a progression that would produce design guidelines for educational facilities and its scope is limited to the design development process and the development of design evaluation tools. While the overall procedure utilizes methods such as observation, discussion and survey, the primary intent of this paper is to inform the methodology that will direct environmental design of learning environments.

2.0 Background

‘Autism is a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences.’[5]

The three main areas of difficulty which all people with autism share are sometimes known as the 'triad of impairments'. They are difficulty with social communication (difficulty with verbal and non-verbal communication like language, gestures, facial expressions or tone), difficulty with social interaction (difficulty with social relationships, for example appearing aloof and indifferent to other people), difficulty with social imagination (difficulty in the development of interpersonal play and imagination)[6]. Autism is known as a ‘spectrum disorder because the severity of symptoms ranges from a mild learning and social disability to a severe impairment and highly unusual behavior. Autism may also occur in association with other difficulties like mental retardation, sensory dysfunction, hyperactivity and seizure disorder. The most recent estimates of the prevalence of Autistic Spectrum Disorders have suggested a figure closer to 1% of the population in UK [7] where it has touched the lives of over 500,000 families. In USA, it is estimated that 1.5 million children[8] and adults have some or the other form of autism, and another 15 million (parents, health care professionals, loved ones etc) gets directly impacted by autism. Numerous studies have placed the occurrence of autism at a rate of approximately 1 in 500 people[9]. This means there are an estimated 2.0 million autistic persons in India and 2.65 million autistic persons in China, at their current population, assuming that there are no significant variations in this rate worldwide.

Educating children with autism is a challenge for both parents and teachers. These children have unique strengths and weaknesses (Hodgdon1995). Academic goals are tailored to that individual's functioning level. Educational programming for students with autism often addresses a wide range of skill development including academics, communication and

[5] Individuals with Disabilities Education Act (IDEA), United States of America, the federal legislation under which children and youth with disabilities receive special education and related services.

[6] National Autistic Society, United Kingdom, http://www.nas.org.uk

[7] National Autistic Society, United Kingdom, http://www.nas.org.uk

[8] Based on the autism prevalence rate of 2 to 6 per 1,000 (Centers for Disease Control and Prevention, 2001) and 2000 U.S. Census figure of 280 million Americans.

[9] Disability fact sheet on Autism (NICHCY: 1.800.695.0285), No.1, April 2007, A publication of the National Dissemination Center for Children with Disabilities, USA, pp3& http://www.autism-india.org/afa_ aboutautism. html

language skills, social skills, self-help skills, leisure skills and behavioral issues (Schopler, Lansing & Waters, 1983; Maurice, Green & Luce, 1996).

3.0 The Study

According to the literature on environment and behavior relations, how a person behaves in a particular situation does not reflect either the person alone or that person's environment but rather, the interaction between the two (Mead, 1934; Cronberg, 1975). This perspective on the nature of person-behavior-environment is the defining characteristic of a transactional perspective (Moore, 1976 Wandersman; Murday & Wadsworth, 1979; Stokols, 1981, 1987; Altman & Rogoff, 1987). A term used to characterize the appropriateness of a particular person-behavior-environment transaction is "congruence" or "fit". Fit is a state of equilibrium where an individual's capabilities are in balance with the demands of the environment. Equilibrium may not be a specific pivot point but rather "zones of adaptation" within which individuals are sufficiently challenged yet not so challenged or deprived that they are under pathological stress. Perception of users plays a role in "fit." Enabling environments, designed to achieve the best fit, should be congruent with the functional requirements of users.

The study is carried out based on the belief that 'Performance of pupils with autism is enhanced in appropriate physical environment'. The objective is to identify the enabling aspects of educational environments, measure their affects on educational performance and develop design guidelines that will lead to the development of effective educational spaces for autistic children. The present study is intended to create a developmental framework for designing educational facilities and it will offer a tool for architects, designers and facility managers to design high performance educational spaces.

The study is carried out in two stages. In the first stage, a set of environmental design considerations to aid children with autism to respond more positively to teaching were developed based on the management strategies (Schopler, Lansing & Waters, 1983; Maurice, Green & Luce, 1996) used in the existing educational settings. These environmental considerations produced autism-friendly environments and they were based on the initial study[10] that reviewed eleven educational facilities including eight field studies at Germany & India and three literature studies at USA & UK with children with autism. The facilities chosen represent most restrictive to least restrictive educational settings for children with autism.

Based on the expert's interviews in the educational facilities, environmental interventions adopted by therapists and available literature (BB-77 1992; BB-94 2001; Stokes 2001; Harker & King 2002; Humphreys 2005), autism friendly environmental design considerations were developed. These environmental considerations were expected to improve educational performance of pupils with autism. The environmental considerations included detailed description of the autism friendly environmental requirements at both macro (location, site planning, landscaping etc.) and micro (building design, services, furniture, fittings, building materials etc.) level. Design parameters were developed to evaluate the enabling aspects of educational environment. They are concise versions of the environmental considerations that had a strong connection to autism. These parameters have a tripodic relationship between deficits, conditions and spectrum and summarize the environmental requirements for children

[10] Initial part of the study was carried out under Research &Development project sponsored by All India Council of Technical Education, India

with autism. They acted as a 'measurable quantity' during evaluation and will be used to determine the result of the study in the form of design guidelines.

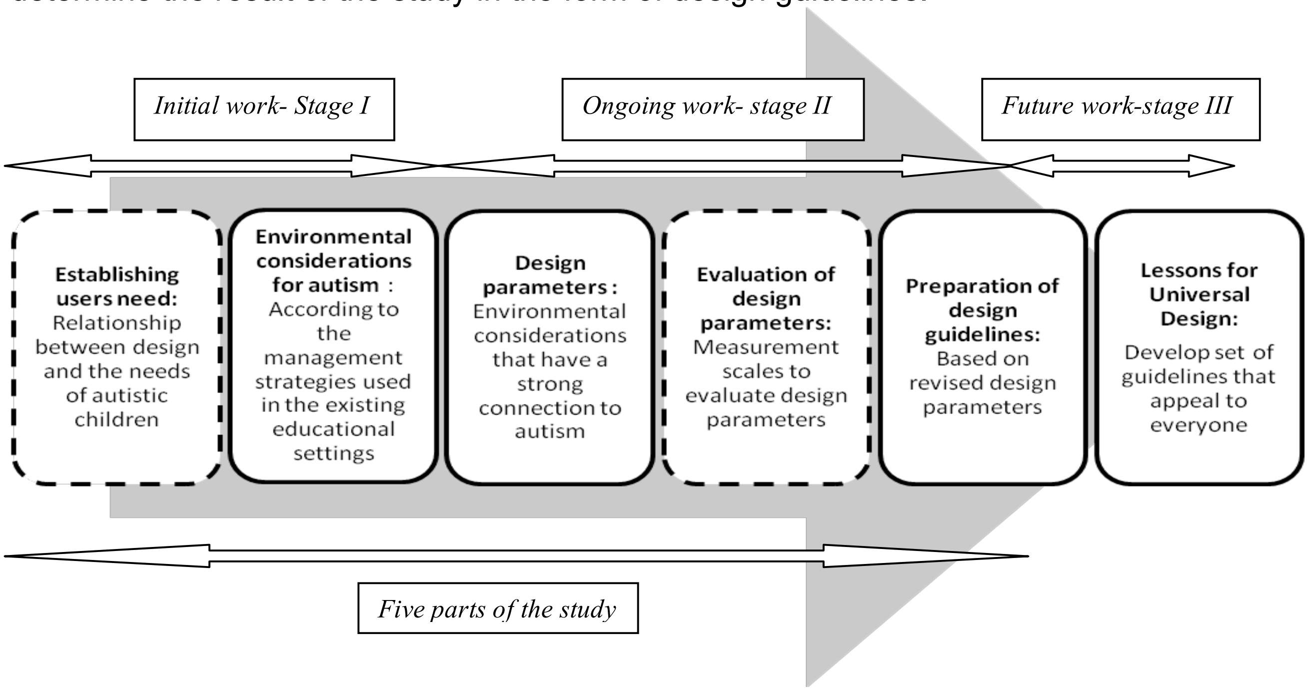


Figure 1 *The design development process*

In next stage, the study is extended[11] to develop three testing tools to evaluate the design parameters. To be explained later, these tools are the environmental audit, performance measurement scale and design parameter rating scale. The environmental audit is a checklist of design parameters derived from the environmental design considerations for autism and their presence is expected to improve educational performance. The performance measurement scale is derived to test the performance aspects of the parameters. To understand how environment impacts educational performance, the measure scale will be used by teachers to obtain information about children's performance and the role the environment plays in education. Design parameter rating scale is developed to assess the importance of the parameters and the extent to which the environment is important for education. Teachers will employ the scale to rate the role of environment in education.

This paper uses the design parameters to lay ground for the tool development in the new study. The design parameters and tool development work have been included in the paper. The larger study will conclude with a set of design guidelines based on evaluated design parameters to develop a framework that architects, designers and facility managers can employ to design educational facilities for children with autism.

4.0 Tools:

4.1 Environmental Audit (EA)

The environmental considerations for educational spaces for children with autism are developed for all the aspects of building design. They are prepared as per the literature on

[11] Ongoing part of the study is done under Fulbright program in College of Architecture at Georgia Tech, Atlanta, 2007-08

autism and observations in existing school facilities for autistic children. The eighteen design parameters summarizing environmental considerations form the basis of environmental audit checklist.

These eighteen items on the checklist are intended to prompt inspection so that their extent of presence in the environment can be recorded on a five point scale from exceptionally high to unusually low level (Table-1). Designers surveying a facility will be asked to check the building features that matches with the checklist in the environment. These are the assessment criteria and they depend upon extent of their presence in the environment. For example for exceptionally high level they have to be strongly present in all areas, for high level they have to be strongly present in some areas, for moderate level they have to be somewhat present in classroom and so on.

ENVIRONMENTAL AUDIT						
ENVIRONMENTAL FEATURES	Exceptionally high level	High level	Moderate level	Low level	Unusually low level	Comments
Physical structure						
Visual structure						
Visual instruction						
Opportunities for community participation						
Opportunities for parent participation						
Opportunities for inclusion						
Opportunities for future independence						
Space standards						
Withdrawal spaces						
Safety						
Comprehension						
Accessibility						
Space for assistance						
Durability and maintenance						
Sensory distraction management						
Opportunities for sensory integration						
Flexibility						
Monitoring for assessment and planning						

Table 1 *Environmental Audit*

4.2 Performance Measure for Pupils with Autism (PMPA)

There is usually a list of misfit situations between the building and the occupants that can only be discovered in an occupied facility (White 1991). Performance Measure for Pupils with Autism is a sequential evaluation process that measures performance of the pupils in an existing educational environment that has already undergone environmental audit.

Since design parameters and performance measures are related, the questions to assess the performance were derived from the design parameter. Teachers will be asked to respond to a questionnaire (Table-2) about the educational performance of children that is related with their interaction with the environment.

Performance Measure for Pupils with Autism		Yes	Some	No	Comments
1	Most pupils are able to locate themselves in the school environment?				
2	Most pupils know the purpose of different spaces in the building (like instructional areas, work areas, leisure areas, dining areas and others)?				
3	Most pupils are able to perform activities more independently in the areas that uses color coding, picture coding and number coding?				
4	Most pupils are able to perform activities more independently in the areas with visual instructions?				
5	Most pupils are able to perform different type of learning activities (academic, self-help, vocational, leisure, social, community and others) in the school environment?				
6	Storage in teaching areas is usable by most pupils independently?				
7	Most pupils require parent's involvement in educational planning?				
8	Most pupils get the opportunities to interact with same age peers?				
9	Most pupils are comfortable in common areas (like cafeteria, group teaching areas)?				
10	Most pupils use planned/unplanned spaces for unique needs such as furniture and corners for withdrawal purposes?				
11	Most pupils are safe in the school environment (escapes, railings, heights, sharp edges, non-slippery surfaces, electrical outlets, breakable items, non toxic materials and others)?				
12	Most of them understand safety signs and emergency exits in the school environment?				
13	School building offer independent access to most pupils?				
14	Most pupils need assistance while learning new activities?				
15	Most pupils use the school building (materials, finishes, fittings, hardware and equipments) for intended purposes?				
16	The use of building and equipment by pupil demand				

	frequent maintenance?				
17	Most pupils can deal with visual distractions (like escape routes, windows, lights, shadows, patterns) in the school environment?				
18	Most pupils can deal with auditory distractions (like classroom noise, sound and vibrations from equipments) in the school environment?				
19	Most pupils can handle tactile distractions (like different textures of the building materials, furniture) in the school environment?				
20	Most pupils can manage olfactory distractions (like smell from kitchen and dining areas) in the school environment?				
21	Most pupils benefit from multisensory stimulations (like opportunities for rolling, jumping, spinning, vibrations, music, different smells and tactile experiences) in the school environment?				
22	Does reorganization of spaces helps implementing different instructional method and new therapy to most pupils?				
23	Is monitoring method effective and does not distract most pupils?				

***Table 2** Performance Measure for Pupils with Autism*

4.3 Design Parameter Rating Scale (DPRS)

Children with autism vary widely in abilities, intelligence, and behaviors[12]. This was clear after observing children with autism, listening to the staff, discussing their behavioral characteristics, visiting autism schools and learning about autistic spectrum disorders. Everyone is impacted differently by autism though for most people, the environment forms the basis for their response. As a result, some people who are highly functioning individuals can be taught in classrooms with able-bodied children, whereas others have more unique needs and their classroom requires to be present in specialized schools. But for all of them, the environment serves as an important teaching tool and their education is enhanced by well designed environment and negatively affected by ill conceived spaces.

The children with autism need structure, clarity, predictability and safety in their surroundings to improve their performance. To address this, teachers will be asked to review the eighteen environmental design parameters and rate them for their importance in education and development (Table-3).

[12] Disability fact sheet on Autism *(NICHCY: 1.800.695.0285)*, No.1, April 2007, A publication of the National Dissemination Center for Children with Disabilities, USA, pp 3.

Design Parameter Rating Scale						
Environmental Features	Highly recommended	Recommended	Recommended with reservation	Not sure	Not recommended	Comments
Provide Physical Structure- organize physical environment through clear physical and visual boundaries to establish context of activity associated with a physical space.						
Maximize Visual Structure-organize visual environment through concrete visual cues and visual importance by incorporating color coding, numbers, symbols, labeling, illuminated sign boards, highlighters etc.						
Provide Visual Instruction- give sequence of steps to follow an activity (in the spaces where activities are to be performed) in the form of written instructions, pictures, visual schedules etc.						
Opportunities for Community Participation- involve pupils in the community activities in every day works such as shopping or using public transport.						
Opportunities for Parent Participation- involve parent in schools activities to address pupil's individual educational needs.						
Opportunities for Inclusion - present an environment to the children with autism to interact with able bodied peers.						
Maximize Future Independence- provide environment for learning life skills and vocational skills that makes them independent in future.						
Generous Space Standards- help pupil with autism to deal with social demands as they are sensitive to loss of personal space and threatened by crowding.						
Provide Withdrawal Spaces- quiet areas that allow pupils with autism to withdraw to avoid unnecessary stress and anxiety in socially demanding spaces.						
Maximize Safety- minimize threats to pupil due to their own condition, unawareness or any disaster.						
Maximize Comprehension- clear layout, direct routes, clear zoning, simple forms, and no visual clutter assist pupil with autism to perceive the school environment easily.						
Maximizing Accessibility- poor coordination and balance, epilepsy, poor attention span in autism may require building to be made physically accessible.						

Provide Assistance- space needed to help pupil doing learning activities in classroom, toilet, dining areas and others						
Maximize Durability and Maintenance- durability and maintenance of equipment, hardware, furnishing, fitting, furniture etc from damage and misuse by pupil.						
Minimize Sensory Distractions- least distracting settings that are away from any visual, auditory, tactile distractions.						
Provide Sensory Integration-includes multisensory stimulations in the environment like opportunities for Rolling, jumping, spinning, vibrations, music, different visual experiences etc.						
Provide Flexibility- relating to broad spectrum of functional skills and diverse teaching models.						
Provide Monitoring for Assessment and Planning- monitoring pupil with minimal distraction for assessment, safety and activity planning.						

Table 3 *Design Parameter Rating Scale*

5.0 Conclusion:

In rehabilitation practice, the environment provides a prosthetic support for functional performance. Standards and codes establish the importance of the environment and the need for appropriate interventions to match individual capabilities. The prevailing view that one environment for everyone may not provide the needed support that many children with autism require, triggers the idea of individualized learning opportunities that best enhances education and development.

Autism is thought to put people in a difficult position surrounded by uncertainty and unpredictability, which can be unnerving. Although designing physical environment for autism requires a good understanding of autism and the need of individual requirements, some design principles can be applied to improve their responses to teaching and therapies. The present study attempts to identify environmental issues of importance for educating children with autism. Then, the study employs teachers and therapists to measures their impact on education. Finally, the environmental issues will be tested to determine the design guidelines to facilitate children with autism in educational spaces.

The future course of study plans to establish a connection with universal design principles. The environmental design aspects of the study will be compared with school design guidelines to highlight compatibility and contradictions. This will help to develop a set of guidelines of appeal to everyone. We do not expect to come up with uniform set recommendations for everyone, but rather a flexible set of directives that will allow creating many different types of educational environments within the larger environmental concept so places can be personalized to meet the needs of all children. Universal design for educational facility will be inclusive, and it will provide equal educational opportunity for everyone.

References:

Altman, I & Rogoff, B. (1987). World Views in Psychology: Trait, Interactional, Organismic and Transactional Perspectives. In D. Stokols & I. Altman (Eds.), Handbook of Environmental Psychology, pp.7-40, Volume 1, New York: John Wiley & Sons.

Calkins, Margaret, Sanford, Jon A., Proffitt Mark A.(2001), Design for Dementia, challenges and lessons for Universal Design, Universal Design Handbook, pp. 22.1-22.24, chapter22, Preiser, Wolfgang, Ostroff, Elaine (Eds.), New York: McGraw-Hill.

Cronberg, T. (1975). Performance Requirements for Building – A Study Based on User Activities. Sweden: Swedish Council for Building Research.

Designing for pupils with special educational needs: special schools (1992), BB77, Department for Education and Employment, United Kingdom, HMSO.

Harker, M., King, Nigel (2002), Designing for special needs, RIBA publications.

Hodgdon, Linda A. (1995), Visual Strategies for improving Communication, Quick Roberts Publishing.

Humphreys, Simon (2005), Autism and Architecture, Autism London, Feb-March.

Inclusive School Design: Accommodating pupils with special educational needs and disabilities in Mainstream schools (2001), BB94, Department for Education and Employment, United Kingdom, HMSO.

Khare, Rachna (2005), Prototype design of special school for autistic pupil, unpublished report to the All India Council of Technical Education, India.

Maurice, C., Green, G. & Luce, S. C. (1996), Behavioral intervention for young children with autism: A manual for parents and professionals.

Mead, G. (1934). Mind, Self and Society. Chicago: University of Chicago Press.

Moore, G. (1976). Theory and Research on the Development of Environmental Knowing. In G. Moore & R. Golledge (Eds.), Environmental Knowing: Theories, Research, and Methods, pp.138-164. Stroudsburg, PA: Dowden, Hutchinson & Ross, Inc.

Schopler, E., Lansing, M. & Waters, L. (1983), Individualized assessment and treatment for autistic and developmentally disabled children (vol III): Teaching activities for autistic children, TEACCH.

Stokes, Susan (2001), Structured Teaching: Strategies for Supporting Students with Autism, pp.57-69, CESA 7, Wisconsin Department of Public Instruction.

Stokols, D. (1981), Group x place transactions: Some neglected issues in psychological research on setting. In D. Magnussson (Ed.), Toward a psychology of situations: An interactional perspective, pp393-4150, Hillsdale, NJ:Erlbaum.

Stokols, D. (1987), Conceptual strategies of environmental psychology. In. D. Stokols & I. Altaman (Ed.s), Handbook on environmental psychology, Vol.1, pp.41-70, New York:Wiley.

Wandersman, A., Murday, D., & Wadsworth, J. (1979), The environment-behavior-person relationship: Implications for research. In A. Seidel & S. Danford (Ed.s), Environmental design: Research Theory and application, pp. 162-174, Washington, DC: Environmental Design Research Association.

White, Edward T. (1991), Post occupancy evaluation and the corporate architect, pp.3-6, Architectural Media Ltd. Arizona

TRAINING: LIMITS AND BENEFITS BY THE BEST PRACTICES

Annalisa Morini
CNR (National Research Council)
ITC (Construction Technologies Institute) Italy
a.morini@itc.cnr.it

Keywords: Accessibility; Best Practices; Training

Abstract

Education and training are important aspects of creating the most suitable approach for an efficient comprehension of the concepts related to accessibility. Once people understand and incorporate them, it is easier to implement the concepts, and give better solutions than simply applying laws or technical rules. Best practices play an important role in education and training, because they show, in a simple and easily comprehensible way, what can be done and what already has been done, promoting a positive behaviour also in those technicians or decision-makers who are facing the problem for the first time.

Of course, best practices reflect the level of knowledge of:

- *people who write the book/paper about the best practices;*
- *people who chose and analysed the examples and*
- *the different actors involved in the design and building phases of the construction.*

In this paper we will underline the advantages and limits of showing best practices, trying to create a critical approach in reading them. In fact, best practices can not be considered as "the result", but as a continuous improving approach, starting from the technical and economic possibilities of the actors of the building process. The goal is therefore to look at them not in a passive way, but to try to put into evidence possible further improvements. The idea started with two European projects in which we worked and recently completed: POLIS and BAS. In fact, we noticed that the building examples of "best" practices that our partners and ourselves chose at the beginning, with the increase of knowledge of the field, became good but improvable examples. Goals are therefore the following:
to analyse the examples with a critical eye;
to understand that accessibility is a continuous improving process.

1. Introduction

Due to many factors, especially because of the work and efforts of associations for persons with disabilities accessibility (or Universal Design or Design for All[13]) is a concept which evolved during the years and which is destined to change in the future. Rules, laws, suggestions, technical requirements are tools which will accompany or push its change. If we

[13] The different terms derive more from a geographical custom that from the concepts; in fact, UD born in USA thanks to Ron Mace, while DfA in Europe. While the two imply the involvement of any type of product, accessibility is directly addressed to building and building components, even if nowadays it is often accompanied (or substituted?) by the word usability. Another term now frequently used is inclusive, even if not spread in the same measure. Further, we noticed that also visitability and adaptability, parts of the concept of accessibility that Italian law introduced as one of the first countries in 1996 and that in the past were regarded with suspicion, are now appropriately used because it was fully understood their meaning. For a further knowledge on terms, see also Ostroff, 2001.

briefly remember the concept of accessibility at the end of '60 years, even words related to accessibility were different. People with physical impairment were called "invalid, mutilated, crippled", barriers were considered only obstacles for people with physical disabilities, while nowadays barrier is considered anything that does not allow users to orient themselves and recognise places or sources of danger.

New laws and rules followed during the years and tried to cover greater areas, both within construction fields (from public buildings to private, from buildings to outdoor areas) and economic sectors, covering education to transport and health services to employment). While in the USA there are common technical rules related to Universal Design, in Europe there is not and it is surely a disadvantage. Even if according to Nummelin and Christophersen (Nummelin, Christophersen, 2005) "regulations do not necessarily mean that a sufficient level of accessibility is achieved in new or existing built up settings", they can constitute a common basis for starting and also to go further and probably produce an improvement.

A common framework in Europe could constitute a big saving in costs, time, a wider dissemination of the same knowledge to anyone, and a clearer application of the rules[14]. Probably something is changing, if it is true that the Consortium of European Building Control (CEBC) made an enquiry in 2006 that was devoted to understand which and how technical rules are applied in all the European countries, (25 at that time), even if the results are not yet published[15]. In the past, the accessibility of many public buildings was not guaranteed. Now the discussion and the fight in many cases is changed to the use of a back door instead of the principal one: is this a discrimination toward people with disabilities or not?

Examples and figures accompanied the technical rules, in order to facilitate the task of designers and architects, then the phase of "best practices" accompanied and even overcame the technical details: designers are invited to follow the already built buildings or details. This is not a wrong method if the examples can constitute a suggestion for the realization of new construction and not to copy "the example". This, in fact, can have two consequences:

On one hand, it can reduce the research of new solutions, crystallizing the process of creativity; On the other hand, the designer follows, without criticism, the proposed solution, even if this could be improved.

The experience of two European projects in which our Institute was involved, POLIS and BAS described below shows that accessibility must be the result of a continuous amelioration process, as other aspects of the building sector, for example the maintenance. Only in this way we can have the possibility to find the more updated and suitable solution for each building or part of the building. So the term "best practice" is a bit presumptuous and would be substituted by "good practice", probably adding "for the moment".

2. Examples of Best Practices

As we wrote in the beginning, two European projects will be described, in particular for their case-studies, in order to demonstrate the dynamic concept of accessibility.

---

[14] An example is constituted by tactile guides for visually impaired and blind people: there are a lot of different productions even within each country and that is an advantage, but each are produced with its own rules. The unique study we know that trey a comparison by testing 15 of them, chosen among Swedish and English products is due to Swedish colleagues (Stahl et al, 2006).

[15] CEBC is constituted by several public or private companies, one per country, with the goal of the technical control of buildings, generally for the insurance companies but sometimes also for the public bodies. The enquiry was carried on by the English partner. See www.cebc.co.uk

POLIS – Decision support tools and policy initiatives in support of a Universal Design of buildings, was a three year European project, financially supported by DG Research[16]. The goal of POLIS was to give a tool to decision makers that can measure the level of accessibility for different type of people with disabilities both of a built building and of a design of a building. Further, when the tool shows that some aspects are below the desired level of accessibility, we can propose interventions to enhance the accessibility for a specific group of people with disability, addressing the type of interventions in that direction. In other words, if a building has people that are partially blind among the workers, probably the decision-maker of the building will put the first financial intervention that will provide a better access and use for them rather than to another type of disabled people. With some months of delay, a publication was provided on the application of the method in a five case study: Edificio de la Naviera Aznar, in Bilbao, Spain; BRE Office and Conference Centre in East Kilbride, UK; School of Applied Technology in Crete, Greece; a multipurpose research centre in Rome, Italy; and the Diaspora Museum of Tel Aviv, Israel[17].
The following shows show the main elements, fortunately not all found in each case-study:
- The height of buttons and controls of the parking vending machine should be lowered; parking areas are too distant;
- Sidewalk ramp dimensions are inadequate (see Figure 1);
- No public transport serves the building;
- Tactile guidance are not provided;
- Toilets are not always accessible: manoeuvring space is insufficient, grab bars element are inappropriately inserted;
- The reception area is not well signposted;
- Thresholds are hard to overpass;
- Doors are heavy to push.

Figure 1 *The inadequate sidewalk ramp (Source: POLIS, p.68)*

[16] www.polis-ubd.net

[17] POLIS (2007) Building and Urban Space Accessibility, BrePress (in press).

If we consider that 4 of the 5 buildings are new or recently renewed, the overall level of accessibility is not satisfactory. Further, the main concern is not about details which were not considered, but about those which have been considered and not properly solved, as the wrong sidewalk ramp, the incorrect position of grab bars, the existence of a threshold, the wrong height of the vending parking machine. In these cases, the improper study of the requirements to be satisfied are evident and even now, a better training for the technicians is necessary and urgent.

Building Accessible Services, (BAS), is a two-year European project financially supported by the DG Employment and Social Affairs[18]. Started in December 2004, BAS concluded its activity at the beginning of 2007. The goal of BAS is to evaluate the accessibility of some buildings, showing not only how accessibility was applied but also how it could be improved. Seventeen case-studies, generally two per country, were analysed and published in a final book[19]. In each of the case-studies the following characteristics, chosen as well describing the building, were shown:

- A general description of the building, with a plan and an explanation of the conditions determining the building process and the aims and achievements of related works to improve the accessibility;
- A description of the principal accessibility characteristics, plans of the different floors and technical details of technological systems applied;
- A selection of pictures showing details of accessibility solutions, with references to go deeper and, more important, possible further ameliorations to improve accessibility.

We want to start from this latter item, called "Final Considerations and possible accessibility ameliorations". We found in the examples some common key features, and among others, the following:

- In almost all the examples an expert of accessibility was involved, but this does not ensure the complete satisfaction of the accessibility requirements;
- In some examples, accessibility is guaranteed only in some parts of the building, not to the entire building;
- The building is accessible, but not its outdoor parts, its surrounding and the public transportation system, is sometimes also very distant.

Going deeper into the details, we noticed (of course, not in every example):

- The building is accessible, but not yet tested by different types of people, so it can be considered accessible for people who already visited and used the building, but still we don't know for others (in particular, people with reduced sight);
- The use of colours to help orientation or colour contrast to better identify particulars is not frequently applied;
- Lights sometimes are too dazzling, provoking problems, especially for people with cognitive impairments;
- The introduction of the automation of some elements can improve the accessibility (as automated doors);

[18] More information can be provided by its website: www.accessible-buildings.eu or, for the initial phase, www.basproject.itc.cnr.it.

[19] The book is BAS, 2006, see References.

- The length of renovations sometimes appear too long to the users[20].
As general remarks, we can extract by the examples:
- The attention toward the wheelchair user is more developed if referred to other types of impairments;
- The support for orienting and addressing people in the right direction is not always considered, apart from the provision of tactile guides;
- The surroundings of a building or complex are not always properly considered, such as the transportation system can be accessible but too far or not frequent, parking areas not always are close to the building entrance or directly linked;
- If a technical rule is provided, for example for lifts, the level of accessibility is higher[21].

Another general comment referring to the change of behaviour by the partners in the analysis of the examples refers to when each partner, in search of "the best" case-study, found one they thought would work, but after reanalysing it at the end of the project, discovered it to have weak elements or need for improvement. In other words, we all increase our knowledge in the field and when we become aware of inappropriate technical or lack of details we must ask the technicians responsible for the construction of the building if it possible and when these details could be added or improved. This procedure was also adopted by the designers and decision makers in charge of the building, who, rethinking the project, provided further improvements or at least put the works in the agenda for the future financial investments.

Conclusions

Until now, we considered in POLIS and BAS only the physical aspects of the building, but at least other two elements have to be taken into account: the management and control, and the personnel. Among them, we underline:
An adequate control of the respect of the technical provisions, such as the classic example of the obstruction of a ramp along a side-walk.
An appropriate training for the staff if the building provides a service (as a postal office, a chemistry, and hotel).
The task of training people with the principal aspects of disability is undoubtedly a new effort in the direction of Universal Design; in fact many problems are due to the lack of knowledge about how to educate people with disabilities so they can use services offered in a building. This aspect becomes more acute if there is an emergency, such as a fire, in the building. A special committee of the Fire Department in Italy, that included exchanged opinions of people with disabilities and their associates, was formed to analyse situations in case of an emergency in the working environments. It was demonstrated that in many cases firemen did not know how to face the rescuing of people with disabilities. The final report of the

[20] This was the case of the renewal of the subway in Brussels, which will need 10 years to become really accessible, with the renewal of two stations per year. In some of the BAS conferences, when the case-study was presented disabled people argued about the excessive forecasted times.

[21] The European rule is the EN 81-80 (see References) then adopted by each country, for instance in Italy it became the UNI EN 81-80, adopted at the end of 2005.

Committee is an approved document, which has now become a Ministry Decree, and even if not perfect, is surely an improvement in addressing the problem[22].

Figure 2 *The ramp linking the street to the entrance is obstructed by a motorcar. (Source: BAS, p.170)*

There are many complaints regarding respecting the law and regulations, not only in Italy, but in many other countries that are considered more "advanced" and respectful countries. Respect of rules depends by two factors:

Consciousness of the problem, including the application of civil rights by the central governments;

Adequate control, not only by the public bodies, but also by the civil society.

Finally, all civil society, including people with disabilities, their relatives, friends and associates and any person who wants to be sure to live in a country in which respect is not a vain term, looks to the public authorities to apply the rules. A well publicized example is the construction of the Santiago Calatrava bridge in Venice. When the argument showed that the Italian law for accessibility was ignored, the Major of Venice met technicians and asked for a revision to the design that will make it accessible. It was done, and even if the "solution" is not fully satisfying according to many people, and the construction is not yet completed, nor so we

[22] According to Marsella (Marsella, 2004) the first technical code was the decree dated March 10, 1998 'General Criteria for Fire Safety and Emergency Management at Work'. This Decree was developed jointly by the Ministry of the Interior and the Ministry of Labour. It contained some general indications concerning the evacuation of workers with impaired mobility and defined the criteria for risk assessment and safety measures in the workplace.

know precisely its characteristics of the design, we can affirm that the compromise is better than a never-ending story[23].

Acknowledgements
The author is in debt with her colleague and friend Shirley Confino Rehder for her suggestions in improving the paper.

References

BAS, Building Accessible Services (2006) Evaluating accessibility and highlithing good practice. A showcase of Building and Urban Space Accessibility in the EU, Project supported by the EU, DG Employment and Social Affairs.

Confino Rehder, S. (2007) Improving the Design Process, CIB World Building Congress, Cape Town, pp. 23-28.

EN 81-80 (2004) Safety rules for the construction and installation of lifts.

Marsella, S. (2004) Peculiar factors of the fire risk assessment for people with disabilities, CIB W084 International Conference Accessibility and Safety for All, Verona, 22 March, Proceedings.

Nummelin, J., Christophersen, J. (2005) Summary, in Morini, A. State of the Art Report on Accessible and Comfortable Environments for All, CIB, December, pp. 3-5.

Ostroff, E. (2001) Universal Design: the new paradigm, in W.F.E. Preiser, E. Ostroff, Universal Design Handbook, Mc Graw Hill, New York, pp. 1.3-1-12.

POLIS (2007) Building and Urban Space Accessibility, HIS BRE Press, Watford, UK.

Stahl, A., M. Almen and M. Wemme (2006) Guidance and warning surfaces. Test of tactility by blind people, 3rd European BAS Conference, June 13, Lund, Proceedings.

[23] The illustration of the different construction phases and the different point of views about this realization would need a separate paper, and even within the Members of CIB 084 Working Commission we have different opinions. Just to resume, an additional cable-car will be inserted on the bridge, providing the crossing to wheelchair users. Among the several opinions, we refer to only the two "extreme": the stronger opponents would have preferred that the justice would intervene and punish all the actors responsible of the design, approval and realization of the bridge, while the weaker opponents affirm that even without the cable-car but providing the crossing of the lagoon by the traditional ferry-boats would have been enough (see also Confino Rehder, 2007).

ACCESSIBILITY AND DEVELOPMENT PLAN OF JOSEF RESSEL PATH IN BASOVIZZA’S IGOUZA WOOD (TRIESTE – ITALY)

Paola Nasti
Specialist in Rheumatology, Physical Medicine and Rheabilitation
Mondovì (CN) – Italy
pnasti@gmail.com

Keywords: Universal Design, leisure time, parks, tools, signals.

Abstract

Everybody needs to enjoy the widest accessibility and usability in every space of lifetime as regards to the foundations on which our social and civil life grounds, that are the principles of solidarity, equal dignity and opportunity.
Leisure time stands among these opportunities, especially the touch with nature as main lifetime of every human being; chances of enjoying, socializing and growing represent a right that must not be limited against quality of life.
Therefore making natural areas usable is a challenge of civilization so that the largest group of citizens, including those affected by temporary or permanent motor and/or sensorial impairments can benefit of a cultural and environmental heritage that is unique across our home country.
The aim of developing Josef Ressel path is to make it accessible and usable by many users, so that everyone can experiment the relationship with nature without discriminations due to specific psycho/physical abilities, allowing the social integration between different individuals.
The path, 4000 mt. long and currently accessible for blind people, has been proposed with some solutions to allow people with motor and sensorial disabilities an easier usability.
According with the principles of design for all, these solutions have been thought also to meet the usability requirements of other categories of people who, sometimes through their lifetime, might not be able to perform their usual activities as previously (pregnant women, elderly persons, people with temporary reduction of abilities).

Introduction

The usability of leisure time, especially the experiencing nature, is an essential moment of lifetime, but it is also a civil right that, in Italy, is underlined by Article 3 of Italian Constitution (Nasti P, 2005). It tells that all citizens have equal social standing and are equal in the eyes of the law, without regard to sex, race, language, religion, political opinions, personal and social conditions. The Italian Republic has the duty to remove the economic and social barriers which limit freedom and equality of citizens, promoting the full development of people and the total involvement of every worker in the political, economic and social organization of the Country.

About the 20% of Europeans show a decreased mobility, affected by either permanent mobility skills, sensitive and mental challenges, aging, or temporary disabilities, including conditions such as women who are pregnant.

Therefore, usability of National Parks and Protected Areas represent a challenge to the civil society in order that most citizens can come in closer contact with nature (www.informahandicap.it/europa_disabilita.htm).
Nowadays in Italy natural areas and parks cover a surface of about the 10% of the whole national territory, adding a similar extension of sea areas (www.legambiente.com, ACLI Anni Verdi 2002, www.parks.it). They do differ in the ways of management of the wide and varied territories that must accommodate human presence in a natural setting. The goal is to enable most people, including those who are affected by every kind of disability, to benefit the environmental and cultural heritage that is unique.

<u>THE JOSEF RESSEL PATH: state of the art</u>

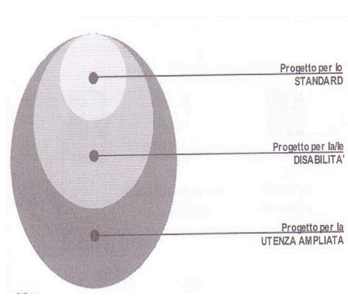
The historical-naturalistic and high-tech path dedicated to Josef Ressel was planned and realized by foresters in the Karst with the purpose of giving independence to people, particularly to the blind. The path was conceived to inform, learn, touch and listen.
This walk is one of the first in Europe to be equipped with an infrared transmitter system that allows, by a proper receiver, to have vocal information (in Italian, Slovenian or English) regarding the direction and the environmental and historical peculiarities of the territory you walk across. The receiver can be collected at no charge at the "Centro Didattico Naturalistico" (Naturalistic Educational Centre), located at the entrance of the town of Basovizza.

The Josef Ressel Path is about 4 kilometers running through the easy flat paths of the Igouza and Lipizza woods. Crossing the border between Italy and Slovenia, it links up Basovizza to the stud farm of Lìpizza. Nowadays only the Italian section of the path in the Igouza Wood (1,9 kilometers) is traversable.
On the track there are four resting areas equipped with benches, informative boards in three languages (Italian, English, Slovenian) and equipment for tactile use and vocal messages. Along the track are placed 65 transmitters for audio-guide use, with vocal messages 90 seconds long on the natural characteristics of the wood.
Information boards with tactile materials allow a multi-sensory usage of the natural characteristics of Igouza Wood.
After 150 meters from the last stop, the Josef Ressel Path leaves the forest track turning to the right into the CAI path n.3, a stretch of track of about 340 meters where the vocal messages are not available and the ground gets rough.
On the right there is a handrail followed by a bridge that gets over a limestone outcrop.
When the CAI path n.3 joins the road in disuse "Basovizza – Sesana", the vocal signal is available again and it guides for 50 meters till the boundary line, where an informative board tells about the history of the road and the state border.
This completed road comes back to Basovizza.
An alternative path has been recognized to let people affected with poor motor skills cross the wood, avoiding the inaccessible ground of CAI path n.3. This path joins the road in disuse.
At this time the surface of the whole track is not accessible and usable by people whether or not they are using motorized wheelchairs. .
Almost at the end of the Basovizza-Sesana road the historical little pool *Kavocev Kal v Babni ogradi* has been restored.
(Interreg program ItalY-Slovenia, Naturalistic Didactic Center, Trieste, 2000-2006; www.interreg.fvg-it-sl.org).

THE JOSEF RESSEL PATH: development plan

Josef Ressel Path development plan was aimed to make it accessible and usable by many users, including people with disabilities with poor motor skills, using or not using wheelchairs, so that everyone can experience a relationship with nature. The development plan includes the adjustment of the alternative path and the Basovizza-Sesana road.

The plans follow the Principles of Universal Design striving towards broad-spectrum solutions that helps everyone, not just people with disabilities, thus allowing for the social integration of all. (Nasti P, 2005). These Principles address everyone and the entire spectrum of human frailties including age and abilities, avoiding separate and stigmatizing solutions. Using these Principles in the planning will address the needs of the largest number of users (Biocca L, Morini a, 2002; Vescovo F 2000).



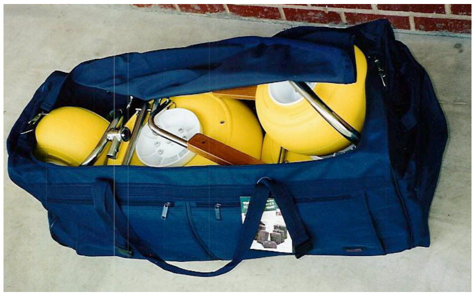
Design for all

Plan of adjustment (Nasti P, 2005)

The Path

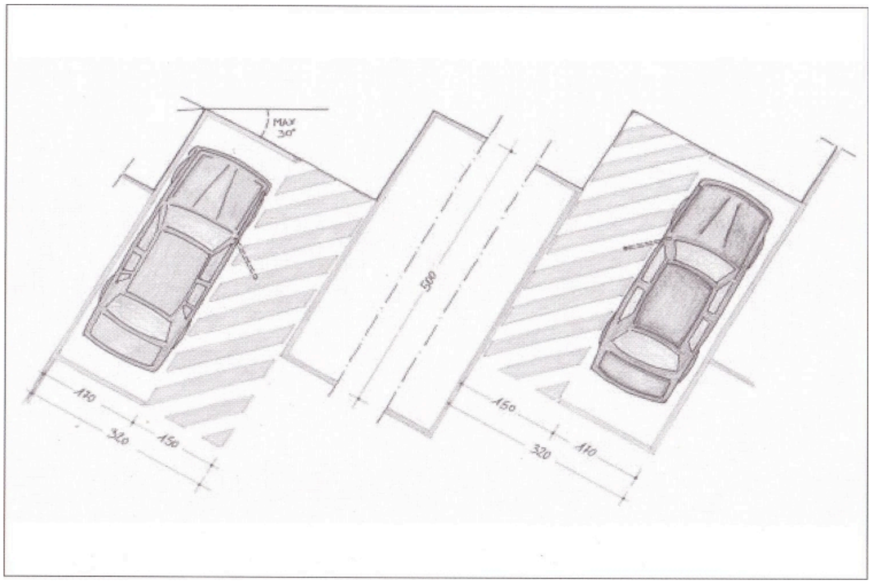
Adjustment of CAI path n.3: wooden walkway, 1 mt width, at the border of the path linking the existing walkway at the end of the path. The new way permits people using wheelchairs to travel the path safely without getting on the limestone outcrop. Adjustment of the secondary path: the appearing calcareous stones can be levelled with a big hammer and then milled to reduce their sizes. In this way the path can have improved drainage and usable by people in wheelchairs.

Universal wheelchair (Landeez): designed specifically to enabled people; this wheelchair can roll easily over every kind of land (sand, snow, stones); the soft plastic pneumatic tires absorb almost all road shocks for a remarkably comfortable ride. For travelling by car, it can be disassembled and placed in the trunk in seconds (www.landeez.com).



Parking

Nearby the park entrance, they are building a reserved parking with the following characteristics:
320 x 500 cm
accessible connection to the path;
flat area, max 1% inclination;
vertical signals, minimum 210 cm height.



Resting Areas

One resting area equipped with a bench and an informative board along the secondary path; Three resting areas along the Basovizza-Sesana provincial road.
One board with wide characters and in Braille, placed in the resting areas and along the path to let users read information about next stop distance and its characteristics.
Different materials will be used to permit different perceptions of the area.

Surface

The surface of secondary path will be levelled by using a big hammer to move the stones and then milled to reduce them in smaller pieces. The final surface will result in better draining and be wheelchairs friendly.
Resting areas' actual surface will be replaced with rubble 15x30 mm.

Seat Supports

Every 100 mt along the JR path, the secondary path and the Basovizza-Sesana road, some seat supports, 75 cm high, can consent a short resting stop.

Containing Cordons

Some exposed parts of the paths can be dangerous to people who are blind and people who use wheelchairs. Some cordons will be placed as a border signal for the blind and a stop for wheelchairs.

Handrails

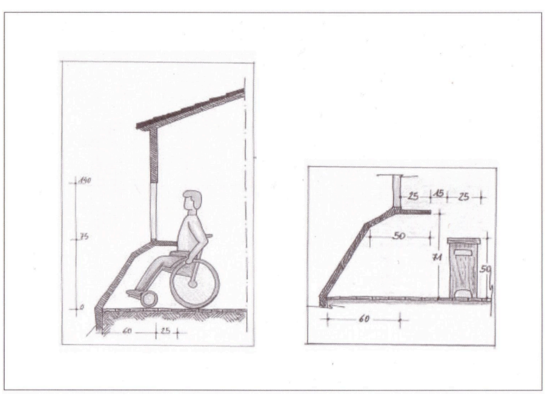
A wooden handrail with metallic direction interrupters will be placed along some sections of the paths to support blind people, people with a bad sight, elderly people, people using aids.

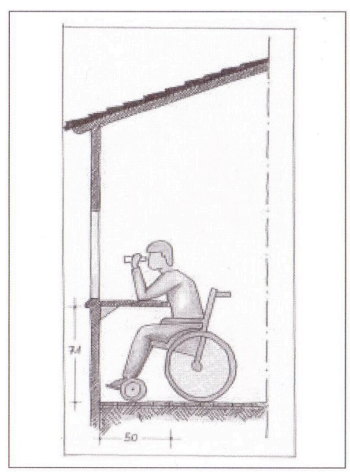
Signals

At the beginning of the path, an information board, inclined at 45°, 90 cm high and also written in Braille, will be installed. It will show the paths' map and characteristics, the resting areas and toilets locations.
Small educational boards (21x30 mm, inclination 45°, height 90 cm), also written in Braille, will be placed by main trees and geo-morphological elements and will be accessible for children and people in wheelchairs.

Fauna And Birdwatching

A watching box will be built in a well-signed glade, out of the main path. The box will be reached from the path by an accessible track.
Technical characteristics of the box:
- Sole way-in: < 2 cm;
- Way-in without door: right light minimum 90 cm;
- Inside: 150x150 cm, furniture free;
- Niche under the slits for wheelchairs users: 60 cm;
- Console under the slits: 50 cm depth, 70 cm high;
- Slits for sitting or people with low stature: height 75-140 cm;
- Slits for standing and tall people: height 125-190 cm.





By the *Kavocev Kal v Babni ogradi* pool, along the BS provincial road, a footbridge with handrail will be placed to observe amphibians: width 1 mt, with final enlargement 150x150 cm for u-turn.

Rubbish Baskets

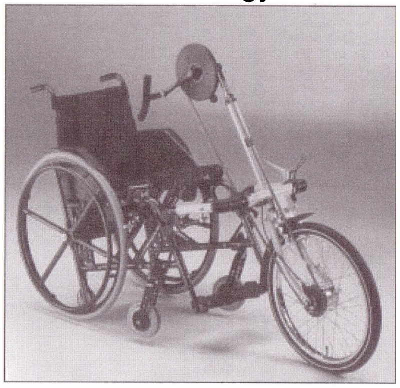
It is possible to place some rubbish baskets close to parking areas and at the end of the path. The ones with a large hole, maximum height 80 cm, are preferred. A lower hole will allow children and people with low stature to use them easily.

Hygienic Services

The plan provides two city toilets, one placed at the beginning of the JR path, one placed nearby the borderline. They are a highly technological service with up-to-date management.

Physical Activity

People who do not have the use of their legs could practice physical activity by a special hand-driven cycle. Some models can convert a standard wheelchair into a bike (f.i. EasyBike – see picture below). This hand-bike will be available to rent at the Naturalistic Educational Centre.
Along the BS road it will be possible to realize a gymnastic way with wooden tools for training.



Aids And Mobility Means

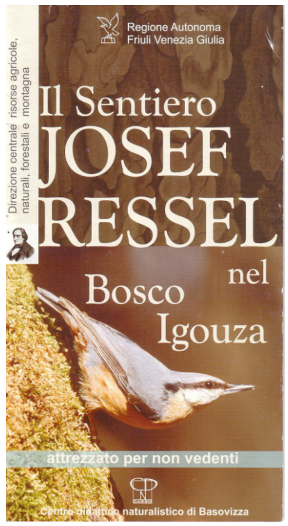
Nowadays a special van, available on demand, helps users to return back to Basovizza.
It will be possible to rent:
electrical scooters that will assist people who tire quickly move easily through the park, (f.i. patients affected by heart diseases, obesity, walking impairments)
The Landeez, universal all-terrain wheelchairs, to be used on the CAI path n.3.

Maintenance

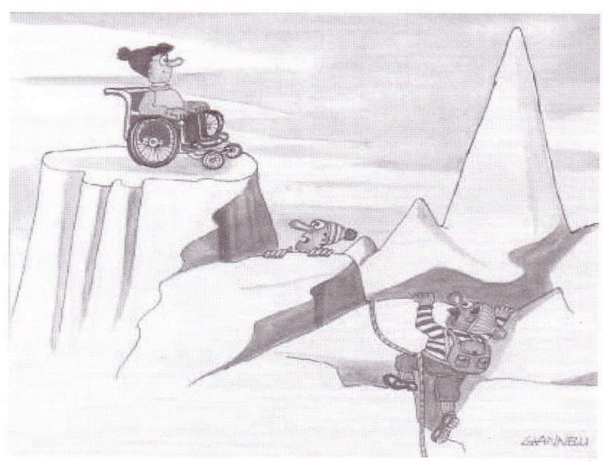
Taking care of the spontaneous vegetation, emptying rubbish baskets by a good and regular maintenance program is essential to preserve the safety and wooden equipment of the pathways.

Informative Materials

A guide has to contain different information to accommodate user needs and abilities. This guide will also contain information about mobility along the paths, the inner accessibility, the characteristics of the paths, the services offered and the natural flora, fauna and geo-morphologic aspects of the location.



As human creatures, we all follow a common destiny;
so, our "common house" cannot have too tight frontiers:
the planet must be our home
B. Haring



Acknowledgements

The author is in debt with her colleague and friend Shirley Confino Rehder for her suggestions in improving the paper.

DESIGN FOR ALL IN HERITAGE AND LEISURE FOR LARGEST GROUPS OF USERS

Luigi Biocca
CNR ITC Italy
l.biocca@itc.cnr.it

Keywords: accessibility, heritage, tactile, information, education

Abstract

Design for All is largely influencing planning, rehabilitation and refurbishment of various types of the built environment. Nowadays, leisure areas are to be considered as relevant as other main facilities and services, due to the growing importance and cultural awareness of leisure and free time activities as revitalizing people's lifetime.
Usability, ease of use, comfort, safety and accessibility would not fit only main building (i.e. housing, offices, transportation) but also buildings for leisure like museums and cultural heritage, where focus is on enjoying the pleasure of an exhibition, admiring the beauty of a natural and/or artistic site, or an attractive layout of spaces.
Enjoying a good quality of leisure areas is then relevant for any groups of users. Museums, exhibition areas and heritages can reach potential new customers with a plan of 'open-to-all' visiting exhibition.
Some Italian case studies where heritage's exploitation can meet a full success among users is presented, after illustrating the new role of museums/exhibition areas in our society and culture.

Introduction

Changing cultural trends and policies as regards to leisure and entertainment activities and areas are rapidly turning into a 'mass-culture' delivery that implies several and different consumption modes, depending on different users' needs and differentiated demands from wider categories of people with their personal levels of education and leisure time expectations.
The role of cultural heritage has extended so to offer several services and facilities to audiences in terms of education, communication, enjoyment and leisure.
Some case studies in the Italian context offering more usage modes will be illustrated as relevant for the next evolution of the culture delivery.

Museums/exhibitions/cultural heritage: new scope and meanings in the information and culture age.

The role of museums and its exhibitions areas has radically changed through the last decades, even much faster than previously. Information age and multi-mediality have brought up into a new dynamics for the museum's business, art supply and consumption as well as new values of leisure time from the perspective of the users.
Museums have then grown more and more in complexity as well as in the various and combined cultural programs they can supply to larger audiences.
From the traditional museum perspective, with a very limited interest to a 'mass-culture' delivery and mostly based on permanent historical exhibits open to highly educated people, to

today's extension of art consumption, the heritage and exhibits areas has grown so important that play as a 'leisure box' almost in the same way as a entertainment park.

The new users' target

Unlike in the past, when traditional museum exhibits were delivered to people of elite educational status, art and culture consumption today is targeted to several potential and differentiated user categories: exhibition and communication tools, multi-mediality and design attractiveness of the public spaces can meet a large range of demands and expectations.
In fact, user demand has been growing as well as the offer has. User demand does not concern only requirements for preferences of exhibits and/or different other events, but it is also related to everyone's characteristics. In fact, Universal Design principles take for granted that accommodating people with several abilities must be a priority, regardless of ages.
This can really make access universal to the largest extent of population.
Many cultural and exhibits facilities worldwide have made or are making big efforts to increase capacity of accommodating users with different needs and demands.
Accommodating people with different abilities has actually been for long time a focus mainly for those with motor disabilities, while other sensorial and/or cognitive difficulties were seldom considered or even neglected in many cases.
Nowadays the need of 'opening' to other sensorial needs is gradually taking place in some initiatives and perhaps it can be the most interesting trend on how extending users' participation and access.

The Italian context

Although the cultural context in Italy is somehow more affected than other countries by the role and tradition of museums and exhibitions as well as the relevance of the historical monuments and real estates of most ancient city centres, some positive experiences have been recently launched to transform the cultural events in a more dynamical and trendy attitude for various categories of consumers. Museums have then acquired more and more relevance in extending their activities from the traditional exhibition to education, conferences, lectures, daily tours, tourist visits, etc.

Motor and other disabilities

As in other countries during the last years, also in Italy a major concern has been mostly on motor disabilities issues for a long time. More interest to other sensorial difficulties has been growing more and more in importance only from recently by pressure groups of relevant association and no profit entities.
The main focus on motor difficulties had then brought up into considering the access to buildings as a mere physical factor mostly based on design solutions, i.e. more appropriate rooms, staircases or elevators: accessibility and usability of spaces has been almost the only requirement for a facility/building area to be 'universally designed' and used for the benefit of larger users' groups. This is still agreeable nowadays, but certainly not limited to motor disabilities only.
A range of different requirements and demands has been coming out and these have to be considered, also by using appropriate and alternative means other than design only.

We illustrate some outstanding case studies, where the first of them focuses on people with motor disabilities and their access to heritage, while emphasis of the second and third is on enlarged services and activities as well as on user target extensions to different needs and abilities. In particular, issues of art consumption for the benefit of blind and partially sighted will be discussed.

MERCATI TRAIANEI,
ROMA, CENTRAL ITALY

It is a huge archaeological area that includes several monuments and heritage pieces. As a part of the larger area of the ancient ruins of Fori Imperiali, plenty of tourists visit it all year round.
This has brought the need of welcoming people also with mobility difficulties. On this purpose, layout of walkways and visitors' corridors have been partly remodelled for allowing those people to visit freely large areas of the complex as well as admire and enjoy viewpoints that have remained long inaccessible. Visiting tour has been remodelled by installing a lifting system connecting two different storeys and improving walking by installing footbridges and easier walkways that also access some breathtaking view onto the Fori Imperiali areas (see picture 1).

Picture 1 *Two walkways out around Mercati Traianei*

NATIONAL TACTILE MUSEUM OMERO,
ANCONA, CENTRAL ITALY.

The Italian Union of Blind People developed firstly the idea of a museum for people with low vision. Ancona City Council founded in 1993 the museum, which has been a State Museum since 1999 - when it was recognized by the Italian Government as one of unique national heritage properties. The Museum aims to “promote cultural growth and integration of low vision people and to extend their art knowledge”.
However, the Omero Museum also intends to be a pleasant and stimulating cultural space for everyone, thus exhibiting, as an advanced facility with a flexible layout, which can fit specific, needs of any visitor.

The Museum was remodelled and then opened to the public on December 2003 (designers A. Panzini and G. Fraccascia), this innovative facility offers a continuous, barrier-free pathway, which meets all the current Health and Safety regulations.

Exhibition areas are 750 sqm. and display a large collection of sculptures and plastic arts, belonging to four main areas.

- **Archaeology Section** with original objects of various ancient ages and types: ceramic, stone and metal finds from Prehistoric to Late Classical age. The chance of touch is a unique opportunity which helps visitors to understand some of the characteristics of the finds.
- **Architecture Section** with an impressive collection of models of popular buildings and monuments from the past, including Parthenon, Pantheon, Cathedral and Mole Vanvitelliana in Ancona, Florence Cathedral (Santa Maria del Fiore), St Peter's Basilica in Rome and many others.

Visitors can then enjoy a journey among the greatest masterpieces of architecture of all time.
A special section is devoted to architectural models of the city of Ancona so to invite visitors also to an artistic journey through the city's history from its Greek origins to the eighteenth century.

- **Ancient and Modern sculpture** with plaster casts and copies of the most famous sculptures of all ages, from the Egyptian period through the Greek, Etruscan, Roman, Romanesque, Gothic, Renaissance, Mannerist, Baroque, Neoclassical until the Avant-garde of early 1900's.

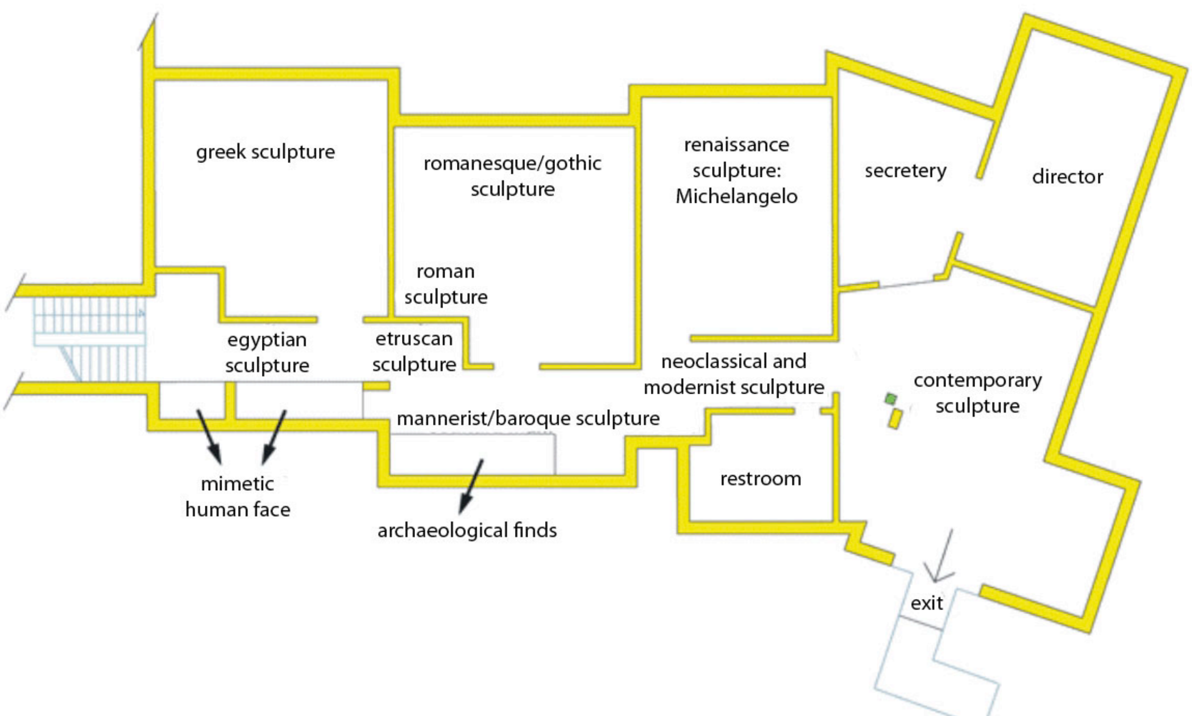
The Venus of Milo, the Charioteer of Delphi, Giotto's relief panels for the Florence Cathedral bell-tower and Michelangelo's casts of the St. Peter's Pietà are just a few of the displayed art masterpieces.

- **20th century and Contemporary sculpture section** with touchable original works by famous artists working in Italy and abroad.

Main building features

The architectural models are displayed on the first floor while the sculpture rooms are on the second floor (see picture 2-3). They are arranged in chronological order, from Ancient Egyptian and Greek casts and copies until to the collection of contemporary original statues.
The Archaeology and Human Expression sections are displayed along the corridor.
The Museum services are situated on the third floor: the new conference room with projection facilities, the learning activities workshop and the documentation centre.
Coloured panels have been placed behind the works to improve visibility.
Each area has a different colour scheme. Visitors with disabilities can access the museum by a second entrance, which is connected to the road by a standard ramp and by a stair lift for access to the upper floors. Blind and low vision visitors can use other aids: a walk-assistant and learning and educational tools such as relief panels explaining the various styles of sculpture and architecture as well as information on single works, available in large printing characters or Braille.

Picture 2 *View of the second floor*



Picture 3 *Second floor plan*

Current Exhibition
An Exhibition Opening Ceremony on September 2007 was held for a tactile exhibition featuring the "Augusto/capite velato" - a sculpture with veiled head of the first Roman emperor. The technical ability makes this sculpture as an exceptional symbol of the magnificence of the Roman Empire.
Visitors' eyes can admire the candid marble of this splendid face, but also low vision and blind people can do that with their hands – and all the others, too – as well as be able to explore the work and enjoy with emotion the memory of time, the materials' language and the shape perfection. This is a unique event, which highlights the Museo Omero's constant striving in making all works of art – originals included - accessible in a multi-sensorial way so to promote an access to culture for all.

Education
The Education office plays an important role in implementing the Museum's goals. On this purpose, a staff of experts developed specific educational and training strategies for all school types for the benefit of blind and low vision pupils/students. In particular, they provided two services:

Art and Archaeology Workshops
Consists of workshops and lectures about art and archaeology - totally accessible to blind and low vision pupils - so to encourage a multi-sensorial approach. Workshops can cover various topics, so formats can be very different. A sample of a recent workshop format was as follows:

- The materials of memory
- The tactile image and its restitution as object
- The magic of signs
- A day at the Museum. Sculpture and restoration workshop
- Working on the body. I'm a statue, a tree, a landscape ...
- Extraordinary objects
- Multimaterialism, Assemblage, Ready-Mades. From the ideas of the 1900s to the present day.

Art and aesthetic Education Program for low vision pupils and blind adults.
Consists of a more specific program of art education for low vision students, with particular attention to sculpture and architecture.
This educational format is also available to blind adults in order to promote a life-long education as well as guarantee equal opportunities for cultural growth and social integration.

Objectives:

- To develop tactile perception and other sensorial abilities;
- To learn how to use relief-drawing tools;
- To learn how to create and read simple relief images;
- To get confident with the basics of visual language and art language;
- To recognize and read relevant forms of aesthetic value, and understand their meanings.

Programme and activities:

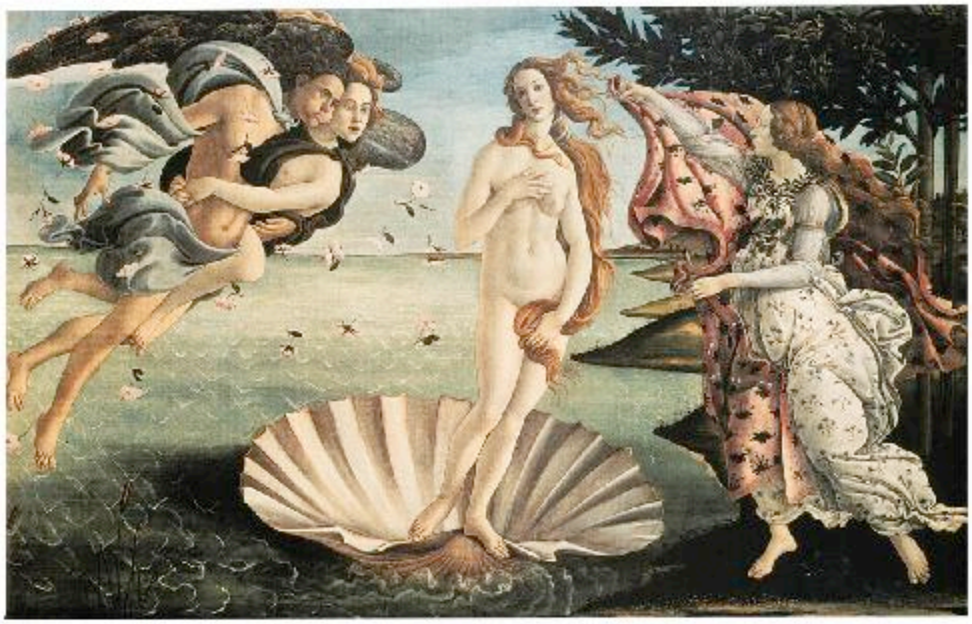
- Individual and group activities for the group/class can be held at the Museum, local monuments or at the school and will be organized in co-operation with the teachers.
- Use of relief-drawing tools, clay, relief pictures and information cards, works from the Museum collection, information materials in largee printing characters, in Braille and on CD.

Schedules:
Number and frequency of the workshops are agreed between teachers and families. Workshops can be held in the morning or the afternoon. Each workshop is 1h 30mins.

ISTITUTO CAVAZZA AND MUSEUM OF TACTILE PAINTING, BOLOGNA, NORTH ITALY.

Anteros Museum of Tactile Antiques and Modern Painting was founded by the Istituto Cavazza in September 1999, and opened to the public on 2000. It represents a unique experience in its genre in Europe. It exhibits tri-dimensional reproductions of art works by famous painters in Art History. These works were designed and arranged by the School of Applied Sculpture of Bologna.
The tri-dimensional reproductions come along with information materials on historical styles and specific descriptions of each artwork, also translated in Braille. This information also guide visitors in their tactile exploration.
The goal of the Anteros Museum is to become in itself a useful tactile "handbook", gathering and disseminating knowledge of the historical and aesthetical value of paintings.

Education formats
Anteros Museum holds courses in Art History, and interpretation methodology, which are designed to teach to both blind and sighted persons. Moreover, there are research projects of the cognitive processes involved in decoding images by blind and low vision persons. Several visits and initiatives take place at the Museum, as well as cooperation projects with universities, educational institutes, and organizations. All these provide customized guide-tours and lessons to single and group visitors. Discovering the mind's imaginative and cognitive potential of blind or low vision people means awareness and serenity of developing one's interpretative independence, as well as strength of visual thinking. This is partly achieved also thanks to proper sensorial integration, and tactile perceptions.
To acquire knowledge of painting means to be introduced to composition, to perspective tri-dimensional space of formal values art works are composed of. Clearly this information, which is accessible by the sense of touch, excludes information on colours. However, it is possible to provide this information with chromatic devices on the relief design, or further methods, to persons with low vision, or who became blind at older age.
The importance of gaining knowledge about art, matching senses with intellect, is true also for sighted persons. Sighted visitors of the Anteros Museum discover that seeing with the hands strengthens understanding, and that linking sight with touch results in the rehabilitation of a sense, which is too often inhibited.
Learning how to see with the hands and touch with the eyes means, both for blind or sighted persons, that prejudices stop being an issue in order to freely learn on the beauty of art pieces (see picture 4).



Picture 4 *"Venus" by Botticelli: standard painting and tactile version*

Museum Research, Information Gathering and Dissemination
Activities at the Anteros Museum include museum research, information gathering and dissemination, and updating educational resources. The Istituto Cavazza has been for some time rigorously applying the method of teaching to blind and low vision people about images through theoretical and practical lessons. Its goal is to teach about Art History as a story of

shape transformation, phenomenology of vision and perception; a story of styles, ideas, iconography and iconology. In order to complete theoretical aspects, lessons and exercises in a laboratory allow building projects in relief design and plastic works through which one can experience understanding of iconic shapes, as well as the cognitive-interpretative and active-expressive nature of the students who are involved in this type of activity.

International Conference

In order to create an international platform of exchange in relation to art and museum-related interests for persons who are blind, an international conference took place in the year 2001 entitled: Tactile Perception and Cognition of Artistic Form by Blind and Visually Impaired Persons - Interpretative Act and Rehabilitation Role. The conference, which took place at the CNR of Bologna, was organized by the Istituto Cavazza, the Italian Blind Union, the National Federation of Institutions for the Blind, and the Italian Library for the Blind Regina Margherita of Monza. Renowned psychologists, and representatives of international museums attended this conference, among them the Louvre in Paris and the Metropolitan Museum in New York.

Conclusions

This paper illustrated some attempts to see Universal Design from a perspective different than 'traditional' motor disabilities. Extension of heritage tourism and art & museum consumption has brought to define emerging needs of new potential users who spend longer time after the leisure activities. The challenge of including other people with any different sensorial difficulties is then becoming a more complex task to enhance participation in the future events of the cultural industry.

References:

- MORINI, A., BIOCCA, L. (2002), *Sites of historical interest: the potential of Design for all in redevelopment projects*, CIB W84 Meeting, CNR Roma, october.
- MCGINNIS, R. et al. (2004) *Museums and Universal Design*, Designing for the 21st Century Conference, Rio de Janeiro, Brazil, CD Proceedings, December.
- MCGINNIS, R. et al. (2004) *The Visual Language of Art: Universal Design approaches to Museum Publications and Interpretation*, Designing for the 21st Century Conference, Rio de Janeiro, Brazil, CD Proceedings, December.
- http://www.mercatiditraiano.it/
- http://www.museoomero.it/
- http://www.cavazza.it/

UNIVERSAL ACCESS TO SPORTS VENUES IN THE U.S.

Jon A. Sanford
Center for Assistive Technology and Environmental Access, Georgia Tech, Atlanta, GA and Rehab R&D Center, VAMC Atlanta, Decatur, GA, USA
jon.sanford@coa.gatech.edu

Keywords: accessible seating, sports venues, accessibility, wheelchair seating

Abstract

This paper reports findings from post occupancy evaluations that were conducted at nine sport facilities in the U.S. The purpose of the project was to evaluate existing accessible seating in order to make recommendations for changes to the ADA Accessibility Guidelines. In each venue, accessible seating alternatives were documented and feedback from patrons with disabilities was solicited. Although, complaints by wheelchair users about obstructed sightlines during sports events were the key problem that prompted the study, based on user evaluations, four issues clearly stood out as the primary factors impacting the quality of the accessible seating: 1) number and size of wheelchair spaces and companion seating, 2) dispersal of wheelchair seating, 3) sightlines over standing spectators and 4) integration of accessible seating. Clearly, no one of these factors determined the quality of accessible seating. Rather, the quality was dependent on the interrelationships among these factors. For example, in facilities where problems with wheelchair seating were articulated in terms of poor sightlines, other mediating factors such as the lack of integration and poor seating locations were typically found. Conversely, complaints about sightlines were rare in facilities with good integration and accessible seating locations. As a result, the overall quality of accessible seating was dependent on a delicate balance of design and management decisions and practices. Most importantly, the quality of users' experiences were maximized through decisions and practices that promoted flexibility and provided people with disabilities with a range of options that enabled them to make their own choices about where to sit, with whom they will sit, what they will see, and what they will hear.

Background

From their beginnings with the Greek Olympics, sports venues have been, throughout history, among the most important pieces of secular architecture. Though the great neighborhood stadiums of the 19th and early 20th Century gave way to utilitarian, regional, all-purpose facilities in the latter half of 20th Century, the last decade of the Century saw the rebirth of stadiums as economic catalysts and sources of urban pride. Socially, sports venues are places where people, regardless of age, religion, or ethnic, cultural, or economic background come together and share a common experience. For some, that experience is watching the game, for others it is just being there to celebrate the event and be part of the crowd. People with disabilities are no different. For them, facility design should provide equal opportunities to participate in all aspects of the experience - from being able to see the sporting event from seats of their choice to being an integral part of the crowd.

This paper reports findings from post occupancy evaluations (POE's) that were conducted at ten sport facilities in major urban areas. The POE's were undertaken in order to make recommendations to the U.S. Access Board[24] for changes to the ADA Accessibility Guidelines (ADAAG) regarding accessible seating. Among the issues in ADAAG, four were clearly the primary factors impacting the seating quality: 1) number and size of wheelchair spaces and companion seating, 2) dispersal of wheelchair seating, 3) sightlines over standing spectators and 4) integration of accessible seating.

Methodology

Research Design. POE, a user-oriented building evaluation technique that was developed in the 1970's,is a systematic process to acknowledge the importance of users' experiences and perspectives in assessments of building quality. Today, POE is widely adopted by user-oriented design researchers and practitioners as an effective process for generating information that is useful in renovating existing facilities, programming new facilities, and developing standards and guidelines.

Sites. The sample included facilities that represented a wide array of factors including: the type of primary use for which a facility was designed, whether wheelchair spaces were provided through new construction or renovation, seating capacity, type/location of the wheelchair seating) that might impact accessibility. Although all sites were built to local and/or state accessibility codes, they did not necessarily comply with ADAAG. The variation in compliance provided the opportunity to evaluate differences in accessible features within and across sites. Facilities selected as study sites included: three new arenas used primarily for professional or collegiate basketball with seating capacities from 9,000 to 21,500 (America West Arena, Phoenix, AZ; Mullins Memorial Center, Amherst, MA; and Smith Center, Chapel Hill, NC); two new, major and minor league professional baseball parks with seating capacities of 12,000 and 48,000, respectively (Harbor Park, Norfolk, VA and Oriole Park at Camden Yards, Baltimore, MD); two new indoor multi-use arenas built primarily for football with fixed seat capacities ranging from 65,000 to 71,600 (Alamodome, San Antonio, TX and Georgia Dome, Atlanta, GA); one renovated outdoor football stadium with a seating capacity 65,000 (Los Angeles Memorial Coliseum, Los Angeles, CA); and one new high school football stadium with bleacher seating capacity of 3,700 (Cougar Stadium, Chattahoochee High School, Alpharetta, GA).

Data Collection. Three broad types of information were obtained through the POE's: site documentation, user evaluation, and management practices. Site documentation included a systematic process of measurement and photography to document the physical characteristics of "as-built" accessible design features. User evaluation involved touring and telephone interviews with individuals with disabilities who had attended past events at each facility as well as debriefing people with disabilities and their companions during and after events that were attended with research staff. Management practices consisted of interviews with facility managers to document policies and practices that influenced the accessibility and usability of a facility (e.g. ticketing policies for wheelchair spaces).

Participants. A total of 118 users participated in the study. The touring interviews were conducted with four to seven individuals with disabilities at each site. At most sites

---

[24] The US Architectural Transportation Barriers Compliance Board (Access Board) is an independent government agency vested with promulgating the ADA Accessiblity Guidelines.

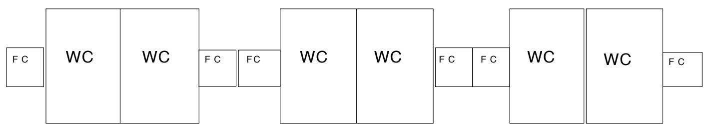
where events were attended as part of the data collection, four to six individuals with disabilities and their companions were guests of the research team at an event, and asked to act as expert informants.

Findings

1. Wheelchair Spaces and Companion Seats

Seating Configurations. ADAAG requires one percent of seating capacity to be allocated to wheelchair spaces. Front or rear access spaces must be a minimum of 33"x48" and side access spaces must be 33"x60". The guidelines also require at least one fixed companion seat for each "wheelchair area" (i.e., adjacent to each wheelchair space). As a result, two percent of the seating capacity must be provided on accessible routes. Typical wheelchair and companion seating options include:

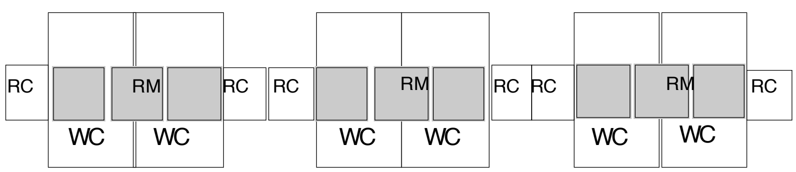
A. Permanently fixed seats. When fixed companion seats were used, typical configurations alternated two wheelchair spaces with two fixed seats (Figure 1).



Drawing not to scale
WC = Wheelchair Space (33" typical width)
FC = Fixed Companion Seat (19" typical width)

Figure 1 *Typical Arrangement of Wheelchair Spaces and Companion Seats*

B. Removable seats. ADAAG permits removable to be provided in wheelchair spaces when they are not needed by people in wheelchairs. Whereas, wheelchair spaces are 33" wide, standard seating is only 19-22 inches in width. As a result, when removable seats were used three seats up to 22" in width could occupy two adjacent wheelchair spaces (Figure 2).

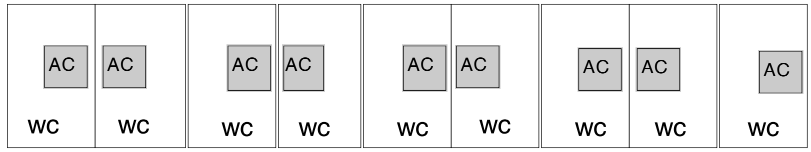


Drawing not to scale
WC = Wheelchair Space (33" typical width)
RC = Removable Companion Seat (19" typical width)
RM = Three-seat Removable Module (19-22" typical width per seat)

Figure 2 *Typical Configuration of Removable Seats*

C. Adjustable seats. Adjustable or rotating seats (Figures 3 - 4) located in wheelchair spaces rotated out of the way to provide sufficient space for an individual wheelchair. This enabled each space to be used interchangeably by a wheelchair user, companion or general patron, and as such, this potentially provided two percent of the seating for wheelchair users. On the downside, the 66 inches required for two adjustable seats required 21 percent more space than the combined 52 inches required for a wheelchair space (33 inches) and a typical companion seat (19 inches).

***Figure 3** Adjustable Seats*



Drawing not to scale
WC = Wheelchair Space (33" typical width)
AC = Adjustable Companion Seat (19" typical width)

***Figure 4** Configuration for Adjustable Seats*

2. Dispersal of Wheelchair Spaces.

Dispersal is the extent to which wheelchair locations were provided in a variety of viewing positions around the seating bowl (horizontal dispersal) and from top to bottom of the seating bowl (vertical dispersal). ADAAG attempts to ensure dispersal of wheelchair spaces by requiring that seats be available at a range of ticket prices. However, ticket prices are variable and are more dependent on decisions of operations personnel than on the actual location of seats. As a result, in facilities that did not truly disperse wheelchair seating, the ADA requirement was typically met by clustering wheelchair spaces in one location and offering them at the lowest available price.

When horizontal dispersal was successfully achieved, it was manifest as ring of wheelchair seating around the seating bowl. This occurred where there was an accessible route that encircled the seating bowl (e.g., a concourse with a slope of 8 percent or less), typically at the front or back of a seating level. In contrast, vertical dispersal at all seating levels was difficult to achieve, particularly at higher levels, as slope from top to bottom of the seating bowl, which was dictated by sightline geometry, typically started at approximately 14 percent at the lowest level and rose sharply with each successive level.

3. Sightlines.

ADAAG requires that patrons in wheelchairs be provided with sightlines that are comparable to those afforded other patrons. Although comparable sightlines are not defined, they have been interpreted to mean that a view of the playing field is available when patrons stand in front of wheelchair locations. In sports venues where standing and moving around during an event are routine crowd behaviors, wheelchair locations had to be elevated above the row in front (i.e., by removing rows of seats) to compensate for the potential of obstructed views and provide comparable sightlines.

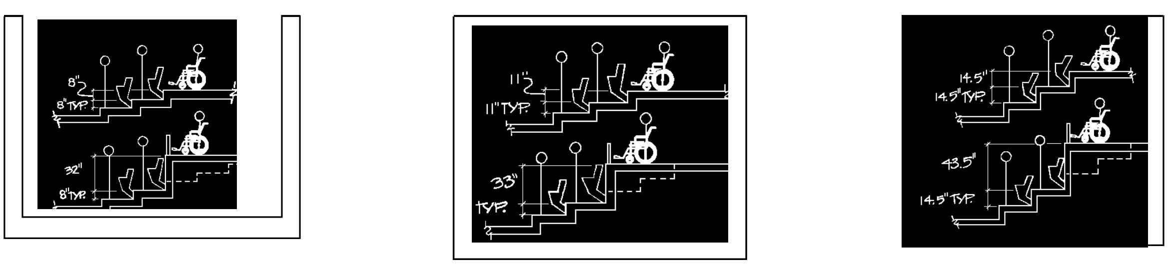


***Figure 5** Obstructed Sightlines of Typical Rows (top) and Comparable Sightlines of Raised Rows (bottom) for Lower, Mid- and Upper Seating Levels*

4. Integration.

ADAAG requires wheelchair spaces to be integrated with other seats in the seating bowl. Although there are a variety of interpretations of this provision, the most common is "integrated with other seats in, and part of the seating the area." Like dispersal, integration is both horizontal (integrated with other seats within the same row) and vertical (integrated with adjacent rows in the seating section).

Horizontal integration. Three factors that impacted the relationship between wheelchair spaces and adjacent seats in a row: type of seating configuration, demarcation of wheelchair spaces and shoulder-to-shoulder alignment.

Type of Seating Configuration. The use of individual, fixed companion seats that looked like other fixed seats in a seating section with open wheelchair spaces provided better integration than open wheelchair location with no fixed seating. However, removable or adjustable seats in wheelchair spaces effectively disguised the spaces, thus providing better integration.

Demarcation of wheelchair spaces. While, many facilities painted lines on the floor like "parking spaces," numbering and delineating wheelchair spaces like other seats (i.e, by section, row and seat number) made them look more like fixed seats. These practices helped to prevent confusion over how many seats were available in any location, and eliminated ambiguity as to where the individual spaces were located.

Shoulder-to-shoulder alignment. Shoulder-to-shoulder alignment (Figure 6) made conversation with a companion easier. To provide shoulder-to-shoulder alignment, a wheelchair had to extend at least 12 inches beyond the back of an adjacent fixed seat.

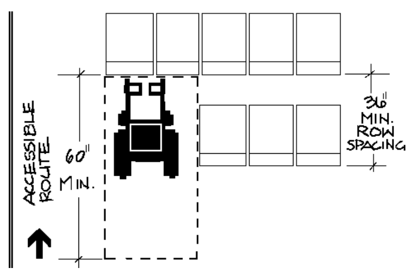


Figure 6 *Shoulder-to-Shoulder Alignment*

Vertical Integration. When people attend an event as part of a group, they often sit in contiguous rows. Therefore, the degree to which patrons who use wheelchairs are able to be integrated with both companions in their group and other patrons is based on the relationship between the wheelchair location and the rows immediately in front or behind. This relationship was a function of three factors: separation from fixed seats, separation from general circulation, and row height.

Separation from Fixed Seats. Most building codes require a guardrail between a cross aisle and the first row of seats when the exposure of the seat back is 24 inches or more. This is generally interpreted to include wheelchair spaces adjacent to a cross aisle because the resultant drop-off from the seat immediately behind a wheelchair space into an empty wheelchair space is a safety hazard. However, the use of railings in front or behind wheelchair spaces, which would otherwise be vertically integrated as a result of their elevation, effectively segregated these spaces (Figure 7).

Figure 7 *Railings on cross aisles*

Separation from general circulation. Concourse areas or cross aisles frequently become social gathering places where groups of spectators loiter while eating, drinking, talking, and watching a game. When wheelchair locations abutted a concourse or cross aisle, other patrons often squeezed between wheelchairs to climb over seats, as it was easier to squeeze between gaps in wheelchairs (Figure 8) than to use the row aisle which required stepping over people in the row. In other cases, wheelchair spaces that were located on concourses (Figure 9) were often overrun by patrons wanting to get a better view of the event while socializing. This obtrusive behavior was generally magnified when there are few occupants in a wheelchair location.

Row Height. The major component of vertical integration is the elevation between a wheelchair location and the contiguous rows in front or behind. This varied in each successive level of a multi-level facility. For example, seats at the lower level were integrated with an 8 inch difference in row height between contiguous rows, whereas a 21 inch difference would be integrated for an upper level. Nonetheless, when rows were raised to provide comparable sightlines (see Figure 5), the change in slope carried significant social costs, particularly the loss of vertical integration. Clearly, many subjects felt that seating options at sites where sightlines were not comparable were not only acceptable, but they expressed a strong preference for socially integrated spaces.

Figure 8 *Shortcuts to Fixed Seats*

Figure 9 *Concourse Seating*

Discussion

Although the impetus for the Access Board’s funding of this project was a response to formal and informal complaints about sightlines in sports venues, sightlines were just one of many factors, including number, dispersal, and integration of wheelchair spaces and companion seats, that were related to the quality of wheelchair locations at some sites. In fact, widespread reports of problems with sightlines may be greatly exaggerated. For example, in facilities where sightlines were considered to be problematic, the lack of integration of wheelchair spaces and companion seats with nearby fixed seats, poor seating locations and/or limitations in the number of available seats in prime seating locations, seemed to exacerbate problems that were articulated by users solely in terms of sightlines. In other words, in facilities where sightlines are considered to be problematic, fixing the sightlines alone would not result in wheelchair spaces of acceptable quality. This was evidenced by the lack of complaints about sightlines at facilities where wheelchair locations had similar obstructed sightlines, but where these locations were well dispersed and integrated.

In addition, the interrelationships among the various factors related to seating quality and facility size made the design of sports and performing arts facilities a complex and highly specialized task. There was not one single issue, such as providing sightlines for wheelchair spaces that drove a set of decisions about the design of a facility. As a result, seemingly minor, ostensibly simple changes, such as providing comparable sightlines for all wheelchair spaces or increasing the amount of space that must be provided on accessible routes, could significantly alter the quality of seating for all patrons, the overall size of the facility, and ultimately the financial viability of a project. Moreover, interrelationships among the various factors related to seating quality and facility size called into question the extent to which the provision of comparable sightlines was the most important characteristic of wheelchair locations versus one of several important characteristics that could be optimized, but not maximized simultaneously. Finally, facility management practices and attitudes were arguably the most important issue in the overall experiences of people with disabilities regardless of the physical accessibility of a facility. No matter how good or bad the physical accommodations, management practices and staff sensitivity always seemed to be the most critical issue in quality of experience and customer satisfaction. All of these considerations, taken together, suggest that the overall quality of seating was dependent on a delicate balance of design and management decisions and practices. Most importantly, stadium design should be based on decisions and practices that promote flexibility and provide people with disabilities with a range of options that will permit them to make their own choices about where to sit, with whom they will sit, what they will see, and what they will hear.

TECHNOLOGIES FOR A BETTER USABILITY IN THE BUILT ENVIRONMENT: STRATEGIES FROM TWO INITIATIVES IN ITALY AND UK

Luigi Biocca
CNR ITC
l.biocca@itc.cnr.it

Guy Dewsbury
LANCASTER UNIVERSITY
g.dewsbury@lancaster.ac.uk

Keywords: decision support system (DSS), assessment, telecare, dependability, system/tool.

Abstract

Easy living, safe and comfortable built environment, and free mobility can increase implementation from technology tools/supports/devices only after concepts of Design for All have been suitably applied to the benefits and needs of various users.
On this purpose, authors will present two initiatives from their countries, concerning the development and/or installation of systems/tools in order to increase the quality of life of citizens.
Italy: a EU-funded project, POLIS, has developed a software/tool that enables assessment of the accessibility level in an office building. The tool is further to be tested and adjusted, but data collected so far seem to be prominent to achieve a good level of sharpness in the accessibility quantitative assessment.
The United Kingdom: a municipal program for telecare and assistance aid is providing tailored installations at home for people with different requirements which has given rise to the DTA: the Dependability Telecare Assessment tool. This tool has been developed to assist a person centred approach to the design and installation of telecare systems in the UK. The different issues of implementations will be compared, pointing out how next steps can evolve for improving the living environment.

Technological tools supporting the accessible environment: the POLIS project in the Italian experience

POLIS (Decision support tools and policy initiatives in support of a universal design of buildings) was a 3-year project (January 1, 2004 – December 31, 2006), funded by the European Commission under the PRIORITY 8.1 (Policy Oriented Research) program (Contract number: FP6- 50086 22), whose goals are as follows:

- To provide for a detailed analysis of accessibility characteristics and data and to use this information to develop a decision support system, called hereafter a Decision Support System for a Universal Building Design (DSS.UBD), aiming at the well-founded evaluation of various building design scenarios, with the long run goal to increase the cost efficient uptake of Universal Design by society and to provide for a drastic enhancement of the quality of life of people with specific needs (disabled, ageing, children, etc.)
- To address the relevance of the proposed solutions within the existing EU/member country policy instruments and to suggest practical means of integration within existing or, very likely, newly required policy instruments, towards the ultimate goal of an "accessibility for all" EU standard. Also, to investigate the means and modalities by

which such a specification can lead to the development of a EU wide certification scheme/label, with regards to building universal design.
- To disseminate the results towards different audiences (EU and member state authorities, designers, engineers, product developers, etc.) and to identify business opportunities in terms of new-era assistive technologies and services.

The project aims to build a DSS able to determine and improve accessibility of buildings in harmony with the Universal Design principles and then with the different needs of people with motor/sensorial difficulties. This DSS allows different users' groups (professionals, decision-makers, city office managers, developers, clients and customers) to manage accessibility existing data, design characteristics and requirements for new refurbishments and to plan new future solutions.
The DSS tool includes several factors, whose complexity is too relevant to be described here in detail, but we can summarize them as consisting of space characteristics (paths, furniture and services), users' types and building types.
The first step was then analysing different building types and users so to determine some sets of environmental and building characteristics to which associate a description and a value within a certain range that depend on the response of a characteristics to the need of accessibility.
After building a complete database for a certain building type, the user can query the system to know an overall value level of accessibility.
The software intends to be a guide, pointing out - for a broad range of services - a number of specific equipment which would guarantee the use of these services by people with disabilities.
This equipment has also identified a number of elements to input into the Polis database to be managed in the analysis of accessibility with the software.

Main features of the DSS software

1. <u>General data</u>

- *Project Type*
- *Building Category/Type*
- *Building Name*
- *Building Floors*
- *Disability*

Eight disabilities types have been identified (see Figure 1). Analysis of accessibility is made by choosing a single disability or making a multi-selection; in the second case the system will process any selected disability. The system will display the most relevant services for any single selected disability or merge the most inclusive and relevant group of services for more selected disabilities, but the total group does not figure a simple amount of the services for each disability.

Figure 1 *the disability menu toolbar*

○ *User*

Defined users' groups are "worker" and "customer"; the system targets the first as employee, decision-maker, city office manager, developer or similar users that need to query the services level, and targets the second as client or customer who needs to use a service.

2. Building structure

Includes information on number of floors, types and number of existing services (see Figure 2). Services are divided in two macro-categories, basic and optional. A set of basic services and a set of optional services have been associated to any building type.

***Figure 2** the building information menu toolbar*

3. Paths management

Generated basing on the services selected by the user. The system displays ways to reach a certain service or the closest one in case of similar existing services (e.g. more toilets in the same floor).

4. Services management

The system automatically reports the list of services to which a name, number and relevance is associated.

All the elements and data here categorized were taken out from the BAM methodology, to which we refer readers to further details on the POLIS website.

The Italian case study for the DSS demo

The former offices of our research institute (CNR ITC) have been tested for implementing the DSS.

All the elements of the office premises were analysed and defined as values for that building type relevance (e.g. a meeting room of an office has a higher value than in other building types because it is strictly linked to the office routines). Elements include the following factors:

- Route Elements (main and alternative horizontal and vertical paths);
- Services (furniture, objects and other relevant end points of human activities);
- Service Paths (the access ways to Services);
- Devices (tools, buttons, controls/equipment that enable performing of activities).

All these elements are detected and given a certain number value - based on their relevance – then are listed both in text database and in a building map (see Figure 3). The outcome was a demo displaying the overall accessibility in walking through several building areas and also showing any existing crucial point for the passage of persons with difficulties. The system is then able to show how and to which extent – depending on different disabilities - everyone can walk through the building spaces.

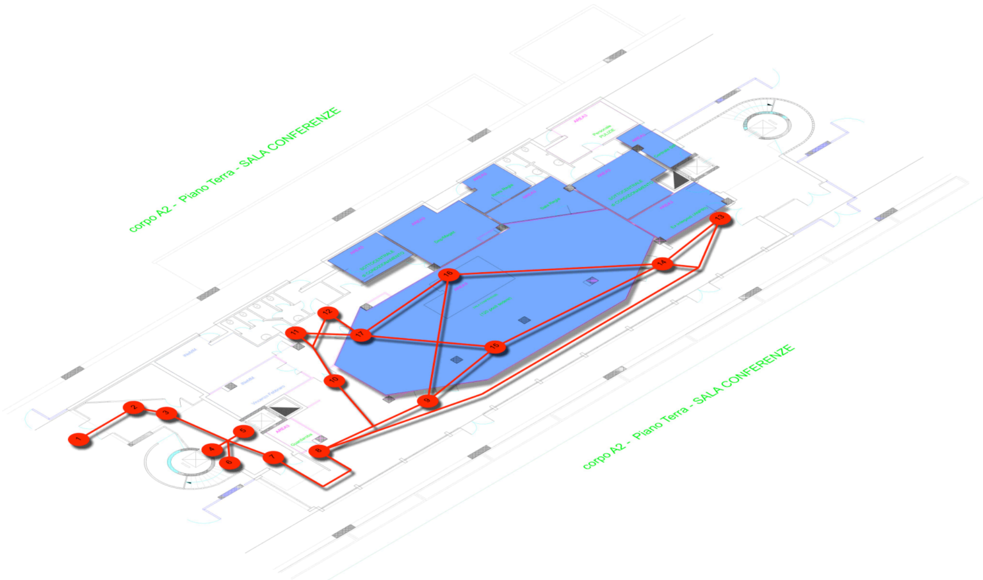


Figure 3 *axonometrics of the main office level with the crucial access and walk-through points (in red)*

Benefits of the software system, once it is further implemented to other building types, can be summarized as follow, as regards to different end users:

- City officer/decision maker in assessing the requirements of accessibility of the public real estate during municipal development or renovation plans;
- Designer/professional in selecting the more appropriate design solutions for accessibility prior to the building completion;
- user with different disabilities in previewing the PC-demo of the walking-through scenario inside a building, so to know in advance the services accessibility and/or to compare the services levels among similar building types (f.i. when making a reservation of more hotels in a certain urban area).

The system can generally apply also to the following contexts for the benefits of those with difficulties:

- development plans by national housing agencies;
- renovations and new access plans to archaeological/heritage areas;
- remodelling plans for the national facilities (i.e. Post Offices, Transportation, Health Centres;
- Information board and maps systems of tourism reception facilities;
- Accessibility performance certification by research centres, universities, certification entities) both voluntarily and mandatory.

The background to Littlesville Telecare in the UK experience

Littlesville is a name given to provide anonymity to the actual locality of the test sites. Littlesville council is situated in the UK. Littlesville is home to an estimated 326,760 people who are a younger and more diverse population than the national profile. Littlesville is the 20th most ethnically diverse area in England with 29% of its population belonging to a black or minority ethnic group. It is the 2nd most religiously diverse council in the country: 14.8% of its population is Jewish and 8.5% of residents describe themselves as Indian, Bangladeshi, Pakistani or otherwise as Asian. The demographic factors most likely to impact on the delivery of the telecare service are seen as:

- An increased number of people with dementia. The population aged 85 and over is expected to increase by 400 and dementia rates grow strongly with age.
- A significant number of carers. The 2001 Census indicated 28,200 residents who were providing unpaid care, of whom 4,603 provided 50 or more hours per week. With many of these carers retired, or approaching retirement age with health problems of their own, carer support is seen as a priority area.
- As women tend to live longer than men there is a large preponderance of women in the older population, one that increases as age increases. Just over 18,000 of those aged 60 and above live on their own and may therefore be particularly vulnerable. Over half of this number are 75 and above, and just under one fifth are 85 and above. There are a total of 76 registered care/nursing homes for older people in Littlesville: the local authority currently funds approximately 1100 residential and nursing home places.
- According to the Royal Society for the Prevention of Accidents, more than 600,000 people aged 65 and over ended up in hospital as a result of falls in 2002. Of those, 48,000 had fractures of the hip; up to a third of hip-fracture patients die within a year of their accident and half lose the ability to live independently. £1.8 billion a year is spent on hip fractures in the UK.

Evidence suggests that telecare does not save money directly, through cutting down on personal care, but saves money indirectly through maintaining people's independence in the NHS, community and relieving places in residential supported accommodation.
In 2005 the UK Government's Department of Health announced the 'Preventative Technology Grant' (PTG) which meant that all municipal councils would receive financial assistance to build a telecare service in their region http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/Browsable/DH_4122310. For Littlesville council this meant that it received over half a million pounds Stirling over a two year period beginning in 2006.

Defining telecare and the Littlesville Approach

To define telecare is difficult as there is no one clear definition. Here are some of the five most common UK definitions:

1 "Telecare describes any service that brings health and social care directly to a user, generally in their homes, supported by information and communication technology. It covers social alarms, lifestyle monitoring and telehealth (remote monitoring of vital signs for diagnosis, assessment and prevention).

"Telecare covers a wide range of equipment (detectors, monitors, alarms, pendants etc) and services (monitoring, call centres and response).

"Telecare equipment is provided to support an individual in their home and tailored to meet their needs. Telecare services range from a basic community alarm service that is able to respond to an emergency and provide regular contact by telephone to an integrated system that includes detectors or monitors (ie motion, falls, fire and gas) that trigger a warning to a response centre. More complex systems include telemedicine, which is designed to complement healthcare via monitoring vital signs such as blood pressure. Data is transmitted to a response centre or clinician's computer where it is monitored against parameters set by the individual's clinician." (http://www.pasa.nhs.uk/PASAWeb/Productsandservices/Telecare/ accessed January 2008)

2 "Telecare is the continuous, automatic and remote monitoring of real time emergencies and lifestyle changes over time in order to manage the risks associated with independent living." (Steve Hards, Telecare Aware - www.telecareaware.com accessed January 2008)

3 "Telecare has been defined as "the remote or enhanced delivery of health and social care services to people in their own home by means of telecommunications and computer-based systems"
(Brownsell S, Bradley D., 2003).

4 "Telecare is as much about the philosophy of dignity and independence as it is about equipment and services. Equipment is provided to support the individual in their home and tailored to meet their needs. It can be as simple as the basic community alarm service, able to respond in an emergency and provide regular contact by telephone." (DoH Building Telecare in England, p9)

5 Telecare is defined as the "network of monitoring, advice and analysis we have outlined - could play a major role in implementing government policy on long term conditions. The major benefits would be:

- Greater choice and empowerment for patients, who may be enabled to become experts in their own care.
- Potential reductions in expensive and unnecessary hospital admissions, which are already stretching hospital budgets.
- Helping to reduce the impact of known trends towards higher levels of long term conditions and towards greater co-morbidity.
- Integrating parts of the health and social care services more closely.
- Better planning and swifter implementation of improved services, based on accurate data and research."

(Source: House of Commons
http://www.publications.parliament.uk/pa/cm200405/cmselect/cmhealth/398/398we04.htm
accessed January 2008)

In Littlesville, we consider telecare to be the appropriate use of technology to support people to live independently in their own homes. This means that we are not per se adapting the building structure, rather the approach takes for granted that buildings fail to support people and technology can be used as an intervention to compensate for the lack of appropriate building design inherent in most UK buildings.

Littlesville provides telecare in a distinct manner and provides a unique service. Some of the key features that make it unique are the person centred design approach to the assessment of people; the fact that Littlesville use two main providers of telecare solutions thus offering more choice to the recipients and Littlesville provide both lifeline based telecare as well as standalone.

To clarify the final point, there is a difference between standalone and lifeline based telecare. Standalone devices produce noises or alerts to alert people in the building. No sounds or data should go beyond the four walls. So standalone is predominantly used to support carers by producing alerts. For example a person is unsafe to get out of bed so a sensor produces an alert each time the person gets out of bed thus alerting the carers to the persons disposition so they can assist. Standalone is counterpoised by lifeline based telecare. This type of telecare is similar to the community alarms and uses much of the same technology. Hence, when a person produces an alert the signal is wirelessly transferred to the dispersed alarm unit which dials up the response centre. The response centre can determine what telecare device has produced the alert and their action will be based on what is best for the individual.

DTA: Dependability Telecare Assessment tool.

The person centred approach that is used in Littlesville is a result of research that began in the academic world which centred on the notion of dependability in relation to assistive technology [Dewsbury et al, 2005, Dickenson and Dewsbury 2006]. This culminated in a number of variants namely CATS, CATCH, MDDS and now DTA [Dewsbury et al 2006, 2007 and Sommerville and Dewsbury 2006, 2007; Dickenson and Dewsbury 2006].

Through research conducted between 2002 and 2008 nine aspects of technological viability were developed (Figure 4) which allowed technological interventions to be empowering. This meant that the person in receipt of the technology (telecare or AT system) was not a passive recipient but actively engaged in the process and the design (Figure 5). Furthermore, this interaction between technology and the person can be broken down into four main elements: Acceptability; Trustworthiness; Adaptability and Fitness for purpose. A person must have technology that is fit for intended purpose, it must be acceptable and trustworthy as well as adapt to their changing needs. Each of these elements can be broken down further to other dependability characteristics that demarcate the socio-technical system (Figure 6).

Figure 4 *The empowering nature of technological intervention*

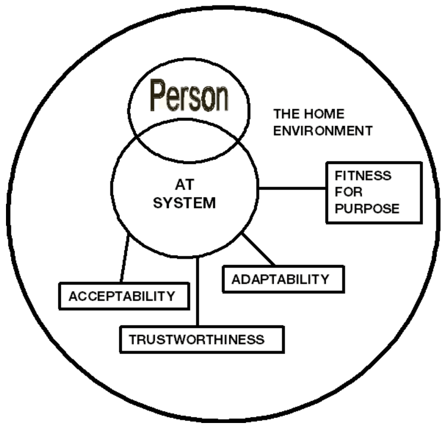


Figure 5 *The relationship between the person and the technology*

Fitness for Purpose
- Transparency
- Requirements

Trustworthiness
- Availability and Reliability
- Safety
- Confidentiality and Integrity
- Maintainability
- Survivability

Acceptability
- Usability
- Leamability
- Cost
- Compatibility
- Efficiency
- Responsiveness
- Aesthetics

Adaptability
- Configurability
- Openness
- Visibility
- User repairability

Figure 6 *The telecare dependability characteristic*

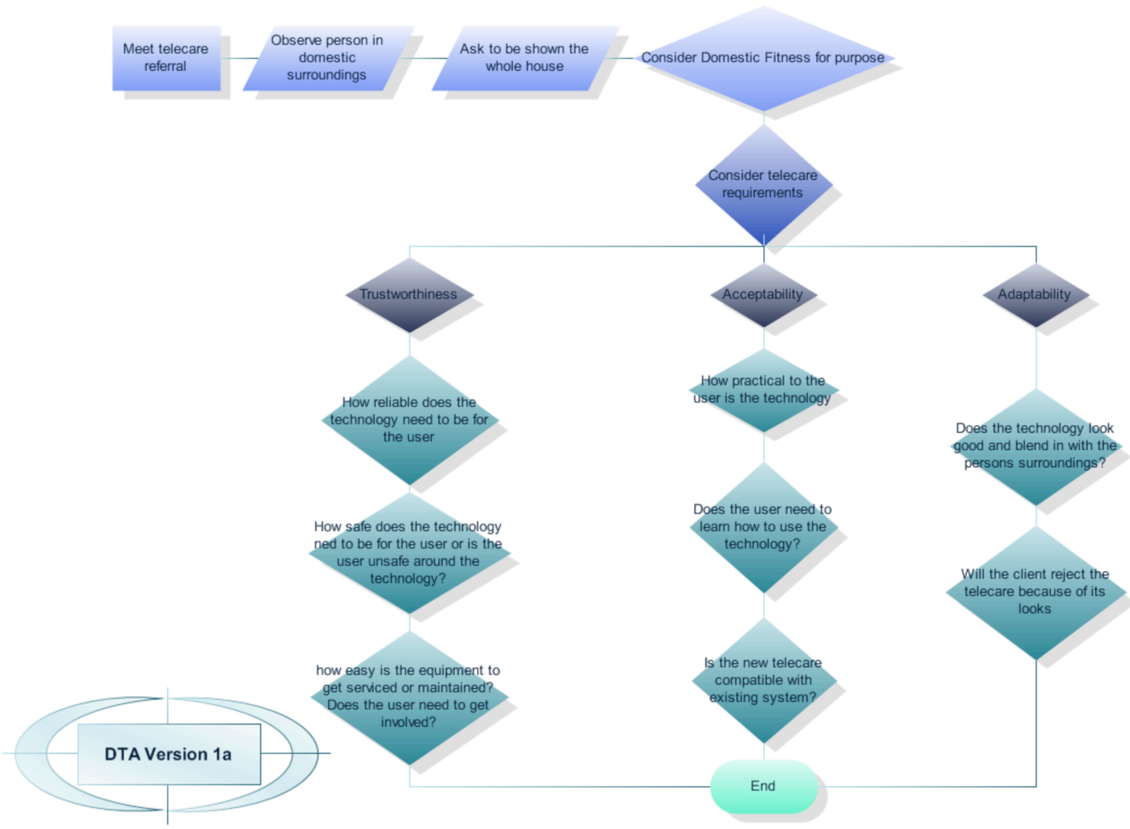


Figure 7 *the DTA process*

So when a person is assessed from any service within the council, health or mental health service the should receive an holistic assessment that includes a telecare assessment based on the dependability criteria in Figure 6. Clearly, not all aspects of the table are to be prevalent with each assessment but as a guide the elements have proven to be useful in ensuring person fit to technology as well as adapting the living spaces to be more acceptable for the occupant (Figure 7). The other clear advantage of the DTA tool is that it does not mean technology is foisted on people but rather is arrived at through a process of negotiation and discussion with the parties who have an investment in its use. This means it is rarely over used and most importantly when technology interventions such as telecare are used it is a limited intervention which is person-specific and solely needs based.

Conclusions

The systems illustrated so far have very different backgrounds, nevertheless they strive for increasing relevantly independence and freedom of performing home activities in the easiest ways. The Italian initiative is a built environment based approach (more focus on a free and easier walking through different building types) but its EU-funding nature results as a complexity for a further software implementation, which is a crucial issue to be overcome before the system can fully apply and give a satisfactory response.

The UK context is describes the person centred design of technology to support independence for people with a range of functional and mental incapacities. Both systems imbue characteristics of universal design and inclusivity. The former taking the high perspective of ensuring buildings are built to a specific standard and the latter concentrating on the peoples relationship with their surroundings from a micro perspective. Individually they both benefit the person but together greater benefits are forthcoming.

When comparing the methods, both exemplify designs that meet peoples needs. The Italian approach is to consider the building and modify this to meet the needs of the user, whereas the UK approach considers the person within the building and adapts the technology to support independent living. Both approaches are complimentary and can be used in conjunction with each other or independently. Both approaches embody Universal Design and Inclusive Design principles and each approach seeks to enhance the quality of life of the user.

This paper synthesises a number of elements but essentially contains the question when to adapt buildings against when to intervene with technology. The two approaches act as elements on a continuum. Ideally homes should always be designed with the most up to date technology to support the concept of lifetime homes, but in reality many homes do not meet these requirements and therefore the occupants require technology to make up for the limitations of their environment.

Main references:

- BIOCCA, L., CHRISTOPHERSEN, J., MORINI, A. (2005) *Design integrated environments by combining accessibility and new technologies*, IAHS World Congress on Housing, Pretoria, South Africa, CD Proceedings, September.
- BIOCCA, L., DEWSBURY, G. (2004) *Housing and Technologies in the EU for promoting Quality of Life*, CIB World Building Congress 2004, Toronto, Canada, CD Proceedings, May.
- BIOCCA, L., MORINI, A. (2004) *Housing Programs supporting the emerging needs of older people*, ENHR World Congress, Cambridge, Proceedings, July, p. 185.
- BIOCCA, L., MORINI, A. (2004) *Smart homes initiatives for older people*, IAHS World Conference on Housing , Trento, CD Proceedings, september.
- BIOCCA, L., MORINI, A. (2005) *L'accessibilità in edilizia - Il progetto di ricerca europeo BAS Building Accessible Services*, L'Edilizia no. 142, dicembre (in Italian).
- BIOCCA, L., MORINI, A. (2007) *Il sistema di supporto alle decisioni (DSS) come strumento di valutazione dell'accessibilità in edilizia nel progetto di ricerca europeo POLIS*, L'Edilizia, january, pag. 42-43 (in Italian).
- BIOCCA, L., MORINI, A., MORUZZI, L. (2005) Application of POLIS methodology: the Technical User approach, POLIS 5th Meeting – Mid Term Review, Warsaw, Poland, September.
- BIOCCA, L., SANDSTROM, G. (2004) *Aging in place' in Italy and Sweden: guidelines and outcomes from two housing experiences*, Designing for the 21st Century Conference, Rio de Janeiro, Brazil, CD Proceedings, December.
- BROWNSELL S, BRADLEY D. (2003) *Assistive Technology and Telecare - Forging Solutions for Independent Living*. Bristol: Policy Press,
- CNR ITC (2006) *BUILDING ACCESSIBLE SERVICES*, Evaluating accessibility & highlighting good practice. A showcase of Building and Urban Space Accessibility in

the EU, Project supported by the UE – DG Employment and Social Affairs 2004-2006 (text and CD).

- CNR ITC (2006), *Case study of CNR-ITC: Multi-purpose research center, Italian National Research Council*, Rome, 2006
- CNR ITC (2006), *CD DEMO upon the POLIS DSS.UBD to evaluate the building accessibility*
- CNR ITC et al. (2006) *POLIS Deliverable D 2.1.-B*
- DEWSBURY G AND DICKINSON A (2006) '*Enabling and applying person-centred design for older adults*' In Dickinson A and Dewsbury G (Eds) (2006) Special Edition, 'Computer Systems for Older People', Gerontechnology, 5(1) – May 2006, Gerontechnology Society, pp56-57, ISSN 1569-1101.
- DEWSBURY G, SOMMERVILLE I, ROUNCEFIELD M, BAGNALL P, (2005) *Designing Technology with and for Older People*, paper presented at HCI 2005 Workshop HCI and the Older Population, Edinburgh, Monday 05/09/2005
- DICKINSON A AND DEWSBURY G (2006) '*Designing computer technologies with older people*' In Dickinson A and Dewsbury G (Eds.) (2006) Special Edition, 'Computer Systems for Older People', Gerontechnology, 5(1) – May 2006, Gerontechnology Society, pp1-3, ISSN 1569-1101.
- DICKINSON A AND DEWSBURY G (Eds.) (2006) Special Edition, '*Designing for Older people*', Gerontechnology, 5 (1) International Society for Gerontechnology, May 2006, ISSN 1569-1101.
- DoH (2005) Building telecare in England, http://www.dh.gov.uk/assetRoot/04/11/56/44/04115644.pdf
- SOMMERVILLE I AND DEWSBURY G (2007) *Dependable Domestic Systems Design: A Socio-Technical Approach*, Interacting with Computers, Springer, Volume 19, Number 4, July 2007, 438-456, ISSN: 0953-5438.
- SOMMERVILLE, I., DEWSBURY, G., CLARKE, K. AND ROUNCEFIELD, M. (2006) in Clarke, K, Hardstone, G, Rouncefield, M, Sommerville, I, (Eds.), *Trust in Technology: A Socio-Technical Perspective*, Series: Computer Supported Cooperative Work, Vol. 36, XXV, Springer, ISBN: 1-4020-4257-4.
- For more information about the POLIS project see: www.polis-ubd.net/
- For more information on DTA see www.smartthinking.ukideas.com/MDDS.html

A LAN-BASED HOME CONTROL SYSTEM

Ferdinando Grossi, Valentina Bianchi, Guido Matrella, Ilaria De Munari e Paolo Ciampolini

Dipartimento di Ingegneria dell'Informazione
Centro di Collaborazione sulle Tecnologie Assistive
Università degli Studi, Parma, Italy
paolo.ciampolini@unipr.it

Keywords: home control, ambient assisted living, remote monitoring

Abstract

Information and communication technologies may play a key role in fostering accessibility and livability of the home environment, supporting living in place of elderly people and people with disabilities. Depending on the actual user's needs and degree of self-reliance, ICT home tools can increase safety and usability of the home equipments, provide assistance in daily living activities or implement assistive services to compensate for specific impairments. Effective introduction of such tools within the home environment, however, should cope with cost and architectural constraints, system openness and flexibility, ease of use and reliability. To tackle these problems, an innovative approach is proposed: a comprehensive home control system has been developed which features automation, environmental control, personal monitoring and communication capability. The system is based on standard LAN technologies and IP communication protocols; it is fully integrated with home data network and may share resources with it. By exploiting mainstream technologies, low cost and high performance are attained. By combining in a hierarchical approach high-level software control processes, abstraction of the hardware levels, flexible interfaces, a versatile and reconfigurable system is obtained, virtually open to any external device and capable of evolving in time according to the user's needs and ICT progresses. Intelligence is widely distributed over the home environment, and allows for continuous monitoring of home activities. Mobile (i.e., wearable wireless sensors) are also incorporated in the same network, providing personal monitoring as well. Remote monitoring and control is enabled by an internet connection.
Evaluation at a pilot-site, operating since January 2007, is described.

Introduction

Information and communication technologies are becoming an ubiquitous component of our daily life, deeply influencing our work and life styles. Thanks to the fast development pace of microelectronic industry, performance of electronic devices are steadily improving, while their size and cost are decreasing. This allows for electronic devices to penetrate more and more deeply into an increasingly wide set of applications and functions. In particular, such a capillary penetration, and the parallel evolution of communication techniques, are fostering the transition from a "concentrated" view of technology to a much more "distributed" one, in which a large number of intelligent devices cooperate, often on a peer-to-peer basis, to build a common network of services or functions. This provide a number of definite advantage,

which are especially relevant for the home environment: distributed systems are inherently more flexible, adaptable and expandable and can thus be more easily tailored to the varied needs of homes and of people living in them.
On the other hand, distributed system pose more complex coordination and reliability issues. And, as far as the home environment is concerned, accessibility and usability of the networked services should be taken care of. This holds especially true if we consider the needs of older adults or people with disabilities: ICT technologies can be exploited to build Home Automation Systems (HAS), which may contribute to the home ergonomics and allow for the development of specific functions useful to improve autonomy (hence quality of life) of people suffering from some mobility or sensorial impairments (Cole, 2002).
Although being relevant for any general-purpose HAS, functional flexibility, system openness and reliability, implementation and maintenance economy are of the utmost importance in this particular context, which conjugates the more customary HAS functionalities with more specific assistive technologies or telecare issues, converging in a common framework. Functions of a conventional HA system can be summarized as follows:

- Safety: control of environmental risk conditions (flooding, smoke, fire, etc.);
- Security: anti-theft, anti-intrusion;
- Automation: motorized doors, windows, curtains; light control; appliances control; HVAC management;
- Communication: remote control of home functions; remote surveillance;
- Entertainment: audio, video, computer games;
- Energy saving: power balance and scheduling; smart integration or alternative sources.

Some of these functions may effectively support daily living activities of older adults and people with disabilities; more specific assistive applications may also require the integration of additional functions and services, such as:

- assistive devices for motion impairment (lifters, motorized wheelchairs, …) and sensorial impairment (augmented/alternative communication interfaces, voice synthesizers,…)
- the use of telemetry systems for physiological parameters (telemedicine)
- management of assistance calls (either voluntarily or automatically activated)

Such a mere listing of elementary functions, however, just offers a narrow view of the possibility of assistive home automation, and makes it impossible to grasp the main implementation difficulties. The effectiveness of technology devices aimed at supporting everyday living activities is conditioned by several factors:

- the strong need for customization (adaption to the specific needs), which makes it difficult to define standard solutions;
- variability of functional requirements over time, due to the evolution of health conditions or changes in family composition or caregivers;
- ease of use: solutions that require training or require technological expertise are, by their nature, scarcely universal;
- architectural and construction constraints;
- reliability and tolerance to system faults;
- implementation and maintenance costs;
- the user perception of an actual benefit;
- the need of reduced intrusivity, with respect to the users' habits and freedom of choice.

This implies the need of developing open and flexible systems, able to evolve and change over time following the evolution of available technology and of user's health and needs. Although HA technologies being now relatively widespread and consolidated, the achievement of these objectives is still not an easy task. In general, every HA system relies on the networking of its components, which allows for a common control interface and enables coordinated functions. Networking also allows for sharing components common to different functions, avoiding duplication and redundancy and thus allowing cost savings. Finally, interconnection allows to conceive actions and activities which involve several home devices and which would not be obtainable from independent individual components: for example, the communication between the lighting system and presence sensors (usually exploited for security purposes) enables automatic light switch-on, avoiding the need for a person walking with cane or rollators the need to directly handle the switch. The same simple principle can be extended to more advanced functions, including more articulated sequences of operations or verification of more complex sets of event-triggering conditions. The functionality of the interconnected system therefore largely exceeds the sum of its individual components features. The interconnection network requires, in addition to a physical medium to convey signals, the adoption of a common communication protocol, which determines formats and rules of interpretation of events network. Various HA-oriented protocols exist, characterized by different combinations of features and performance: however, since there is not an universally agreed choice, devices designed to operate in a given environment cannot easily cooperate with devices intended for different protocols. Closed standards and the resulting difficult interoperability are actually recognized among the main obstacles to the effective spread of conventional HA systems. Moreover, it becomes especially critical in the case of assistive systems, whose need for customization and flexibility may possibly not be resolved in the finite set of standard applications originally provided by the manufacturer.
More generally speaking, a number of technological aids are designed as autonomous devices with limited or no communication ability; in other cases, they exploit completely different communication technology standards (for example, many AA communication systems are inherently based on the use of a personal computer).
We should then refer to a highly heterogeneous scenario, which requires interoperability in a single framework of many different subsystems, the choice of which is not necessarily primarily driven by home networking considerations.

The technical approach
The system developed at the laboratories of the Center for Assistive Technology of the University of Parma (TAU-Lab) aims at matching such constraints, by developing a common infrastructure capable of supporting automation, safety and security, communications and monitoring features. The system is based on the distribution of computational intelligence, in a highly modular and hierarchical approach, designed to deal effectively with interoperability and expandability issues and to keep costs as low as possible. It was also conceived for acting as a flexible testbed for innovative features. The basic assumption concerns the choice of communication protocol and physical network medium. The network must allow circulation of information having very different levels of complexity, ranging from simple binary commands to multimedia contents. To deal with vastly different bandwidth requirements, we referred to the communication protocol Ethernet (IEEE 802.3). This standard is actually

largely widespread in the development of high-speed local area networks (LAN) and, more recently, is also being exploited for industrial automation purposes.

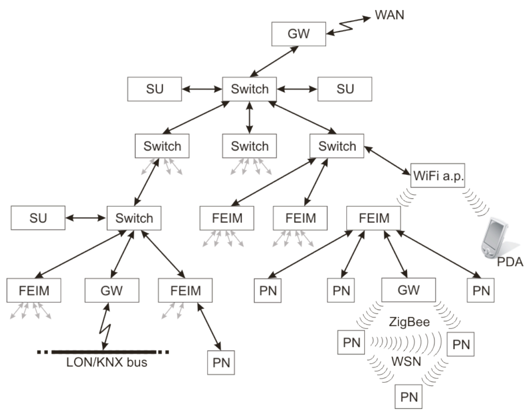


Figure 1 *System architecture*

The system can be schematically represented as in Fig. 1, which highlight the hierarchy of the network, organized on multiple layers of peer, independent components. Terminal elements of the structure, called "peripheral nodes" (PN), manages interaction with the home environment. A PN can be a simple object like a switch or a light bulb, or a more complex subsystem such as a smoke sensor, a door motor, etc.. Electrical devices not originally conceived for network control can still be operated by means of system-controlled power outlets. Each peripheral node is connected to the network through a configurable interface module (called FEIM: Field Ethernet Interface Module), which manages low-level communications towards each PN according to its needs. The module (Grossi, 2007), designed at TAU-Lab and based on a microprocessor, can talk through analog and digital ports, which can be configured within a range of options, wide enough to interface all peripheral nodes of practical interest. The FEIM module itself, exploiting its local intelligence, allows for the implementation of simple operating "rules", suitable for establishing basic cause/effect links, such as, for instance:

- pushing a button turns on the light;
- getting off the bed at nighttime turns on a courtesy light;
- flood detection triggers a warning sound, stops water supply and delivery of electrical power (to limit the risk of electric shock).

In addition, the FEIM module manages Ethernet communication, connecting to a network switch. This enables communication toward higher levels of hierarchical network and "peer to peer" messaging among modules. In this way each subsystem, virtually independently of its actual function, is able to communicate with all the others. This ensures the highest degree of flexibility in defining the functional relationships between objects and guarantee openness to subsequent expansions.
Distributed architecture may include one or more supervising units (SU); such nodes have greater intelligence and can implement more complex operating rules (for example involving peripheral nodes pertaining to different FEIM modules). SU's can be exploited for

maintenance and configuration of the system and, in general, to perform computationally-demanding tasks. Complex rules implemented at this level may be, for example:

- check for night wandering of older adults with dementia or Alzheimer's disease;
- monitor the load of the power grid and possibly disconnect appliances (in a given order) to avoid blackouts and risks related to the lack of lighting (falls, panic,…).

The SU are, in general, personal computers, not necessarily dedicated to the exclusive function of supervision: supervisory processes can coexist with other processes. For example, on such units software speech recognition modules can be run, to implement voice commands, or videocommunication can be accomplished. Arbitrarily complex operating rules can be defined at this level: an intuitive management interface is being developed, which allows for generating technical configuration parameters with no knowledge of the physical details of the actual system.
Unlike conventional HA technologies, in this case each device or function shares the same infrastructure and data space, so that virtually any device can interact with any other through the control hierarchy described above. Interoperability is addressed through the introduction of intermediate levels of abstraction: once the electrical interface is dealt with by the FEIM module, operating rules can be defined by referencing to the functional, abstract properties of each object. The FEIM flexibility allows for including in the network objects not originally designed for this, with particular reference to assistive devices, in a relatively simple fashion. Sharing the same communication substrate also yields the immediate possibility of remote and unified system control, by means of wireless units, selected accordingly to the users' needs. Finally, gateways (GW) allow for communications toward heterogeneous (sub)networks: in particular, it allows communication to the Internet WAN, which in turn enables controlling and monitoring the home environment from a remote location.
With respect to home care systems based on conventional technologies, the approach described so far promises improved performance, flexibility and functionality and significantly reduced costs. A further interesting possibility is to be stressed: in this context, every network activity ("events" such as activating a switch, opening a door, using an appliance, moving in a given room, etc.) is recorded in a database, which provides a large amount of statistical information. By suitably analysing these data, investigating frequencies and correlations, richer environmental descriptions can be obtained suitable for implementing diagnostic or adaptive functions (Alwan, 2006). Through data mining or artificial intelligence techniques, for example, smart activity "profiles" can be extracted, capable of remembering or reproducing sequences of events, either carried out automatically when entering a room, or activated through a unified, simplified command. Through the same mechanism, the system can deliver diagnostic or predicting functions: for example, information on the sleep-wake cycle (Virone, 2002) can be extracted from the events' succession, which could be useful to assess the health condition of some persons.
So doing "virtual sensors" that can capture complex information in a strictly non-invasive fashion can be developed, by exploiting existing hardware, and thus at no additional cost.

A pilot site

The system features and reliability are currently being validated at a pilot site in the countryside near Parma, Italy. It consists of an assisted-living facility, including five independent flats, a common living area, a medical room and shared laundry and kitchen services. The network counts over 600 peripheral nodes, 30 FEIM modules and some

supervising units. Each flat is equipped with basic safety and security features (fire, flood, intrusion alerts). Although, up to now, emphasis has been mostly placed on infrastructure and communication issues, some simple assistive tasks are already carried out by the system, which exploits the common framework described in previous sections. Automatic electrical load balance can be carried out by monitoring power consumption at each AC outlet: if a limit is exceeded, the system deactivates appliances in a given priority order, to avoid disconnections from the grid, which in turn may cause room darkening and possible falls. Intrusion warning are issued and broadcasted to caregivers and/or residents; presences in the common areas in night hours are verified as well, to check for someone wandering. A more accurate localization device is being developed, based on wearable RF sensors: a ZigBee transceiver has been exploited to this purpose. The same device also incorporates a MEMS accelerometer, which is exploited to get information about motion of older residents. A simple fall detector has already been implemented, capable of simple gait analysis as well (Grossi, 2008).
The system also features internet connection, which allows for videocommunications with remote relatives, or with caregivers. A simple telemedicine desk is also present, which allows for a number of basic health parameters to be checked and dispatched to remote medical doctors. The whole technical monitoring and maintenance is carried out by a remote location The system has already run for a complete year, with no noticeable flaws or failures.
A further by-product of the integrated framework approach comes from system event logging, which can be exploited, as mentioned, to profile daily activities. The system recognize a number of different events, ranging from simplest switch operation to more complex sensor outputs or user commands. In particular, presence and motion into different rooms is recorded by passive infrared sensors. Every system event is logged onto a suitable database. In Fig. 2.a, the overall amount of daily logged events is reported over a 6 months period, and shows that an average (black line) of some 120,000 events per day is logged in the winter period.

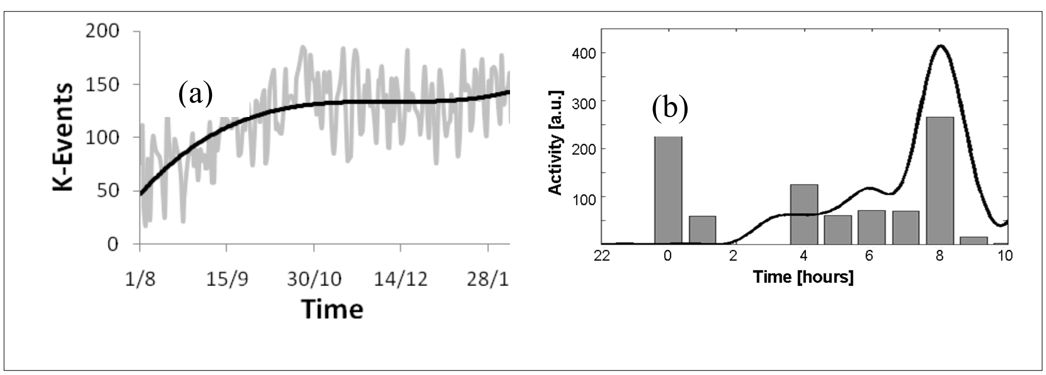


***Figure 2** activity logging*

Although single events may be not necessarily significant for monitoring purposes, a smart analysis of such a wide set of interrelated data could possibly provide an inference tool for evaluation of health and wellness condition of the residents. To this purpose, data accumulated so far will be used to train the system, by working out suitable average activity profiles. Such profiles will provide a reference against which current monitored response will be checked in the future. Should deviations from the average profiles exceed given thresholds, warning or alarm signals could be issued and delivered to caregivers or relatives. Tuning such thresholds is actually the most critical problem, which require careful consideration from technicians, family members and caregivers, to avoid false alarms and to make system outcome reliable. Up to now, accumulated data are being analyzed off-line, to investigate best strategies. To begin with, two kinds of comparisons can be carried out: larger deviations from the average behavior can be assumed to indicate a current health accident, which may require immediate caregiver attention. A simple example is shown in Fig. 2.b. The solid line in the plot shows the activity logged at a bathroom of a given flat in the facility between 10 pm and 10 am, averaged over a several-months period. The bars, instead, refer to the actual hourly activity, as recorded on a given night, and make it evident a significant deviation from customary pattern, which is likely to be ascribed to some unhealthiness and could be reported to caregiver. In this simple case, activity is inferred by the PIR sensors alone, but more information, such as light-switching, doors opening, water flow and toilet flushing, could be used for cross-checking. Programmable control processes can be exploited for implementing more articulated event recognition (e.g., someone unusually wandering by night, in a given zone, with lights turned off). Virtual, non invasive health sensors could instead be implemented by using the same data, looking for slower, long-term drifts, useful for monitoring progresses of a rehabilitation program or for measuring functional decline due to aging.

Cost Evaluation

As mentioned above, one among the basic advantages of the exploitation of mainstream technologies should consist of affordable costs; moreover, being fully scalable, the approach should be suitable even for private homes. With respect to alternative solution in the home automation market, basic elements supporting lower costs include:

- Sharing of the network infrastructure. Home data networking is becoming an almost standard feature, present in most homes (Scherf, 2006). Similarly to what's happening with telecommunications services (VOIP, video on demand), the same network can be used for delivering automation and monitoring services, avoiding additional cabling.
- Hierarchical cabling of peripheral devices, which is based on a star topology, centered at FEIM devices. Most of peripheral devices are fairly simple objects: direct connection to an home automation bus should require on-board network connectivity for each device. The cost of communication node may in most cases prevail on the intrinsic device cost. By connecting them to the programmable interface, no communication capabilities are required to the peripheral node, and networking burden and costs are shared among several devices
- Sharing the network also makes inexpensive data processing units readily available, which in turn allows for customization of services and functions at no additional cost.
- Native LAN and WAN connections inherently allows for a number of relevant features: remote control, monitoring and system configuration and maintenance come at no additional cost, as well as reliability policies based on redundant devices and software processes.

Apart from these general considerations, actual cost evaluation strictly depends on the specific implementation at hand: in the following some significant figures related to the pilot site implementation in Neviano are reported.

An overall cost in the order of 60 K€ was obtained, which can be roughly subdivided in 35 K€ for hardware devices and 25 K€ for labour. In this case, labour costs include cabling and related construction work. The Ethernet cabling is also included, as well as all networking gear and personal computers acting as local servers and supervisors. Design costs are not considered here. More than 600 peripheral devices have been installed. The facility counts approximately 30 rooms, which leads to an average figure of 20 devices/room and an overall cost of 2K€/room. 31 FEIM interfaces were deployed, which connect to slightly less than 20 peripheral devices on the average, with a 50% fraction of available channels used. This figure comes from a trade-off between minimization of hardware (i.e. FEIM) costs and cabling costs, and is heavily influenced by the "retrofit" approach that has been followed, due to the need of working on a pre-existing, inhabited building and to the its peculiar characteristics (thick, brick walls). Planning the same network at the construction (or renovation) stage, would have allowed a more intensive exploitation of FEIM resources: nevertheless, an all-inclusive figure of 100€ per networked device already grants a consistent cost advantage over off-the-shelf home-automation devices. Costs include full LAN deployment, and could be further lowered if Ethernet cabling, network switches and control devices (PC) were shared with or borrowed from the home data network: under these assumptions, additional costs for home automation and monitoring could be in the affordable order of some 3 or 4K € for a medium size flat.

Conclusions

In this paper, a novel design of an environmental control system is presented: special attention has been devoted to the system flexibility and expandability. An integrated HW/SW framework has been devised, based on mainstreaming ICT technologies, which delivers home automation and assisted-living tasks. The adoption of largely diffused technologies makes the solution much cheaper than conventional HA system, and provide some useful opportunities, ranging from remote control to detailed activity logging.
A test implementation has been completed and has been tested, up to now, for a year-long period. Further developments are expected in the near future, including several new sites implementation and more sophisticated assistive functions to be incorporated into the system.

References

Grossi, F. et al., (2008), An Assistive Home Automation and Monitoring System, Proc. ICCE 2008, Digest of Technical Papers, 8.1-4.

Grossi, F. et al., (2007), A Flexible Home Automation System Applied to Elderly Care, Proc. ICCE 2007, Digest of Technical Papers, 8.1-4.

Alwan M. et al., (2006) Impact of monitoring technology in assisted living: outcome pilot, IEEE Trans. On Information Technology in Biomedicine, Vol. 10, pp. 192-198

K. Scherf, (2006) Home Networks in Europe: Key Applications and Drivers, A Parks Associates White Paper

Virone G. et al., (2002) A system for automatic measurement of circadian activity deviations in telemedicine, IEEE Transactions on Biomedical Engineering, Vol. 49-12 pp. 1463-1469

Cole A.M. and Tran B.Q (2002), Home automation to promote independent living in elderly populations, IEEE Proc. Of the 2nd Joint EMBS/BMES Conference, Houston, Vol. 3, pp. 2422-2423

INCREMENTAL AND MEDICALLY ETHICAL DESIGN OF USABLE EHEALTH SUPPORT FOR DISEASE SELF-REGULATION

Olivier A. Blanson Henkemans
Charles A.P.G. van der Mast
Delft University of Technology
The Netherlands
O.A.BlansonHenkemans@tudelft.nl
C.A.P.G.vanderMast @tudelft.nl

Jasper Lindenberg
Mark A. Neerincx
Dutch Institute of Applied Science TNO
The Netherlands
Mark.Neerincx@tno.nl
Japser.Lindenberg@tno.nl

Bertie J.H.M. Zwetsloot-Schonk
Leiden University Medical Center
The Netherlands
J.H.M.Zwetsloot-Schonk@lumc.nl

Keywords: eHealth, personal computer assistants, disease self-regulation, medical ethics, incremental design

Abstract
The graying of the population leads to an increase in health care needs. Among others, chronically ill patients take up medical resources to maintain quality of life and health. The health care service has difficulties to meet these needs. By offering ICT support to the involved patients, medical and technical specialists, eHealth could mitigate this difficulty. However, the currently designed ICT in health care lags behind other sectors. Primary causes are the lack of user-centered design and the medical ethical sensitivity of designing eHealth technology. Our aim is to design eHealth technology tailored to the users' needs and in medically ethical manner. In the framework of the SuperAssist project, and following the eHealth concept, we are developing personal computer assistants for the supervision of disease self-regulation of patient with lifestyle related diseases, such as diabetes. The computer assistant monitors the patient and provides personalized feedback and moderates communication between the patient and involved specialists. To tailor our approach to the requirements of the complex medical domain, we are designing and evaluating assistance incrementally. We performed a domain analysis, created scenarios, conducted experiments in smart home environments and are currently studying eHealth technology in the field. Results of our studies show that, similar to earlier studies in the naval and space domain, an incremental design approach facilitates the medical ethical design of usable eHealth technology.

Introduction
John (aged 52), enjoys his full time occupation as an attorney. Combining his career with his social and family life leaves little room for maintaining a healthy lifestyle. Lately, he experiences some trouble with his health. He visits his physician, who sends him to the policlinic. Test results indicate that he suffers from diabetes type II. The physician strongly recommends him to perform more disease self-regulation activities, including maintaining a healthy diet, performing exercise regularly, using domestic medical instruments and taking medication. Key issues for John are combining self-regulation with his daily tasks while maintaining a good quality of life.

Like John, worldwide, numerous people suffer from lifestyle related diseases, such as obesity and diabetes type II. The health care service has difficulties to meet their care needs. By offering ICT support to the patients and involved medical and technical specialists, eHealth could mitigate this difficulty. eHealth has multiple benefits, such as lowering costs (Eysenbach, 2001), aging in place (Rogers & Mynatt, 2003), motivating the patient (Fogg, 2003), supporting the use of domestic medical instruments (Blanson Henkemans et al., 2006; Blanson Henkemans et al., 2008b), and assessing personal characteristics that influence specific care needs (Stucki et al, 2004).

Currently, ICT use in health care and social work lags behind other branches. Emerging evidence provides support for the beneficial effects of online interactive eHealth programs. However, many challenges remain with respect to research approaches to methodology, implementation, and evaluation (Ahern, 2007). A main issue is that the development of eHealth technology is medically ethically complex. On the one hand, we need to conduct empiric research in the field to validate the usability of eHealth technology. On the other hand, it is essential to keep in mind that the test subject's, i.e., the patient's, wellbeing is at stake (Coyle et al., 2006).

Given the right approach, context and implementation process, investment in eHealth will lead to improved care quality and productivity, which in turn liberates capacity and enables greater access in the healthcare sector (Stroetman et al., 2006). In the past, studies have shown that applying an incremental design approach is beneficial for addressing critical domain and user issues. Cognitive Engineering (CE) applies an incremental approach and facilitates design tailored to the specific needs of an application domain (Hollnagel & Woods, 1983; Rasmussen, 1986; Neerincx & Lindenberg, 2007). Considering the complexity of the health care domain, an incremental design approach may be usable for the design and evaluation of eHealth technology. Consequently, our research question reads, can an incremental approach facilitate design of usable and medically ethical eHealth technology?

In the following sections, we will give an overview of our incremental design of personal computer assistance of disease self-regulation. We will discuss our domain analysis and the design and evaluation of computer assistance in laboratory and field settings. Finally, we will discuss the implications of our findings.

1. The SuperAssist Project

Following the eHealth concept, the SuperAssist project is developing personal computer assistants for the support of disease self-regulation (see Fig. 1). The computer monitors the "patient" performing self-regulation activities in the home environment with the intention of preventing disease, limiting illness, and/or restoring health (Leventhal et al. 2005; Maes & Karoly, 2005). Examples of self-regulation activities are maintaining a healthy diet, performing physical activities, using domestic medical instruments. Based on the patient environment and patient medical record, the assistant provides personalized feedback on the self-regulation activities. In addition, the computer assistant mediates the communication between the patient and the medical specialists who (remotely) supervises the patient's health and between the patient and the technical specialist, who supervises the medical instruments' "health". Each specialist has their computer assistant that supports them with their tasks. The SuperAssist project's scientific partners are developing the models for personal computer assistance for disease self-regulation and business partners bring in their technology and contribute to the development and validation of SuperAssist elements. In the course of the project, there has been collaboration with international partners.

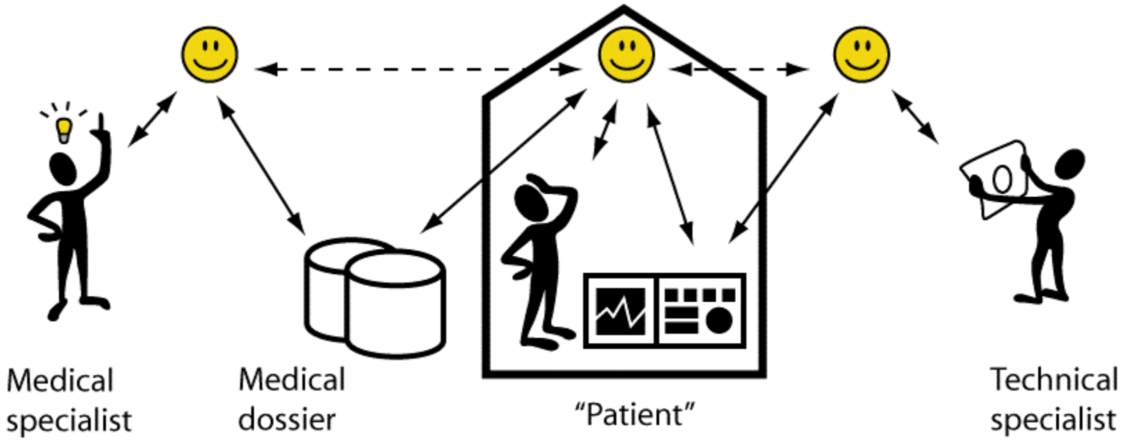


Figure 1 *Personal computer assistants supporting disease self-regulation. The assistants monitor the users, provide feedback on their activities, and mediate the communication.*

Cognitive Engineering

Developing usable personal computer assistants supporting disease self-regulation is medically ethically complex. Evaluating usability is optimal when performed in the actual application environment and with the users for whom using the technology is personally relevant. However, this produces two problems. First, it is difficult to conduct controlled testing in the actual application environment. Many factors, which are difficult to observe outside the controlled environment, can influence the interaction. Second, it is difficult to foresee the, possibly harmful, impact of new technology on the user. For example, in pharmaceutical medical research, drugs go through multiple test phases before the Medical Ethical Testing Commission gives approval for the population's use. Foregoing testing potentially leads to harm to the patient (World Medical Association, 2004).

To address the complexity of developing eHealth technology, we are applying a cognitive engineering (CE) approach. This method guides the incremental development process in which an artifact is specified in growing detail and specifications are assessed iteratively to refine the specification, to test it, and to adjust or extend it. It has proven useful for design of ICT support of different complex domains, such as on naval ships and space stations (Neerincx & Lindenberg, 2007). However, the medical domain has specific requirements.

First, we have to take into account the organizational structure of the medical domain. Second, we need to study the human factors of the different users involved, i.e., patients, medical specialists and technical specialists.

Finally, we have to address the medical ethics of evaluating eHealth technology with vulnerable participants. For the SuperAssist projects, applying the cognitive engineering approach implies incrementally designing and evaluating computer assistants for the support of disease self-regulation. Initially, we performed domain, task and scenario analyses and we interviewed prospective users and medical specialists. Then, we conducted usability studies in Smart Home Environments (Blanson Henkemans et al., 2007). Currently, we are conducting a randomized controlled trial to evaluate an online lifestyle diary with computer assistant.

Incremental Design

Domain Analyses and Scenarios

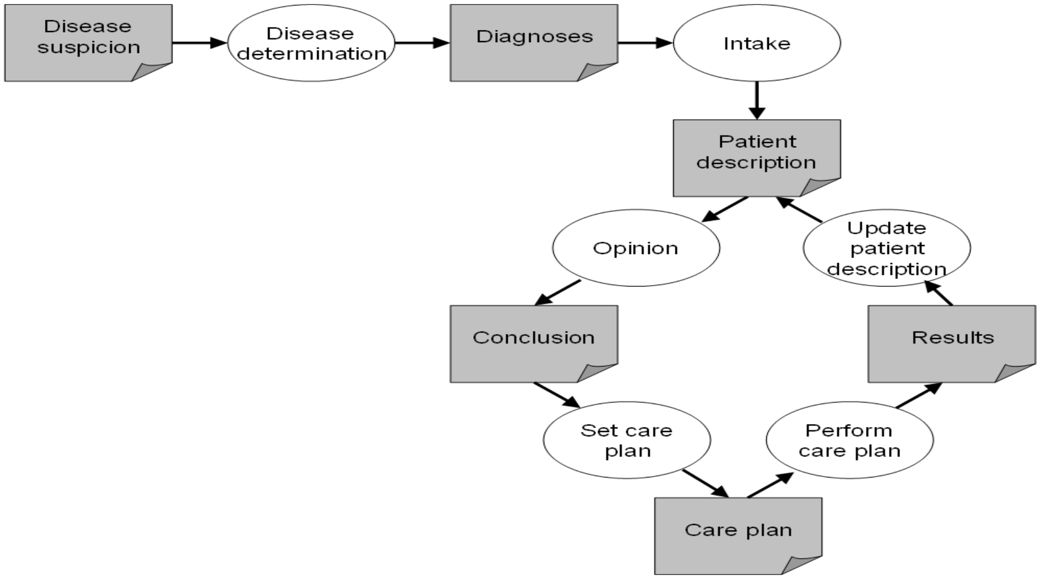
At the start of the project, we conducted an elaborate domain analyses. Amongst others, we performed web searches, literature reviews, document analyses, and interviews (see Table 1). During the domain analysis, we focused on current care processes, requirements of involved patients and medical specialists, and the use of ICT in the health care domain.

Activity	Goal	Domain
Web search	Find relevant projects and products	Dutch projects on patient self-regulation and ICT (e.g., thromboses, hemophilia, hart failure, diabetes, asthma)
Literature research	Find relevant publications	Papers, projects, research groups, journals, conferences
Document analyses	Assess domain requirements	Protocols, medical dossiers, regulations, statistics
Interviews and observations	Assess domain requirements	Medical specialists, patients, patient associations, industry, policlinics

***Table 1** Overview of domain analysis activities*

The project organizes biannual multidisciplinary workshops. During the workshops, the scientific partners present their research results and brainstorm about ongoing activities. The members have different backgrounds, e.g., medical specialists, psychologists, interaction designers, computer scientists, and telecommunication specialists. In addition, a commission, constituting of independent industrial and scientific representatives, guards the projects progression and the business relevance of the scientific results. During the domain analyses, we gained insights in the requirements of ICT and of the different users in the medical domain. First, we laid out the main organizational structure of the health care domain, and mapped out a care plan cycle. The cycle consists of a fixed order of steps, i.e., disease determination, intake, opinion, set care plan, perform care plan, and update patient description (Fig. 2). Then, we determined patient characteristics and their influence on self-regulation, including an overview of the patient's experiences, trade-offs between maintaining a healthy lifestyle and quality of life and personal aspects, such as self-efficacy, motivation, and social support. Finally, we drew out the current use of ICT and possible unknown benefits of ICT in the health care domain (Haan et al., 2005).

Based on the domain analysis, we developed scenarios. A scenario is a description that contains actors, background information on the actors and assumptions about their environment, actors' goals or objectives, and sequences of actions and events (Go & Carroll, 2004). Go and Carroll explain that Scenario-Based Design uses these scenarios as a general representation throughout the entire system lifecycle (analysis, design, and prototype & evaluation). It encourages user involvement, provides shared vocabulary among the system developers, envisions the uncertain future tasks of the system users, and enhances ease of developing instructional materials. Furthermore, it provides a good brainstorming tool for planning and allows the stakeholders to consider alternatives in decision-making



Smart Home Laboratories

After our domain analysis, we conducted various studies in smart home laboratories. It facilitates testing prototypes by offering a comfortable domestic atmosphere and encourages natural behavior in an experimental setting (Mynatt, & Rogers, 2002). We made use of the facilities at the Georgia Tech's Aware Home (www.awarehome.gatach.edu) and TNO/Delft University of Technology's (DUT) Experience Labs (http://www.usabilitytesting.nl).

During these studies, participants were asked to empathize with user scenarios, and interact with the computer assistant accordingly. Younger and older adults who did not have medical complication evaluated the influence of different computer assistant feedback styles on the interaction with the computer assistants while performing self-regulation activities. Although these participants did not have exactly the same characteristics as the prospective users, assessing the different user characteristics, such as cognitive abilities (Czaja et al., 2006) and personality traits, facilitated designing user-assistant interaction models applicable in last phase of the project wherein actual patients are recruited. The interaction was evaluated according the usability standards ISO 9241-11 (1998), which covers effectiveness, efficiency, and satisfaction.

Results of our studies showed that different users require different type of computer assistant feedback styles for usable interaction. In accordance, a computer assistant that was context-aware and adapted its feedback style to the user's health situation was most effective and time efficient. In addition, personal characteristics proved to have a moderating effect on how people evaluated the computer assistant support, similarly implying the importance of personalized interaction. Finally, applying the incremental design in smart home lab studies facilitated evaluating the usability of computer assistants and the benefits of eHealth technology (Blanson Henkemans et al., 2006a, Blanson Henkemans et al., 2006b, Blanson Henkemans et al., 2008a, Blanson Henkemans et al., 2008b).

Randomized Controlled Trial

The domain analysis and the results of the experiments conducted in smart home labs show that personalized computer assistance is usable for support of self-regulation. However, two main drawbacks remain. First, when testing with healthy participants, the subject group does not fully match the conditions of the actual target population. Second, conducting studies in labs creates a lack of knowledge of technology use over a longer period of time and complications that are created in real life settings.

Consequently, we are now conducting a randomized controlled trial with people who are overweight. With the input of the domain analysis and smart home lab studies, we have developed an online lifestyle diary with a personal computer assistant. Participants will use and evaluate the diary over a period of four months from their home setting. The study is under review by the Dutch Medical Ethical Testing Commission (METC). The commission guards human research subjects' rights, safety and welfare through ethical review, administrative review of proposal, and scientific peer review.

Discussion

In this article, we give an overview of our incremental design of personal computer assistance of disease self-regulation. Currently, there is little empirical research on eHealth technology. A main cause for this delay is that design and evaluation of ICT in the medical domain is that it's medically ethically complex. Empiric research in the field to validate the usability of eHealth technology is required. However, it is essential to keep in mind that the test subject's, i.e., the patient's, wellbeing is the primary objective..

Following the cognitive engineering approach in the context of the medical domain, we incrementally designed and evaluated computer assistants for the support of disease self-regulation. In addition, we study the influence user characteristics and computer assistant feedback styles, on the evaluation of the user-computer assistant interaction. We performed domain analyses, designed scenarios, and conducted usability studies in Smart Home Labs. Currently, we are conducting a randomized controlled trial on the influence of personal computer assistant, in the context of eHealth technology, which is reviewed by the Dutch Medical Ethical Testing Commission.

In conclusion, similar to earlier studies in the naval and space domain (Neerincx & Lindenberg, 2007), the cognitive engineering and an incremental design approach has proven successful for medical ethical design of usable eHealth technology. As a result of our approach, the results of our studies are representative and valuable for the different disciplines involved, i.e., the medical, scientific, and industrial domains.

Acknowledgment

The authors would like to thank the following for their involvement in the SuperAssist project: TNO, Delft University of Technology (DUT), and Leiden University Medical Center (LUMC), Philips Research, Benchmark, Science & Technology, the Human Factors and Aging Lab and the Aware Home Research Initiative at Georgia Institute of Technology, online lifestyle diary www.DieetInzicht.nl, and the department of Telecommunication Engineering at Politecnico di Milano. The SuperAssist project is partially funded by SenterNovem IOP-MMI, a program of the Dutch Ministry of Economic Affairs.

References

Ahern, D.K. (2007), Challenges and Opportunities of eHealth Research, American Journal of Preventive Medicine. No. 32, Vol. 5S, pp. S75-S82.

Blanson Henkemans, O.A., Rogers., W.A., Fisk, A.D., Neerincx, M.A., Lindenberg, J., & Mast, C.A.P.G. van der (2008a), Usability of an Adaptive Computer Assistant that Improves Self-Care and Health Literacy of Older Adults, Methods of Information in Medicine, Vol. 47, pp. 82-88.

Blanson Henkemans, O.A., Neerincx, M.A., Sawirjo, V.M., Mast, C.A.P.G. van der, and Lindenberg, J. (2008b), A Computer Assistant for Remote Collaborative Troubleshooting of Domestic Medical Instruments, 2nd International Conference on Pervasive Computing Technologies for Healthcare 2008, January 29 – February 1,Tampere, Finland.

Blanson Henkemans O.A., Caine K.E., Rogers W.A., Fisk, A.D., Neerincx M.A., Ruyter B. de. (2007), Medical Monitoring for Independent Living: User-Centered Smart Home Technologies for Older Adults, In: Jordanova M, Lievens F, (Eds), Proceedings of Med-e-Tel 2007, 2007 Apr 18-20, Luxemburg, Luxemburg.

Blanson Henkemans, O.A., Neerincx, M.A., Lindenberg, J., & Mast, C.A.P.G. van der (2006a), SuperAssist: Supervision of Patient Self-Care and Medical Adherence, In: Pikaar, R.N., Koningsveld, E.A.P., Settels, P.K.M., (Eds). Proceedings of IEA2006 Congress, July 2006, Maastricht: Elsevier.

Blanson Henkemans O.A., Neerincx M.A., Lindenberg J., Mast C.A.P.G van der. (2006b), SuperAssist: A User-Assistant Collaborative Environment for the Supervision of Medical Instrument Use at Home. 1st International Conference on Pervasive Computing Technologies for Healthcare, 2006 Nov 29-Dec 1, Innsbruck, Austria, 2006.

Coyle, C., Doherty, G., Matthews, M., & Sharry, J.(2006), Computer in talk-based mental health interventions. Interacting with Computers, Vol. 19, pp. 545–562.

Czaja, S. J., Charness, N., Fisk, A.D., Hertzog, C., Nair, S.N., Rogers, W.A., & Sharit, J. (2006), Factors Predicting the Use of Technology: Findings From the Center for Research and Education on Aging and Technology Enhancement (CREATE), Psychology and Aging, Vol. 21 No. 2, pp. 333–352.

Eysenbach, G. (2001), What is e-Health? Journal of Medical Internet Research, Vol. 3 No. 2, pp. e20.

Fogg, B.J. (2003), Persuasive Technology: Using Computers to Change What We Think and Do. San Francisco, CA: Morgan Kaufman Publishers.

Haan G. de, Blanson Henkemans O.A., & Ahluwalia A. (2005), Personal Assistants for Healthcare Treatment at Home. In: Marmaris N., Kontogiannis T. & Nathanael D. (Eds.), Proceedings of EACE'05, Chania, Crete, Greece, pp 217-223.

Go, K. & Carroll, J. (2004), 'The Blind Men and the Elephant: Views of Scenario-Based System Design', Interactions, Vol. 11, No. 6, pp. 44-53.

Hollnagel, E., & Woods, D.D. (1983), Cognitive Systems Engineering: New Wine in New Bottles. International Journal of Man-Machine Studies, Vol. 18, pp. 583-600.

Stroetmann, K.A., Jones, T. Dobrev, A. & Stroetmann, V.N. (2008), eHealth is Worth it: The Economic Benefits of Implemented eHealth Solutions at Ten European Sites, European Commission. Retrieved February, 2008, http://ec.europa.eu/information_society/activities/health/docs/publications/ehealthimpactsept2006.pdf.

Leventhal, H, Halm, E, Horowitz, C, Leventhal, E & Ozakinci, G. (2004), Living with Chronic Illness: A Contextualized Self-Regulation Approach. In: Sutton, S., Baum, A., & Johnston, M. (Eds.). The SAGE Handbook of Health Psychology, pp. 159-194.

Maes, S. & Karoly, P. (2005), Self-Regulation Assessment and Intervention in Physical Health and Illness: A Review, Applied Psychology: An International Review, Vol. 54 No. 2, pp. 267-299.

Mynatt, E. D., & Rogers, W. A. (2002), Developing Technology to Support the Functional Independence of Older Adults, Ageing International, Vol. 27, pp. 24-41.

Neerincx M.A. & Lindenberg J. (In press), Situated Cognitive Engineering for Complex Task Environments, Natural Decision Making & Macrocognition, In: Schraagen, J.M.C., Militello, L., Ormerod, T., & Lipshitz, R. (Eds), Natural Decision Making & Macrocognition. Aldershot, UK: Ashgate Publishing Limited.

Rasmussen, J. (1986), Information Processing and Human-machine Interaction: An Approach to Cognitive Engineering. Amsterdam, Elsevier.

Rogers, W. A., and Mynatt, E. D. (2003), How Can Technology Contribute to the Quality of Life of Older Adults? In M. E. Mitchell (Ed.), The Technology of Humanity: Can Technology Contribute to the Quality of Life? Chicago, IL: Illinois Institute of Technology, pp. 22-30.

Stucki, A., Daansen, P., Fuessl, M., Cieza, A., Huber, E., Atkinson, R., Kostanjsek, N., Stucki, G., & Ruof, J. (2004), ICF Core Sets for Obesity. Journal of Rehabilitation Medicine, Vol. 44, pp. 107-113.

World Medical Association (2004), World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects, Retrieved on February, 2008, from http://www.wma.net/e/policy/b3.htm.

THE DESIGN FOR ALL APPROACH IN THE ICT ENVIRONMENT AND THE EUROPEAN DESIGN FOR ALL E-ACCESSIBILITY NETWORK

Pier Luigi Emiliani
Consiglio Nazionale delle Ricerche
Istituto di Fisica Applicata (IFAC)
Sesto Fiorentino (FI), Italy
p.l.emiliani@ifac.cnr.it

Isabella Tiziana Steffan
Studio Steffan – Progettazione&Ricerca
Milano, Italy
info@studiosteffan.it

Keywords: Design for All, e-Accessibility, Ambient Intelligence, Information Society

Abstract

Society is undergoing an important evolution toward an information society. Access to information, interpersonal communication and control of the environment mediated by the intelligent network are considered important for inclusion of all citizens. They must be granted access to all facilities in the society (Universal Access). Universal Access must be pursued both by making everything (systems, services and applications) accessible, but also designing an environment that is supportive and facilitates all activities of the inhabitants. This in turn requires a conceptual framework and implementation approaches summarized in the "Design for All" locution, which is superseding the classical concept of adaptations of product for accessibility (Assistive Technology), even if the two approaches will have to coexist at least in the short/medium terms.

Toward an information society

Our society is undergoing a fundamental transition, from the present industrial society towards an information society. Almost all experts agree on the fact that the Information Society will "not be" the use of an increased number of computers and terminals, such as the ones we are accustomed to use today, or at least this will occur only in small professional activity niches or only for few general activities. Wearable computers, disappearing computers, mobile systems, ambient intelligence, and a variety of technical platforms are some of the expressions emerging from technical discussions. The emerging environment (Ambient Intelligence – AmI) is supposed to be populated by a multitude of hand-held and wearable "micro-devices" and computational power and interaction peripherals (e.g., embedded screens and speakers, ambient displays) will be distributed in the environment. The interaction with the objects and with the intelligence in the environment will allow access to information, interpersonal communication and environmental control. On the user side, it is starting to become clear that the variety of users will increase to the point of including practically all citizens, since the entire society is supposed to become an "intelligent environment", with a variety of contexts of use, ranging from public spaces to professional environments, from entertainment activities to living environments.

This new technological environment is mainly produced by the fusion of information technology, telecommunications and media industries. This fusion must not be viewed from the trivial technological perspective that telecommunications networks are now built using computer technology (a telephone exchange, for example, is really a specialized computer) and that computers are normally networked. What is really interesting is that computer intelligence is progressively being transformed into a distributed function. A computer is no longer conceived of as a stand-alone system working on its own data, but as an intelligent agent able to cooperate with other remote intelligent human or artificial agents (hardware and software) on distributed data. Communications is no longer considered as an additional functionality of computers, but as an integral part of their hardware and, in particular, software systems. Moreover, interconnected computers are starting to be embedded everywhere: in cars, hi-fi systems, kitchen equipment, clocks, shavers, etc.

This development is potentially very promising for users. According to European development scenarios (ISTAG – Ducatel, 2001), from a socio-economic perspective ambient intelligence is supposed:

- to facilitate human contacts;
- to be oriented towards community and cultural enhancement;
- to help build knowledge and skills for work, better quality of work, citizenship and consumer choice;
- to inspire trust and confidence;
- to be consistent with long-term sustainability - personal, societal and environmental - and with life-long learning;
- to be controllable by ordinary people.

Moreover, from a human-computer interaction perspective, interaction with the intelligent environment will have to be redefined. Namely, the ambient intelligence environment is supposed to be developed in order to be unobtrusive (i.e. many distributed devices are embedded in the environment, and do not intrude into our consciousness unless we need them), personalized (i.e. it can recognize the user, and its behavior can be tailored to the user's needs), adaptive (i.e. its behavior can change in response to a person's actions and environment), and anticipatory (i.e. it anticipates a person's desires and environment as much as possible without the need for mediation). Therefore, the emphasis is put on greater user-friendliness, more efficient support of services, user-empowerment, and support for human interaction. Interaction is intended as taking place through "natural" interfaces.

Universal access

The developments toward an Information Society are expected to alter human interaction, individual behavior and collective consciousness, as well as to have major economic and social effects (Danger et al., 1996). As with all major technological changes, this can have advantages, as the ones mentioned above, and disadvantages. New opportunities may be offered by the technological developments, due to the emergence of networked collaborative activities, and the increased possibility of network mediated interpersonal communications, if systems, services and applications are really developed according to the previous specifications. However, the complexity of control of equipment, services and applications, and the risk of information overload, may create new problems. Obviously, the above mentioned problems are particularly relevant for people with disabilities, who have been traditionally underserved by technological evolution. Disabled and elderly people currently make up about the 20% of the market in the European Union, and this proportion will grow with the ageing of the population to an estimated 25% by the year 2030 (Vanderheiden, 1990; Gill, 1996).

It is commonly accepted, also officially in political European documents (European Council, 2000), that the Information Society will have to be universally accessible to all citizens. These include people who have functional, sensorial or cognitive limitations due to disabilities or age. Not only there is a moral and legal obligation to include this part of the population in the emerging Information Society, but there is also a growing awareness in the industry that disabled and elderly people can no longer be considered as insignificant in market terms. Instead, they represent a growing market to which new products can be provided. However, due to the foreseen increase of citizens who will need to interact with the emerging technological environment, accessibility can no longer be considered as a specific problem of people with impairments, but of the society at large, if suitable actions are not undertaken.

It is important here to introduce some definitions of terms and crucial concepts. Universal Access and Universal Accessibility are defined as the right of all citizens to be granted availability of all information and communication facilities and control of the environment in the Information Society, i.e. eInclusion. This can be partially obtained by making them accessible to all citizens. Therefore, access and accessibility are used as an approach toward eInclusion. However, this is not enough. For example, when people are supported by ICT functionalities for independent living at home, particularly if they are cognitively impaired, this requires more than accessibility. The environment must be able to support them with specific functionalities. Universal Access implies not only the accessibility and usability of information and telecommunications technologies by anyone at any place and at any time and but also the support and inclusion in any living context of all citizens. It aims to enable equitable access and active participation of potentially all people in existing and emerging computer-mediated human activities, by developing universally accessible and usable products and services and suitable support functionalities in the environment. Therefore, the approach aiming to grant the use of equipment or services is generalized, seeking to give access to the Information Society as such.

As a conclusion, accessibility to systems, services and applications is not enough, but the concept of Universal Access must be introduced. Correspondingly, adaptations, which have been the traditional approach to favor accessibility, are not any more a real option for satisfying the eInclusion requirements. Design for All must be considered as the main option. Design for All has been mainly introduced in human computer interaction on the basis of serving a variety of users, which means addressing diversity of users. The line of reasoning is that since users are different and they have different accessibility and usability requirements, it is necessary to take all of them into account in a user-centered design procedure. But, the emerging environment is much more complex and diversity must be considered from other perspectives. First of all the interaction is not any more with computers and terminals, but with the environment and objects in it. Therefore, it will be necessary to consider a variety of interaction paradigms, metaphors, media and modalities. Then, users/citizens will not have to cope with tasks determined by the used application, but with goals to reach in everyday life, which will be different in different environments and for different users. Additionally, goals may be complex not only due to the foreseen merging of functions connected to access to information, interpersonal communication, and environmental control, but also because they may involve communities of users. Finally the same goal must be reached in many different contexts of use. This gives an idea of the complexity of the involved problems, the limitation of the classical adaptation concepts, and the need for innovative approaches.

The origins of the concept of Universal Access in ICT are to be identified in approaches to accessibility mainly targeted towards providing access to computer-based applications by users with disabilities. Today, Universal Access encompasses a number of complementary approaches, which address different level of activities leading to the implementation of designed for all artifacts. The approach is also in line with the one at the basis of the preparation of the new WHO "International Classification of Functioning, Disability and Health (ICF)"[25], where a balance is sought between a purely medical and a purely social approach to the identifications of problems and opportunities for people in their social inclusion. When dealing with the problems of people who experience some degree of activity limitation or participation restrictions, "ICF uses the term *disability* to denote a multidimensional phenomenon resulting from the interaction between people and their physical and social environment". This is very important, because it allows grouping and analysis of limitations that are not only due to impairments. For example, people are not able to see because they are blind, or have fixation problems due to spastic cerebral palsy, or are in a place with insufficient illumination, or are driving and therefore cannot use their eyes for interacting with an information system. People may have impairments, activity limitations or participation restrictions that characterize their ability (capacity) to execute a task or an action (activity), but their performance is influenced by the current environment. The latter can increase the performance level over the capacity level (and therefore is considered a facilitator) or can reduce the performance below the capacity level (thus being considered as a barrier).

Here the emphasis on the fact that all people, irrespective of their capacity of executing activities, may perform differently according to the different contexts and that the environment must be designed to facilitate their performances.

Design for all

In the same Commission document already cited in the previous section (European Council, 2000), explicit reference is made to the need of developing the new society (in terms of technology as well as services and applications) using a Design for All approach. Within the context of Universal Access, Design for All has a broad and multidisciplinary connotation, and refers to the design of interactive products, services and applications that are suitable for most of their potential users without the need for any modification (Stephanidis ed., 2001; Emiliani & Stephanidis, 2005).

There are many definitions of Design for All (or Universal Design, according to the USA locution). As a first definition let us consider the one that is available in the web site of the Trace Center, a research organization devoted to make technologies accessible and usable:

[25] http://www3.who.int/icf/icftemplate.cfm

"The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design[26]". At the industrial level, Fujitsu has recently published an entire number of their journal completely devoted to Universal Design, defined as: "designing products, services, and environments so that as many people as possible can use them regardless of their age and physical characteristics (e.g., height, visual and hearing abilities, and arm mobility)". Finally, in a research organization, Design for All in the Information Society has been defined (Stephanidis et al., 1998) as the conscious and systematic effort to proactively apply principles, methods and tools, in order to develop Information Technology and Telecommunications (IT&T) products and services which are accessible and usable by all citizens, thus avoiding the need for a posteriori adaptations, or specialized design.

Figure 1 synthesizes the components of a proactive (Design for All) approach. It emphasizes the fact that it is not only necessary to have a user centered procedure for channeling user needs, requirements and preferences as part of the design, thus specifying products in principle usable by all users. It is also necessary to develop implementation approaches able to really addressing diversity (e.g. a technical approach based on adaptability and adaptivity). An optional Assistive Technology component is considered to emphasize the need of a transition from the present situation to the point when the Design for All approach will be completely deployed.

Even if, there is, apparently, a convergence on the conceptual definition of Design for All, there is not enough interest and sometimes skepticism about it among people working in the social inclusion of people with disabilities, where the related concepts were firstly explored in ICT. This is essentially due to the fact that borrowing the general definition from architecture and industrial design, one is lead to think that the same implementation approach to the application of the principle can be used, i.e. that Design for All in ICT can be obtained designing an artifact (e.g. a human computer interface) usable by all users. Therefore, there is an argument which raises the concern that ''many ideas that are supposed to be good for everybody aren't good for anybody'' (Lewis and Riemann, 1993). However, Design for All in the context of information technologies should not be conceived of as an effort to advance a single solution for everybody, but as a user-centered approach to providing products that can automatically address the possible range of human abilities, skills, requirements, and preferences. Consequently, the outcome of the design process is not intended to be a singular design, but a design space populated with appropriate alternatives, together with the rationale underlying each alternative, that is, the specific user and usage context characteristics for which each alternative has been designed.

[26] See http://trace.wisc.edu/world/gen_ud.html, last visited on 30 June 2008

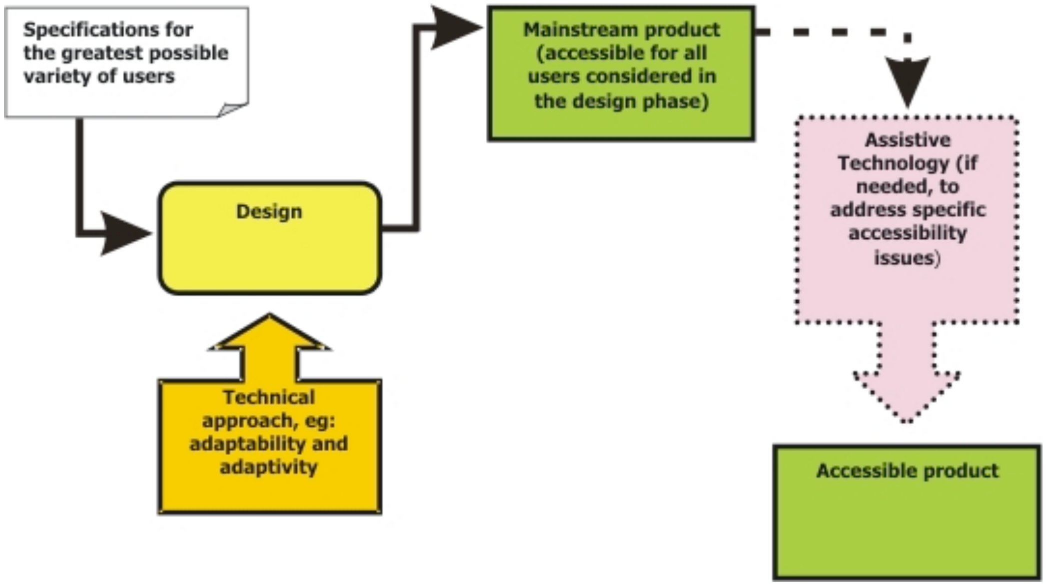


Figure 1 *The Design for All approach*

The above definitions are conceptually based on the same principle, i.e. the recognition

If this is the case, then it is argued that this is clearly impossible or too difficult for being of practical interest. This is due to the fact that, even if it is true that existing knowledge may be considered sufficient to address the accessibility of physical spaces, this is not the case with information technologies, where Universal Design is still posing a major challenge. However, important advances are being made in the development of concepts and technologies that are considered necessary for producing viable Design for All approaches. Examples of implementation of the Design for All approach with present technologies in terms of systems and services adaptable to different abilities and adaptive in real time to the varying needs of people in changing contexts of use have been described in literature (Stephanidis & Emiliani, 1999). Another common argument is that Design for All is too costly (in the short term) for the benefits it offers. Though the field lacks substantial data and comparative assessments as to the costs of designing for the broadest possible population, it has been argued (National Council on Disability, 2006) that (in the medium to long term) the cost of inaccessible systems is comparatively much higher and is likely to increase even more, given the current statistics classifying the demand for accessible products.

The EDeAN Network

In order to responds to the Action Line goal of the eAccessibility initiative of the eEurope 2002 Action Plan, namely: "To ensure the establishment and networking of national centers of excellence in design-for-all and create recommendations for a European curriculum for designers and engineers", the "European Design for All e-Accessibility Network", abbreviated EDeAN and pronounced "Ee-deen", has been established in 2003. The Network was created by the EU and member states through the High Level Group for the Employment and Social Dimension of the Information Society (ESDIS). Members of the Network were added through a call for Expression of Interest and National Contact Centers (NCCs) were also nominated and selected. Therefore, EDeAN is a network of centers of excellence selected based on common application criteria and selection procedures throughout Europe.

EDeAN has been created to help achieve the eEurope objectives and to stimulate activities in Europe within the area of Design for All, with particular focus on ICT and e-Accessibility. The Network is also supposed to collaborate and liaise with various relevant national, regional, European and international networks, organizations and projects. It has the sort time objective of contributing to recommendations for the development of European Design for All curricula for designers and engineers as required by the eEurope Action Plan, while in the long term it is supposed to:

- Contribute to and support the achievements of the eEurope objectives.
- Support the design, implementation and evaluation of European Design for All curricula for designers, engineers and other relevant groups.
- Encourage and support the exchange of academics, experts and/or students within the area of Design for All and e-Accessibility.
- Promote and expand awareness of Design for All and e-Accessibility in both public and private sectors, particularly in relation to digital developments within ICT.
- Provide the means and infrastructure for disseminating and exchanging information on Design for All to all interested parties.
- Advise all interested parties with regard to procurement best practices in relation to Design for All and e-Accessibility.
- Cooperate with relevant national, regional, European and international networks, organizations and projects.
- Liaise, inform and support all members of the Network.

EDeAN is composed of NCCs (National Contact Centers), members and observers. Members are organized in national networks, and observers are organized in mailing lists. NCCs form the EDeAN Steering Committee. Besides the European network, each country is supposed to seek to create and maintain a national network.

While the NCCs are the primary contact for the network within their respective countries at a national level, the Secretariat coordinates the Network contacts at the European level. The EDeAN Secretariat has been created in order to help stimulate, promote, coordinate and provide a common source of information for the European network. Responsibility for hosting the EDeAN Secretariat will rotate among NCCs. The NCCs to have responsibility for the EDeAN Secretariat have been: Danish Centre in Denmark (2002-2003), IRV in the Netherlands (2004), ICS-FORTH in Greece (2005), Stakes in Finland (2006) and CNR in Italy (2007). In 2008 the secretariat is with CEAPAT in Spain.

Conclusions

Design for all is presently considered the suitable approach for granting to citizens inclusion in the Information Society. "Design for All" concepts have been developed in architecture and industrial design. They need adaptations when applied in the ICT environment, particularly at the implementation level. These changes are discussed in the paper. Finally a network set up in Europe to favour the discussion and diffusion of DfA concepts is briefly described

References

Danger, S., Huizing, N., Walker, A., Rowland, A., Anderson, R., Sciaccaluga, R., (1996), "EU Information Society Guide", Brussels, Belgium, The EU Committee on the American Chamber of Commerce in Belgium.

Ducatel, K.; Bogdanowicz, M.; Scapolo, F.; Leijten, J. & Burgelman, J. C., 2001, Scenarios for ambient intelligence in 2010, Technical report, Information Society Technologies Programme of the European Union Commission (IST), ftp://ftp.cordis.europa.eu/pub/ist/docs/istagscenarios2010.pdf

Emiliani, P. L. & Stephanidis, C. (2005), "Universal access to ambient intelligence environments: opportunities and challenges for people with disabilities", *IBM Systems Journal* 44(3), 605--619.

European Council, (2000). Lisbon Extraordinary European Council, 23-24 March 2000 - Retrieved February 24, 2005 from http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/00100-r1.en0.htm

Gill, J. (1996), "Telecommunications: the Missing Links for People with Disabilities", COST 219, European Commission, Directorate General XIII, Telecommunications, Information Market and Exploration of Research.

Lewis C. and Rieman J. (1993), ''Task-Centred User InterfaceDesign: A Practical Introduction,'' http://hcibib.org/tcuid/

Stephanidis, C., and Emiliani, P. L., (1999), ''Connecting to the Information Society: A European Perspective'', *Technology and Disability Journal*, 10, No. 1, 21–44.

C. Stephanidis (ed.), "User Interfaces for All – Concepts, Methods and Tools", Mahwah, NJ: Lawrence Erlbaum Associates, 2001.

C. Stephanidis et al."Toward an Information Society for All: An International R&D Agenda", International Journal of Human-Computer Interaction, 10 (2), 1998, 107-134.

Streitz, N.; Magerkurth, C.; Prante, T. & Rocker, C. (2005), "From information design to experience design: smart artefacts and the disappearing computer", *Interactions* 12(4), 21-25.

Vanderheiden, G.C. (1990), ''Thirty-Something (Million): Should They Be Exceptions?'', *Human Factors* 32, No. 4, 383–396.

ACCESSIBLE DISTANCE MEASUREMENT USING THE GT METRIC GRAPH

Jin-Kook Lee, Charles M. Eastman, Jaemin Lee, Yeon-suk Jeong, Matti Kannala*
Design Computing, College of Architecture, Georgia Institute of Technology
*Solibri Inc.
jklee@gatech.edu, chuck.eastman@arch.gatech.edu, jaemin@gatech.edu,
yeon-suk.jeong@gatech.edu, matti.kannala@solibri.com

Keywords: Distance, Metric graph, Accessibility, Clear width, Circulation, BIM

Abstract
This paper describes a tool for measuring accessibility distances within and through building spaces. When we assess a certain building design, we should evaluate the ease of access from one point to another. Metric distance is important because it is one of the determinants of ease of use, along with space width, stairs and complexity of route. If we can measure the distance as well as check some aspects of the accessibility of a certain circulation path, we can call it an accessible distance measurement. We developed a computational method of accessible distance measurement based on a length-weighted graph structure using a given building information model (BIM). It is called the GT Metric Graph and has been implemented as plug-in software of Solibri Model Checker (SMC). It checks all paths in a building from a start to a target location. This paper focuses not only on its implementation but also on other intrinsic aspects that need to be considered in terms of accessible route. It addresses accessibility and metric distances based on consideration of ADAAG using an example test model.

Introduction
We introduce a method to measure metric distances within building spaces. Metric distance is one of the fundamental determinants of ease of use in terms of accessible building design. Our focus is on two particular aspects of design: metric distance and accessibility. We call this the accessible distance measurement, and we provide a computational method for it using the GT Metric Graph (Georgia Tech Metric Graph) structure for a given building information model. Even though distance is one of the basic required factors when we deal with accessibility, (Church, 2003) it is not easy to determine an effective measurement method. The purpose of the GT metric graph is to measure the distance within spaces by precisely calculated scalar quantity. It supports measuring distances by consistent computational methods, and it could be one of the major determinants for checking compliance with the requirements for accessibility in a specific interior space.
There were previous efforts for developing the method of compliance checking for the rules defined in the Americans Disabilities Act Accessibility Guidelines, (ADAAG) (Han et al, 2002) but the metric distance-related issues have not been commonly tackled by researchers, especially interior accessible routes within buildings. We provide a computational method for measuring accessible distances, with particular interest in considering clear widths for wheelchair accessibility.

GT Metric Graph

Basics for the Circulation Graph

We developed the GT Metric Graph following the question "how can we define people's circulation paths parametrically?", using a method for defining "good circulation paths." Our focus is on the building object's geometry and spatial connections, rather than the observation of free circulation of individuals. We have established specific factors for development reflecting human behavioral aspects of building circulation.

1) Building model-oriented circulation: The GT metric graph is a building model-oriented circulation model rather than an agent-oriented model. It represents the designer's expected circulation paths based on the loaded BIM model in the design review process. It is determined only by a given building model and its spatial adjacency, therefore it is particularly applicable to review in early design phases before construction.

2) Most efficient circulation: It is believed that people tend to walk along the shortest, easiest, and most visible paths. This is one of the key concepts for implementation. We assume that it might reflect the most frequently shown movement pattern of people.

BIM-enabled Circulation Graph

The GT Metric Graph is a computationally generated graph structure for a given building information model for visualizing circulation paths within spaces, and it simultaneously provides a metric distance measurement method. A building model can support multiple views of the data contained within a drawing set in 2D and 3D, and it can be described by its building objects or its attributes rather than mere building geometry. (Eastman et al, 2008 L Chapter 2) As a BIM-enabled application, the GT Metric Graph can be generated on top of the BIM model based on space objects and doors, vertical access objects such as ramps and elevators, as a spatial connection method. The conventional distance measurement method within spaces is a center line based measurement, but it has large tolerance value compared to the real human movement paths. Kannala's method for fire egress distance measurement also has the same problem, but it provides a precise computational method with consistency. (Kannala, 2005) In real-world buildings, there are many difficulties to determine the correct center of certain spaces, such as those with free standing columns, and human circulation paths do not follow a single route but take the form of a series of stochastic patterns. Thus we need a consistent method to determine metric distance within buildings in precise measurement, and the GT Metric Graph provides a solution.

Data Structure of Given Building Model

In this paper we assume that all the required information for the given building model will be provided by IFC[27] data. For graph generation, we need a specific view of the IFC model. We limit the scope of the graph derivation from the building objects to facilitating IFC data. Here we briefly list the key entities of IFC view for the GT metric graph.

1) IfcSpace and its geometry

[27] IFC: Industry Foundation Classes is an open and neutral specification for facilitating interoperability within building information modeling enabled applications. It has been developed and managed by IAI, (International Alliance for Interoperability) and most major BIM tools support the generation of IFC formatted building models. In this paper, the test model is generated by Autodesk Revit, and exports IFC data to Solibri Model Checker for graph generation.

2) IfcDoor and its geometry
3) IfcRelSpaceBoundary for acquiring spatial topology information
4) Vertical access objects: IfcStair, IfcRamp, etc.
5) Predefined agreement on the naming of objects, to distinguish circulation space, private versus public space, etc.
There are some building objects that are considered as obstacles for circulation such as walls or columns, but space objects are already defined by those kinds of physical objects' geometry data. Therefore we focus on space objects and their topological connectivity through doors.

Main Graph Elements
Below is a brief description of some key elements for comprehending how the GT Metric Graph is actualized on a given building model.
1) Buffer distance: Buffer distance is the minimum required distance between a wall and the top-center point of an agent. The default distance is half the length of a general person's shoulder width. Taking into consideration various agents (e.g. single wheelchair access or turning, two wheelchair passing, woman with a child, crowd, etc.) this buffer distance can be adjustable. If there is a space polygon, a buffer polygon could be generated by shrinking the space polygon using a given buffer distance.
2) Concave points: If there is an L-shape corridor, we can find 1 concave point and 5 convex points along the space boundary polygon. These are important vertex sets for the GT Metric Graph, especially concave points. Concave points are intermediate "coupling" vertices between two different door points.
3) Door points: These are two buffer-distanced points from the center of a door and perpendicular to its frame, in opposite directions. It is the most reasonable path to pass through a door. Door points are always a binary set for a door, and they make spatial connections.
4) Edges representing the circulation path: Based on the vertex set described above, graph edges are generated. Concave and door points are located on a buffer polygon of a single space object, and door points in the buffer polygon should be connected when they are simply visible to each other. When they are visually obstructed, this means that one or more concave points are generated, and the closest concave points will be the intermediate vertices between two doors in a space. In this way, space objects have their metric graph edges if a space has two or more doors, and it is naturally regarded as a circulation space.
5) Shortest path: Among the edges, and referring to the series of topological space sets, the shortest paths are chosen through the shortest path finding algorithm for representing a route path between two spaces.
Figure 1 compares the graph-based circulation representation methods between two spaces. The first one represents a topological connection between two spaces, the second one is the general center-line based graph, and the third one is the GT Metric Graph based representation. The topological graph is not suitable for calculating metric distances and for considering building objects' parametric conditions, but broadly used for representing spatial connectivity. The GT Metric Graph shows a measurable metric distance graph edges with more human-like walking trace than previous ones.

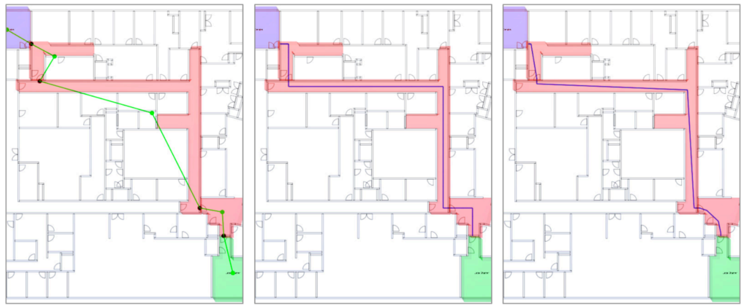


Figure 1 *Three graph-based circulation representation type examples. The third one is the GT Metric Graph.*

Graph-based Analysis for Accessible Routes

The definition of Accessible Route in ADAAG is "a continuous unobstructed path connecting all accessible elements and spaces of a building or facility. Interior accessible routes may include corridors, floors, ramps, elevators, lifts, and clear floor space at fixtures." (ADAAG, 2002) We note that the interior accessibility focuses on building objects such as corridors, floors, and clear floor space at fixtures. They are all space objects defined by bounding physical walls and structural columns. In other words, based on the BIM-enabled feature of the GT Metric Graph, space objects in a building could be easily gained as well as their spatial connectivity. First we use buffered boundary polygons from the space objects' boundary polygons.

Buffered Space Boundary and Clear Width

ADAAG defines the clear width for wheelchair access in an interior environment. Figure 2 shows some rules for the clear width of wheelchair access. It regulates the minimum width of circulation spaces such as corridors, and those rules can be implemented using the GT metric graph structure based on the buffered space boundary polygon approach.

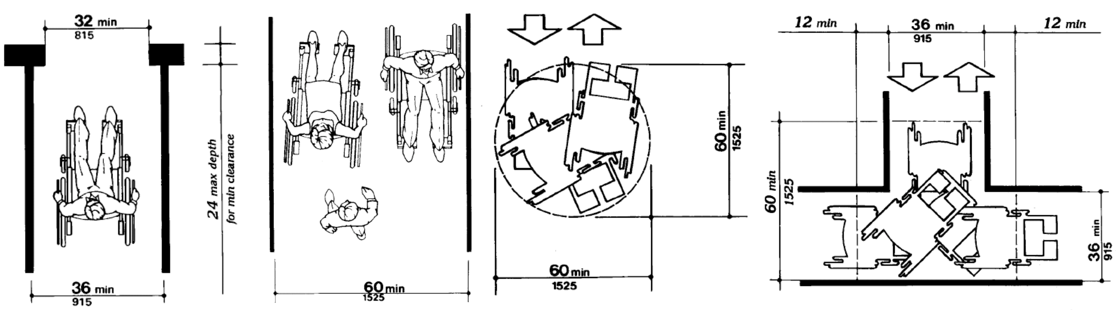


Figure 2 *Clear width definition for wheelchair access: 1) single wheelchair, 2) two wheelchairs passing, 3) turning, and 4) T-shape space turning (ADAAG, 2002). They are minimum 36, 60, 60, and 36 inches each.*

(Han, 2002) used the wheelchair geometry-based approach to accessible routes using motion planner. The motion planner aims at finding comfortable width along a route using the actual wheelchair's geometry. As opposed to this agent-oriented approach, our method is the building object-oriented approach to clear width checking. Figure 3 shows an example test model which has 21 space objects and 25 door objects. The image on the right indicates the space boundary polygons directly derived from its space object geometry. It is a test purpose model, and it has been tested in SMC using IFC format for representing the GT metric graph using different buffer distances. Our focus will be limited to demonstrating how buffered space boundary polygons determine clear width, and how metric distances are computed by the graph structure. Thus, we apply only two clear widths using buffer distances: 36 inches for single wheelchair access using an 18 inch buffer distance, and 60 inches for two wheelchairs passing using a 30 inch buffer distance.

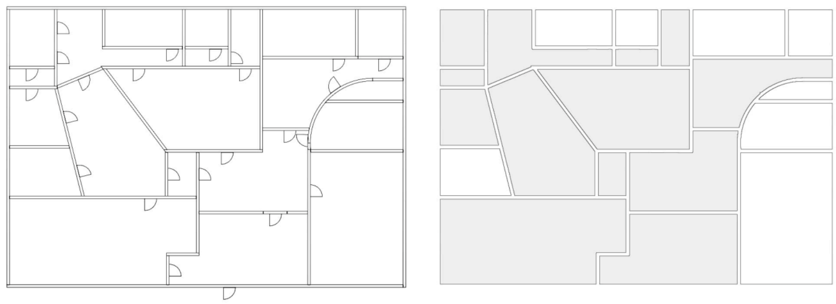


***Figure 3** An example floor plan and its space boundary polygons from the space object definitions. We assume that the spaces which have 2 or more doors are circulation space (gray colored).*

Figure 4 displays two different buffered space boundary polygons: applying 18 and 30 inches for checking two clear widths 36 and 60 followed by the rules shown in Figure 2. The graph operator implemented in SMC shrinks space boundary polygons, and computes relevant vertices to the metric graph generation: door points in blue color and concave points in red color. In this test, we found two result sets as follows:
1) 18 inch buffer test returns 53 door points and 27 concave points.
2) 30 inch buffer test returns 37 door points and 22 concave points.

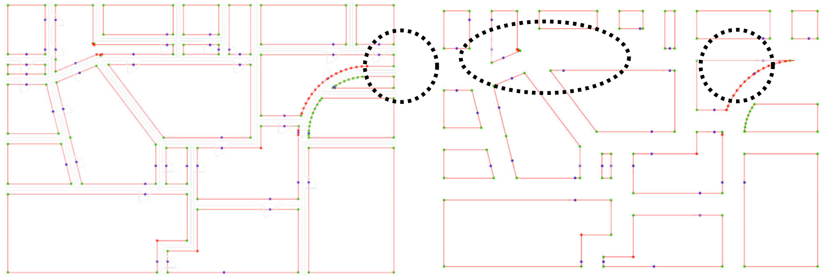


***Figure 4** Buffered space boundary polygons: 18inch buffer and 30inch buffer.*

This test model shows that it has compliances with single wheelchair access clear width. However, as shown in the right image of Figure 4, 16 door points and 5 concave points are missing when the 30 inch buffer is applied to the same model. As shown in the dotted circles, 3 buffered space boundary polygons are missing, and a narrow corridor disappears, thus those spaces may lose spatial connectivity in terms of the metric graph using 60 inch clear width for two wheelchair passing. This indicates that this test model has some problematic spaces in terms of two wheelchairs passing clear width.

Metric Graph on the Accessible Routes

Now the GT Metric Graph can be generated on the buffered space boundary polygons, using the door points and concave points. Figure 5 shows two computationally generated metric graphs for single wheelchair access and two wheelchair passing routes. The total generated edges are 107 and 88 each. Some edges are missing due to missing buffered space boundary polygons as shown in the dotted circles. Especially in the red dotted circle of Figure 5, it shows a missing corridor which is not satisfied with 60 inch clear width, and the two upper spaces lose spatial connectivity for two wheelchair passing. Any instance of circulation route is a subset of this metric graph, and as shown in Figure 5, route graphs will be different as a result of the difference of two buffer distances.

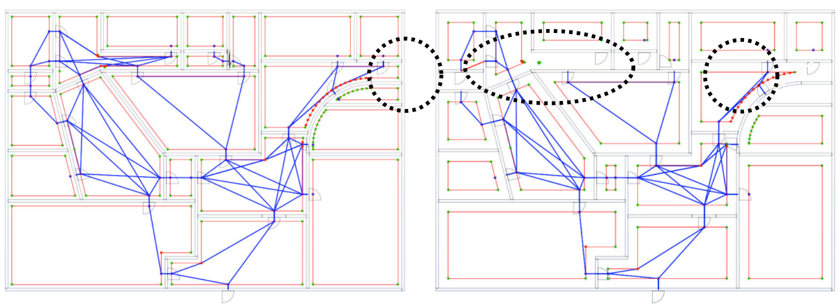


Figure 5 *GT Metric graph on the example plan. Some obstructed wheelchair passing routes found.*

Determining Accessible Route and Distance Measurement

Accessible distance is determined by the sum of gross length of the GT metric graph's edges of a route between two spaces. The route is accessible when the condition is satisfied that there are no obstacles which cut the graph edges between two spaces. If a route between two spaces has missing edges due to missing buffered space boundary polygons as shown in Figure 5 example, it is not an accessible route. The GT Metric Graph structure simply returns the result that a given route is accessible or not based on the clear width condition controlled by buffer distances. Accessible route could be determined as follows based upon the metric graph set, given two spaces, and a given buffer distance. An example of metric graph set is shown in Figure 5.

- Input: two spaces in a given building, buffer distance value, and metric graph set.
- Condition: the shortest metric graph route between given two spaces has contiguous edges.
- Output: True or False whether given parameters satisfy the condition or not.

The contiguity of metric graph edges is determined based on the spatial topology information and door points' binary elements containing spatial connectivity. No door points can be connected to each other if they are located on the network of adjacent space objects. Missing buffered space boundary polygons also omit some door points and concave points, thus an accessible route can be determined only in the buffer and vertex gathering phase of the graph generation process.

In case the route between two spaces is accessible, the metric distance of the route can be computed by the GT Metric Graph structure. As shown in Figure 6 examples, the metric graph edges between two spaces are retrieved from the metric graph set, and they are length-weighted graph edges. Thus the gross length of edges simply returns the accessible distance between two given spaces. Figure 6 illustrates two accessible route examples in the test model. The GT Metric Graph simply calculates the distance 66' 6" and 63' 7" each, in a single wheelchair access clear width condition.

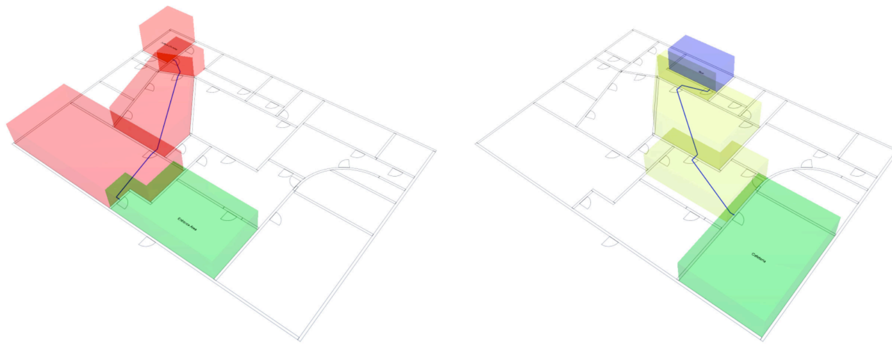


***Figure 6** Accessible distance measurement examples on the test model plan*

In these simple test examples are just part of accessible routes in the model, and total number of counts of non-repeated and shortest accessible routes are calculated by the equation for combinations without repetitions. In the test model example, when the buffer distance is applied 30 inch, total number of route is 210, and non-accessible routes are 74, followed by the GT Metric Graph calculation. Therefore 136 accessible routes could be found in the test model for two wheelchairs passing clear width. Examples in Figure 6 are two of them. If a building model has 1,000 space objects, considered as a general mid-sized office building, total metric routes between any of two spaces are 499,500. If we simply subtract the number of non-accessible routes from the total routes, it is the number of accessible routes of the building. The GT Metric Graph conveniently visualizes those circulation routes and their accessible distances using different buffer values in automation. In this way, it supports to compute accessible distances, followed by the fact that route condition is satisfied with clear width regulations using given buffer distance values.

Summary and Discussion

We proposed that a new BIM-enabled graph application for checking accessible routes within buildings. It also provides an accessible distance measurement method and a circulation visualization method considering various agents' situation based on the buffer values. Recently the term accessibility has become widely accepted in the broad area of design such that the design is accessible to all individuals, whether disabled or not. There is a set of issues within general accessibility described in the concept of universal design, but in this paper we captured and focused distance-related issues for accessibility and described a technological tool for checking accessible routes and computing their metric distances. It supports clear width checking while it is generated based on the buffered space boundary polygons, and continuous unobstructed paths are found within all space objects in a given BIM model. We have given an example test for demonstrating accessible route checking and distance measurement as well as the GT Metric Graph visualization on the model. We hope our approach to the accessible environment leads to further research and technological development in the future.

Acknowledgements
This paper is based upon an ongoing research project supported by the contract from the United States General Services Administration, Office of Chief Architect. The GT Metric Graph is developed for the *GSA BIM Enabled Design Guide Automation Project* led by Professor Eastman at Georgia Tech. The GT Metric Graph is embedded in a wider set of tools being developed for use in automated design reviews for the GSA.

References

Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston. 2008, BIM Handbook – A guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors. John Wiley & Sons Inc. ISBN: 978-0-470-18528-5.

U.S. Access Board. 2006, Justice for All: Designing Accessible Courthouses.

Matti Kannala. 2005, Escape Route Analysis Based on Building Information Models: Design and Implementation, M.S. thesis of Department of Computer Science and Engineering, Helsinki University of Technology.

Ghang Lee, R.S., Charles M. Eastman. 2005, Specifying parametric building object behavior (BOB) for a building information modeling system. Automation in Construction

Alasdair Turner, Alan Penn, Bill Hillier. 2005, An algorithm definition of the axial map, Environment and Planning B vol. 32, pp 425-444.

Department of Citywide Administrative Services. 2004, Building Code of the City of New York.

Richard L. Church, James R. Marston. 2003, Measuring Accessibility for People with a Disability, Geographical Analysis Volume 35, Number 1, January 2003.

Han, Kincho H. Law, Jean-Claude latombe, John C. Kunz. 2002, A performance-based approach to wheelchair accessible route analysis. Advanced Engineering Informatics 16 (2002) 53-71.

U.S. Access Board, 2002. ADAAG, Americans with disabilities act accessibility guide.

Steffen Werner, B.K.-B., Theo Herrmann. 2000, Modelling Navigational Knowledge by Route Graphs. Ch. Freksa et al. (Eds.): Spatial Cognition II, LNAI 1849, pp. 295-316.

C. L. Dym, R. P. Henchey, E. A. Delis, S. Gonick. 1988, A knowledge-based system for automated architectural code checking, Computer-Aided Design Volume 20, Issue 3: 137-145

Jonathan Gross, Jay Yellen. 1998, Graph Theory and its Applications. CRC Press.Charles S.

COST/BENEFIT OF VISIT-ABILITY AND UNIVERSAL DESIGN FOR SINGLE FAMILY HOMES: A USA COMPARISON

Shirley Confino-Rehder
The Rehder Group
Norfolk, VA, U.S.A.
scr@univdesign.com

Keywords: Universal Design, visitability, housing, renovation, cost

Abstract
At what price can we provide accessibility in a single family home? The adoption of the principal method for answering this question, Universal Design, has faced a long struggle in the history of architecture over the last 40 years. All sorts of excuses and reasons account for its slow acceptance and implementation. We now have a quasi-alternative. This paper will explore the concept of Visitability and its relationship to Universal Design.
The concept of Visitability is to have single-family homes that would allow people using wheelchairs to enter and visit the home, use a bathroom, and socialize. Less demanding that the principles of Universal Design, Visitability has been accepted more readily, and has become a part of many local and state building codes around the States.
Is this considered a victory for people who use wheelchairs, or another delay on the road to full accessibility? Is the glass ½ empty or ½ full? What is the real cost and difference to the consumer, the builder, the city, the society as a whole? How far have we really come and how far do we still have to go?
This paper will compare the two philosophies and principles of Universal Design and Visitability, the actual costs as found in recent comparative studies, and project the future of design in the single family home. It will explore the options, and how can we include both concepts in building a future that is accessible to all.

1. Introduction
In May of last year I was asked by our esteemed chairlady to do a research paper on the cost of Universal Design (UD). I am a designer, not a statistician, and hate working with graphs, surveys, and numbers. There are so many variables in a survey, no matter how extensive, thorough and scientific the analysis is, it is never current because of the time it takes to analysis, and the to publish. But, I agreed and started collecting data.
This paper will use information from1979 to 2008. As expected, with allowance made for inflation and rise in cost of labor, the change in costs for accessibility has been minimal, but I am excited to report that the education on the intrinsic value of UD has soared.
There are several ways of calculating the costs of Universal Design. There are the tangible, accountable costs that are the actual dollars and cents of the building at the time of construction, and the dollar value of the benefits that are received as a result of its inclusion in the preplanning stages of the design process. Both are real and should be accounted for. In addition to these costs there is the cost of educating all of the players, and the benefits related to housing, both of which are just as real.

Universal Design (Barrier Free Design, Design for all etc) has had many challenges in its history in design. Cost is the common excuse. Attitude is rarely admitted to. Both are major obstacles. Education is the vehicle to eliminate the obstacles. In the United States (US), accessibility for government funded multi-family housing projects, and the work environment has been part of the building codes for more than thirty-five years. These buildings are, for the most part, in compliance with those laws, as they were written. If it is a law, is it less expensive? Does it help change attitude? When does common sense kick in?

2. History

A. PUBLIC SPACES

We all know that when specifying UD in the design stage of a development, there is no, or a very minor, increase in cost compared to the retrofit costs. Over the years there have been many studies that have compared these differences. In June 1994 at the International Congress on Accessibility in Rio de Janeiro, Brazil, Dr. Adolf Ratzka presented a report on the costs and benefits of non-handicapping environments. Below is a short summary of those studies, starting with a comparison survey done in 1979 by Schroeder and Steinfeld for the US Department of Housing and Urban Development (HUD) (*Illustration 1)* and a similar on in Singapore. Existing public areas were the subjects, showing the cost increases due to accessibility, comparing projects renovated to be barrier free with projects designed with barrier-free specifications.

site	cost for access renovation	cost for original barrier-free design
Convention hall	0.12%	0.02%
Town Hall	0.20%	0.05%
College Classroom	0.51%	0.13%
Shopping Center	0.22%	0.006%

Illustration 1

Results of study:

1. First comparison, the cost of accessible retrofitting compared with original construction costs range from 0.12 per cent for the convention hall to 0.5 per cent for the college classroom.
2. Second comparison, the additional costs if the structures had been designed without barriers right from the beginning range from 0.006% for the shopping center to 0.13% for the college classroom.

In a similar study done in 1980 by the Singapore Urban Redevelopment Authority, referred to by Harrison, (*CIB W84 Report 1993*), used a two cost comparison for a large center consisting of commercial offices, multi-story car park, food center and market. A controlled costing exercise was carried out to compare the cost of the building with and without facilities of access for disabled persons, and the conclusion was that these could be provided for an additional 0.11 per cent of the total cost.

B. HOUSING

Residential planning requires attention to more intimate spaces and personal needs. Unlike a public space that has to accommodate many people, units are smaller, more efficient, and attends to every day activities of cooking, bathing, socializing, personal privacy, and integration with public access. Housing costs are distributed differently.

At the conference, Dr. Ratzka presented several international studies on housing. A French study of multifamily housing (*Armani*, *CIB W84 Report 1993*) estimated the additional costs for bringing up multi-family housing to accessibility standard, on an average, was between 0.5 and 1.0 per cent of total construction costs in new construction. The Swedish Building Research Council for Sweden, and the Australian Uniform Building Regulations Coordinating Council have made the same or almost identical estimates for multi-family housing. A HUD study for guidelines for the Fair Housing Amendments Act of 1988 showed an average cost increase of 0.5 per cent in typical single-family homes in four suburban projects. (*Park CIB W84 Report 1993).*

3. Research, as of 1995, on Housing and Accessibility

A. Multi-Family Housing

Adaptability in design means that individuals, as needed, can adapt basic features in a house. Such examples are reinforced walls for future additions of support systems like grab bars and removable cabinet door to make a counter accessible for a person using a wheelchair. Accessibility in design means that built features are part of the structure and are not easily changed. Examples are wider doorways that have clearances of 32", receptacles that are higher from the floor and wall controls lower from the floor that make both easier to reach.

Various studies by HUD have estimated the costs of "adaptable" housing were about 1/2 of 1% of new construction. In a 1995 study of HUD affordable housing under Sections 202 and 811(see below for explanation) that included data from site visits, interviews of residents, state policymakers, and project sponsors, suggested that project size does not strongly influence either costs or service availability but satisfaction is obtained when the residents' needs, preferences, and requirements for supportive services were met.

B. Affordable Housing for the Elderly and Persons with Disabilities

The following results are from a 2002 US Department of Housing and Urban Development (HUD) study done by the National Association of Homebuilders (NAHB) Research Center. I chose to use this study because of several factors, particularly because it addresses much needed housing programs for the very low income senior and the very low income families with disabilities.

HUD's Section 202 program helps fund construction and rehabilitation of projects to create and expand the supply of affordable housing with supportive services for the "very low-income," elderly. It provides the residents with options that allow them to live independently but in an environment that offers support activities such as cleaning, cooking, and transportation. It also subsidizes rents for three years so residents pay 30 percent of their adjusted incomes as rent.

The Section 811 program provides supportive housing for households, related or not, with one or more very low-income individuals, at least one of whom is at least 18 years old and has a disability such as a physical or developmental disability or chronic mental illness and the elderly. The program allows persons with disabilities to live independently in their communities by increasing the supply of rental housing with the availability of supportive services. These apartments offer more accessible features than the units built under Section 202.

This study is a cost evaluation of the Section 202 and Section 811 supportive housing programs. Structures that were built between 2000 and 2002 were used in the survey. The report was published in 2005. One of HUD's goals was to gain information on future estimate costs for a per-unit, square footage, and elevator/non-elevator basis. Among other detailed information gained was the project site, location, number of dwelling units and bedrooms, structure type and characteristics, gross finished square footage, net residential rental square footage, estimated costs of structure, land, improvements, and total replacement costs, cost breakdowns and information on actual itemized costs for total structures, land improvements, fees, and all overhead costs. A database was created that included Sections 202/811 development cost data and different available cost indices was used to measure changes in costs. Units in Section 202 are larger, but units in Section 811 housing had more accessibility features. See Illustration 2 and 3 for the average construction costs.

Table 4.1
Section 202 Construction Costs
Actual Costs Per Square Foot by R.S. Means Regions

Region	State	Costs Normalized with R.S. Means Locality Cost Adjustment Factors						
		No. Projects	Avg. Bldg. Cost	Avg. Total Cost	Highest Bldg. Cost	Highest Total Cost	Lowest Bldg. Cost	Lowest Total Cost
ALL		338	$61.99	$88.12	$115.10	$162.32	$34.82	$48.10

Illustration 2

Table 4.2
Section 811 Construction Costs
Actual Costs Per Square Foot by R.S. Means Regions

Region	State	Costs Normalized with R.S. Means Locality Cost Adjustment Factors						
		No. Projects	Avg. Bldg. Cost	Avg. Total Cost	Highest Bldg. Cost	Highest Total Cost	Lowest Bldg. Cost	Lowest Total Cost
ALL		206	$66.26	$101.43	$128.60	$240.47	$36.22	$53.65

Illustration 3

Results: Construction Costs in Tables 4.1 and 4.2 show minimal differences, showing average building cost of Section 202 to be $61.99 per square foot and Section 811 (more accessible features) to be $66.26 per square foot.

These studies have led to an expansion of Section 202 and 811 grants that have affected housing all over the country. The new developments have included in the planning some or all features of universal design such as roll-in showers, accessible bathrooms, wide doorways, and adaptability, emergency call systems, grab bars, community rooms, noise control, safety and security measures, is located near amenities such as public transportation, shopping and medical centers, and have outside recreation areas, and parking areas. Sustainable design and energy efficiency have also been included.

Priorities for these projects include locations in safe, desirable residential or mixed residential and commercial neighborhoods; an emphasis on independent living; use of community-based support services in lieu of onsite provision; and good relationships with local neighbors and businesses. A project that is flexible in size, maximizes independence, privacy and inter-

dependence of residents with community, and blends into the neighborhood is desirable.
In 2006 I received a report from Jon Christianson, architect and professor of Universal Design in Norway.
"We have just completed a cost study here - but it will unfortunately only be printed in Norwegian. A part of the study was a case study of a project consisting of five blocks of flats (66 units of varying sizes). Extra cost for UD averaged out at a little more than 1000 USD per unit. Of this, about 150 USD were spent on development and competence building, i.e. cost that were due to the fact that this was the first UD project that the firm had planned and built. Thus, actual cost in later projects can be expected to run as low as 800 USD per unit or less than 12 USD per square metre- as some further savings are expected once UD becomes a regular feature."
Many of the researchers, including this writer, question whether the exercise to identify extra costs of accessible features might be more expensive than the design time required to include them. But they can be helpful in future decisions made on housing and this particular study will be used, as I mentioned before, as a source of information, and reminder, for a request to include UD in a local housing project in Norfolk, VA.
C. Single Family Homes and Visitability etc…
Visitability, Easy Living, and other "style" homes have been introduced as some ways to bring accessibility into housing. It is felt that because of the limited features required to meet its criteria, it will make it easier for builders to accept because it is also "less costly". Visitability although similar in intent to Universal Design is more focused in the social aspects of social-ability, that is having friends and family over who use wheelchairs, or persons who use wheelchairs be able to visit friends and family. It also provides basic access to accommodate people who develop mobility disabilities. Easy Living housing has adapted the same guidelines and is currently being introduced in Virginia.
In the United States, successful Visitability legislation has been passed in many localities, including Atlanta, Georgia; Pima County, Arizona; Bolingbrook, Illinois; San Antonio, Texas; and the State of California. As of June 2006, 46 state and local municipalities had a confirmed Visitability program in place; while 25 of these programs are mandatory ordinances, the other 21 are voluntary initiatives (i.e. cash and tax incentives for builders and consumers, consumer awareness campaigns, and certification programs). In addition, there are numerous efforts to establish Visitability programs in other states, counties and cities across the country. They range from organized groups of individuals with an expressed interest in beginning a Visitability program to locations that are in the final stages of developing a program.
Visitability Features:
1. At least one zero-step entrance on an accessible route leading from a driveway or public sidewalk,
2. All interior doors providing at least 31 ¾ inches (81 cm) of unobstructed passage space and
3. At least a half bathroom on the main floor.

Several additions have been made to the above criteria when the Federal Visitability Bill, HR 1441) was introduced in 2005. This bill would require all newly constructed federally assisted, single-family houses and town houses to meet minimum standards of Visitability for persons with disabilities, including a fully accessible bathroom with reinforced walls, accessible environmental controls and an accessible space for a future bedroom. As of Jan 27, 2008 this bill is still in the first step in the legislative process.

The following are additional validated costs* (abbreviated) for features that were presented to Congress for their guide in to help push the Bill HR 1441 through.

Item 1: At least one zero-step entrance on an accessible route, with no steps or door thresholds exceeding one-half inch in height, and is located on a continuous unobstructed path from the accessible entrance door to the public street or the driveway, which serves the unit. Slopes not steeper than 1:12. The cross-slope of this route must be no greater than 2% and the width no less than 36 inches. The exception is waived if terrain, or physical limitations of dwelling makes it impractical. In new construction:

- When building on a concrete slab and the lot is graded to meet front door. Average cost $0-75. Overall average $25.
- When building with a crawl space or basement. Average cost: $100 to $1000 with an overall average of $500 (deducting the cost of the steps deducted)
- One ADA threshold, with rise of no more than 1/2 inch, at the door of zero-step entrance. Average cost per dwelling $8.

NOTE: Zero-step entrance can be located at whatever entry point is most advantageous: front, side, back or from an attached garage or carport.

Item 2: All interior passage doors, on the main level, are a minimum of 2'10", providing a minimum of 32" clear passage space. Allowing for five interior passage doors on the main level: $25.

Item 3: All environmental controls such as electrical sockets, light switches, and thermostats at reachable heights. Average cost per dwelling: $0.

Item 4. At least one indoor room of at least 70 square feet on the main level.
Average cost per dwelling: $0. (Assuming builder uses typical plan)

Item 5. At least one useable bathroom containing, at minimum, a toilet and sink on the main level with a 30" x 48" rectangle of clear space at each of those fixtures not encroached on by swing of the bathroom door. These spaces may overlap. The entry door may swing outward, or a pocket door may be used. Average cost per dwelling: $0 (Assuming builder uses typical plan that included a bathroom).

Item 6. 6. Bathroom walls reinforced at designated locations to permit later installation of grab bars if desired. (Grab bars themselves are not required.) Lumber from the scrap pile may be used for this purpose. Average cost per dwelling: $40 (materials and labor).

TOTAL AVERAGE ADDED COST PER DWELLING:

On a concrete slab	$98
On a basement/crawl space	$573.

**Among those that have validated these costs are Dr. Ed Steinfeld, Professor of Architecture, State University of New York, Buffalo, NY, H. D. Kiewel, Registered Architect, Minneapolis, MN, and Louis Tenenbaum, Independent Living Strategist, Potomac, Md.*

Florida has had a state law since 1990 requiring that a bathroom on the main floor must have 29" clear passage space in every new house. Builders, without the need for an architect, have had no difficulty in modifying existing plans, at the same cost of narrower doors.

The benefits of Visitability and other programs that limit accessibility features are the ease in which they are being accepted. Albeit, that "ease" is a relative term, I am comparing it to acceptance of the full adaptability, accessibility of UD. The down side, as I, and many proponents of UD feel, is that it is a way out not to include other adaptable features that are part of the criteria of UD. At a conference I attended that introduced Easy Living homes in Virginia, one designer suggested a grading system of accessibility, modeling it after the

LEEDS program for sustainable design. I think this is a wonderful idea, will help both programs of design and allow the builder and home gain recognition.

D. Benefits of Universal Design.

According to the World Health Organization "accidents cause more deaths than any single illness except cancer and cardiovascular disease" In the US, Social Security Disability Insurance is the primary source of income for People considered too disabled to work. In February 2008, the program paid 7,137,000 disabled workers total monthly benefits $7,166,000,000. (*SOURCE: Social Security Administration, Master Beneficiary Record, Feb. 2008*)

At age 65, the likelihood of accidents causing disabilities is greater than 50 percent. Nursing home care currently costs the United States government $100 billion a year, more than double the cost of independent living. Long-term care is costing the federal government more than $150 billion per year. UD in any environment reduces causes for accidents, thus reducing the need for health services and loss of employment. A home designed with UD concepts offers alternatives to nursing homes and long term care centers. Rehabilitation at home instead of institution is possible. A walk-in shower cost less than one month in either place.

Pre-wiring to accommodate any future inclusion of assistive technology and computer technology is part of UD. Home-based, remote healthcare monitoring capabilities that can capture and transmit health data, including visual monitoring, from a patient and send the information to their physician's office or hospital without their ever leaving home is now possible. Security is easily installed to outside sources for monitoring.

Planning with UD concepts will increase the home market, and meet the demand of the future. 75% of professional remodelers surveyed said that they have observed an increase in requests for aging-in-place modifications. We have to listen to the end user.

4. Conclusion

Education is what changes attitude. The builder must recognize the benefits, research the new products and applications of standard materials as well as be able to bring it to their clients.

Educating the consumer about ageing, human frailties, and changes that will occur in their lives as they age is an important factor in creating the demand for accessible housing, transportation, and livable communities. Arkansas, has the highest percentage of people living in poverty in the nation, ranks third highest in the rate of disability, and seventh highest in percentage of residents aged 60 and older. 600 baby boomers (born between 1943-1963) were asked if they realized that with aging, health and abilities would decline. 95% believed they will be independent, but understood their health will decline. 50% believed their neighborhood design played a role in their lifestyle and 25% did not believe that their home design would affect their ability to live independently. Shopping, socializing and visiting doctors and clinics are difficult for those living in suburban and remote areas with limited accessible public transportation and no driving license.

Investment in the built environment and its infrastructure is the most costly of all investments any city, state and country can make, and offers the highest return. It is investing in people. The population of people with disabilities and the elderly is the most diverse consumer group in the world, including all ages, ethnicities, income levels, gender, and purchasing habits. This diverse group has over $1 trillion in purchasing power, and they purchase goods and services

that meet their needs.
The relatively insignificant cost of introducing Universal Design in the planning of urban and rural communities, and the design of products that most people can use, demands that the supportive base continues to grow. The significant return is incalculable when dealing with people, independence, social integration, education and quality of life. The significant real returns can be measure in dollars in the growth of the tax base, the reduction of nursing homes and government subsidies, an increase in buying power, and increase in production and creative design. Global demographics and economics support the case for inclusive design.
The United Nations has reaffirmed that all persons with all types of disabilities must enjoy all human rights and fundamental freedoms at The Convention on the Rights of Persons with Disabilities and it's Optional Protocol on December 13, 2006. On March 30, 2007 a record number of 82 signatories marked a paradigm shift in attitudes and approaches to person with disabilities. Citing that accessibility is the key to ensuring that disabled persons enjoy the same quality of life as others, they resolved (in part) that disability results from attitudinal and environmental barriers, that mainstreaming disability issues are an integral part of development, that accessibility to physical, social, economic, and cultural environments, to health and education, information and communication enables persons with disabilities to enjoy all human rights and fundamental freedoms, agreed that "Universal design" should be promoted, and the products, services, equipment and facilities should be available at the least cost, and finally, appropriate measures to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas. These measures, which shall include the identification and elimination of obstacles and barriers to accessibility, shall include buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces and information, communications and other services, including electronic services and emergency services. Working since 1970 as a design professional advocating Barrier Free Design/Universal Design, I have felt the steady slow climb up a steep mountain, and now, I think I can see the top of it through the clouds.

Bibliography

http://www.disabilityrights.org/705.htm
http://170.97.167.13/local/nv/news/pr2006-11-02.cfm
http://www.hud.gov/local/tx/news/pr2007-11-01.cfm
http://www.tikvah.com/cc/eh/evalpt1.html NA
http://www.governor.state.pa.us.
http://sci.rutgers.edu/forum/showthread.php?t=28359
http://www.ssa.gov/policy/docs/ssb/v62n3/v62n3p41.pd
http://www.ssa.gov/policy/docs/quickfacts/stat_snapshot/index.html
http://www.jan.wvu.edu/media/LowCostSolutions.html
http://www.wbdg.org/design/consider_benefits.php
http://studioaid.org
http://www.independentliving.org/cib/cibrio94access.html
http:// www.earnworks.com.

http://www.un.org/disabilities/
http://www.ilru.org/html/publications/ilru/index.html
http://dailyheadlines.uark.edu/9407.htm
www.ozewai.org/2005/presentations/mirabella.doc
NAHB**'s** 50+ Housing Council Oct. 11 teleconference, National Aging in Place Week (Oct. 8-14).
Smith, Webb and Williams, *Boomer Blind Spot?* Daily Headlines, October 11, 2006
Mirabella, M., Pedlow, R., *Tapping a Hidden Market,* Telstra Research Laboratories, Telstra Corporation Limited, Melbourne, Australia, 2005
Ratzka. Dr. A., *A Brief Survey of Studies on Costs and Benefits of Non-handicapping Environments,* International Congress on Accessibility, Rio de Janeiro, Brazil, June 1994
Richards, Laurel, *'Changing the World for People with Disabilities-One Business at a Time': Seeing People with Disabilities as a Market*, ILRU Program. Houston, TX

INTRODUCING UNIVERSAL DESIGN IN THE CONSTRUCTION INDUSTRY: INVOLVING INDUSTRY

Jan Desmyter and **Stefan Danschutter**
Belgian Building Research Institute
(CSTC-WTCB-BBRI) Belgium
jan.desmyter@bbri.be; stefan.danschutter@bbri.be

Keywords: accessibility, sustainable construction, threshold design, policy

Abstract
Introducing universal design in the construction industry can only be successful if all stakeholders of the industry are well informed and trained, and willing to contribute. In order to realize buildings accessible for all it is not enough to concentrate on legislation and standards. One has also to consider how accessibility could be integrated into everyday construction practice. Based upon the experiences of a regionally funded innovation stimulation project, 3 determining elements will be addressed in this paper. First of all, building owners have to be convinced that it is sensible to invest time and money in accessibility measures, designers need to be open to new knowledge and be prepared to study and/or specialize, general and specialized contractors need to be informed and trained with regard to execution of accessible environments. Secondly, applying universal design and realizing an accessible building have also important technical consequences, which are not always in line with traditional building practices. Looking for equilibrium between accessibility and technical and economically feasible possibilities is therefore an important challenge. Finally, tools have to be developed to allow building owners to communicate about accessibility qualities of the building and building users to check the accessibility level. Integrating accessibility in the overall sustainability and quality communication could result in a major step forward.

1. The Legal Context in Belgium
Most construction companies and professionals, the industry is essentially an SME industry, operate in a local context. The local regulatory framework with regard to urban planning and construction is therefore an important factor which even influences the way the industry is organised. In most European countries regulations with regard to the accessibility of the built environment have been published. Belgium published in 1975 its first legal documents with regard to accessibility. The law of 1975 was completed by a royal decree detailing the requirements, published in 1977. These regulations established a set of categories of buildings for which accessibility standards had to be taken into account during construction or major renovations.
Due to the federalisation of the Belgian state, regional and urban planning became regional competences. The 3 Belgian regions, i.e. Brussels Capital, Flanders and Wallonia, have nowadays different policies and requirements with regard to the accessibility of the built environment. They essentially address the public space and buildings (or part of buildings) open to the public:

• In the Walloon region, ***the CWATUP***, the Walloon code for regional and town planning and cultural heritage, is the code of reference. In 1999 two articles 414 and 415 addressing accessibility requirements for new buildings and renovations were introduced. The conformity of projects is validated by the authority which is given the responsibility to deliver the building permit.

• In the Brussels Capital Region, the ***Regional Urbanism Regulation RRU-GSV*** is the code of reference. Chapters IV and VII are dealing with accessibility requirements, one chapter focuses on the building itself, whereas the second one deals with the public space. The revised RRU was approved in December 2006 and started to be effective in January 2007.

• The Flemish region is the only region in which the national legislation of 1975 and 1977 is still valid. In 2004 a decree was published forcing building owners and designers to communicate in their building permit request about the measures taken to arrive at an “integrally accessible” building without specifying criteria to evaluate these measures. Partly because of the lack of impact of this requirement and the lack of criteria, the Flemish region is currently preparing ***new legislative initiatives*** with regard to the accessibility of buildings, and hopes to publish them by the end of 2008.

The ***federal anti-discrimination law*** which dates from 2003 and which transposes a European Directive, should also be mentioned. The federal law has the merit to ensure a wider level of protection, which goes beyond the area of employment and occupation on which the Directive focuses. Thanks to this law, the term “reasonable accommodation” was introduced in Belgian legislation. In Belgium, provinces, cities and municipalities have the possibility to define specific building regulations (which have to respect the regional and national legislation).
The ***Province of West-Flanders*** has used this possibility and published in 2007 its own provincial accessibility regulation.

The regional (as well as the provincial) regulatory documents refer to an evaluation at the planning stage and consider only aspects which are verifiable on the plan. Aspects such as lighting, colours, interior design, tools and appliances are therefore not covered by the regulations. Practice also shows that due to a lack of know how and education or due to a lack of human resources non-conforming projects slip through the control system. Some authorities try to avoid this by working together with accessibility experts. These experts are then charged to formulate an advice with regard to the accessibility of the project under study. The advice may cover the legal obligations, but may also be broader and deal with universal design aspects. The non-legal part remains however difficult to enforce. Most, if not all, of these experts are working for non-profit organisations with an origin in the social sphere. Contacts with the industry or with profit-oriented organisations are rather limited.

2. Need for Parallel Initiatives

As has been illustrated by the accessibility policy overview paper of Desmyter & Lechat, 2006 prepared in the context of the European POLIS-project, regulatory instruments have to be combined with other initiatives in order to get to an accessible built environment. As was well stated in the Madrid declaration, “*without a strong commitment of all society …legislation* *remains an empty shell.*" Authorities may take a series of policy initiatives to change attitudes and raise awareness. An essential element in this regard is without any doubt the ***education and training*** programs of architects, designers and other building professionals.

The Expert Group report "*2010: A Europe accessible to all*" identified the lack of awareness among building professionals as one of the principle obstacles in achieving accessibility for all in the built environment. Schools or universities have generally not (or not yet fully) integrated universal design or accessibility in their curricula. Projects, such as the UD Education Toolkit project[28], have been launched to make a serious step forward, but it is clear that much work remains to be done.

As far as the public environment is concerned, the role of the ***public authorities*** and the way they can **lead by example**, should not be underestimated. As public authorities are one of the dominant clients of the construction industry, they may give an important stimulus to the integration of universal design in everyday architectural and construction practice. Much remains to be done in this area. In many European countries public buildings and areas are not constructed or decorated according to the principles of universal design. Instead the regulatory (and when available sometimes the normative) framework will be the starting point. As has been reported by Imrie, this regulatory framework may be vague, difficult to execute, full of exceptions and/or composed of minimum requirements. Going further than the regulatory and normative framework will however involve efforts and money.

Sensitizing the architect and designer throughout his regular professional activities should also be an important objective. In Belgium some interesting initiatives have been taken to reach this aim. The purpose was to stimulate the integration of adaptability and universal design in the design and construction of dwellings, a type of building not covered by the regulatory framework due to its non-public character.

• A series of design competitions have been organised by the architects association NAV in close collaboration with BBRI, In-HAM, the Social Housing Company VMSW and the Minister of Housing Marino Keulen. Two of these contests, called "*Extra Leefbaar*", involved a total of 6 project locations spread around Flanders. One of the most important criteria for selection was the integration of universal design. Other criteria related to energy performance and sustainability. For each project location the winner was offered to realize the project in close collaboration with the local housing company.

• The publication of a guideline for lifetime housing at the end of the nineties has also helped to inform and sensitize architects. The guideline, which is currently under review, is well known in the world of architecture, partly because it was also used by social housing companies as a reference. One of the reasons why accessibility and universal design gets more attention nowadays than 5 to 10 years ago is the increasing attention for the ***ageing of the population***. Events such as the Better Lifetime conferences organised in 2006 and 2007[29] illustrate the increasing interest of building promoters and construction companies in accessibility, lifetime housing and innovative ways of care for the aged. Especially in the construction of apartments "lifetime" living as a property to attract customers (essentially buyers) becomes a real commercial argument and this is clearly a new and interesting

[28] http://architectuur.phlimburg.be/onderzoek/universal_design/cd/nl/index.html (only available in Dutch)
[29] http://www.betterlifetime.org

evolution. It illustrates clearly the changing market conditions and offers multiple opportunities for innovations. At the same time, traditional construction practices may have to change in order to find a new equilibrium between accessibility demands and technical requirements at the level of energy performance, water and air tightness and protection against floods.

3. Technical Consequences of Accessibility

Realising accessibility also has technical consequences which are in many cases hidden or unknown to the user. In publications and policy papers with regard to accessibility one often will notice the terms “visitable” and adaptable (for instance the Dutch standard NEN 1814:2001). A walk through an urban area in Belgium, but the same holds for most European countries, will show that most houses are not “visitable” for wheelchair users without assistance. Indeed, a major barrier to access for disabled people is the principal entrance. Also the backdoor to the garden or the doors to terraces and balconies may become important barriers.

The quality of an entrance from the point of view of accessibility is determined by a range of factors, such as the effective door width and the ease of operation of the entrance door. The type and height of threshold is, however, often the determining element. Most guidance documents on accessibility (f.i. BS 8300:2001 and NEN 1814:2001) define that the threshold should be level, or if the provision of a raised threshold is unavoidable, of a height of not more than 15 to 20 mm. In small buildings and housing this requirement may be difficult to deal with. In larger buildings open to the public, such as hospitals, offices or cultural infrastructure, sufficient space is available to allow an adapted design of the entrance. By a combination of ramps, landings and/or a covered entrance thresholds may be completely eliminated. As in housing situations the entrance is generally situated at the level of the façade of the building, and in urban areas very near to the street, these measures are often impossible to take.

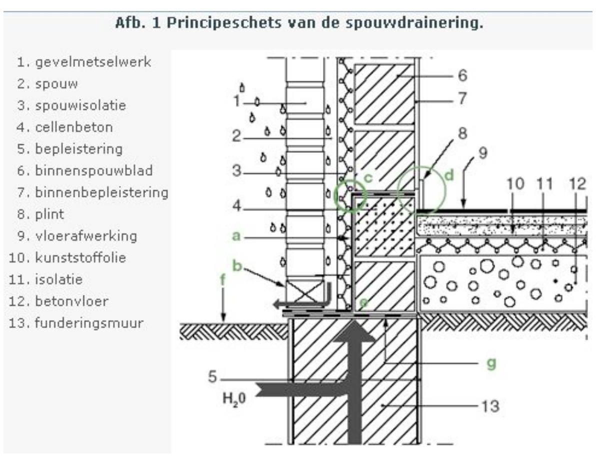


Figure 1 *Illustrative concept of the cavity wall (Mahieu, 2004)*

The threshold design serves a series of technical functions (Stationary Office, 1999).

Although it is not part of a formal building regulation in Belgium, the threshold design has to minimise the risk of water or damp entering the building. The threshold design should also satisfy thermal insulation requirements to ensure thermal bridging is avoided and sufficient air tightness is provided. As the energy performance of buildings becomes a real issue due to the Energy Performance of Buildings Directive, the importance of this latter requirement should not be underestimated. The fact that low-energy and passive houses, schools and offices start to get very popular in Kyoto Protocol related policies will even increase the pressure on the threshold design and execution. Finally, the threshold serves also as a protection against storm water, an item which becomes (again) actual taking into account the climate change effects.

In Belgium most thresholds of dwelling entrance doors are made from a local limestone, well known as "petit granit" or bluestone. The typical new-built house has a cavity wall with an outside brick wall or façade and an insulation material in the cavity (Fig. 1). In order to avoid moisture in the interior wall by rain or rising moisture, a membrane is incorporated in the foot of the wall. The membrane at the interior wall is logically situated at a higher level than the one in the outer wall, the latter of course superior to the external landing. Should this not be the case, the outside wall will become moist and risks to be damaged, for instance by frost. Figure 1 clearly illustrates that the interior floor is generally supposed to be situated at a higher level than the external landing, precisely to avoid moisture penetration by rain and storm water or capillarity. From the point of view of accessibility this however clearly presents a barrier.

In a recent publication (Danschutter & Vandooren, 2008) BBRI proposed a solution for the cavity wall in which interior floor and external landing are nearly at the same level (Fig. 2). The membrane in the outside brick wall should be 2 to 3 cm higher than the outside landing in order to protect the wall against exceptional water table. The drainage should at least be present in front of door openings, but may be continued along the wall. The proposed solution is still far from usual construction practice, partly because it is reasonable to expect a higher price is associated with this type of solution. Instead of a threshold one has to invest in drainage, multiple moisture barriers and a complex execution.

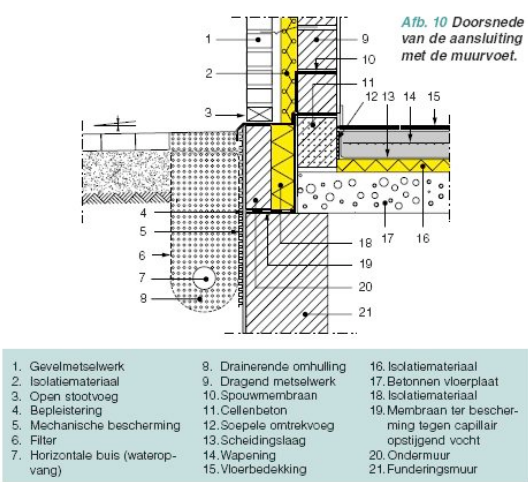


Figure 2 *A wall foot in which interior floor and external landing are nearly at the same level*

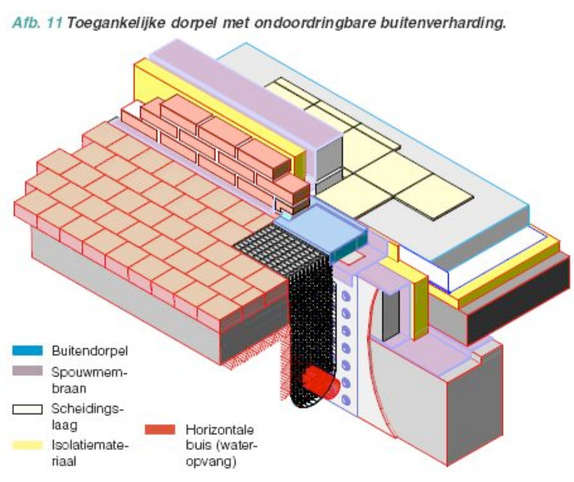


Figure 3 *Accessibility and moisture protection combined*

The door opening itself and the incorporation of the threshold in the cavity wall requires special attention. In order to find a solution which satisfies accessibility and technical requirements, an integral design of external landing and threshold is necessary as illustrated in figure 3. The external landing should have a gradient of ± 2% away from the door in order to provide surface water drainage. As already said above drainage has to be provided in front of the door opening as surface water is likely to be blown towards the threshold. Figures 2 and 3 present a solution for front door openings situated at street level. In case of sliding doors, often used as a backdoor to the garden or as an opening to terraces or balconies, other solutions have to be defined in which even the design of the sliding door has to be adapted. Also traditional door openings to terraces or balconies present a technical challenge: New and robust detailing remains to be defined. As illustrated in table 1, traditional construction practice requires on terraces and balconies a difference in height between internal floor and external landing ranging from a minimum of 50 to a minimum of 150 mm (Danschutter & Vandooren, 2008). The required difference in level depends on the type of outside floor system and the seal system used under the threshold.

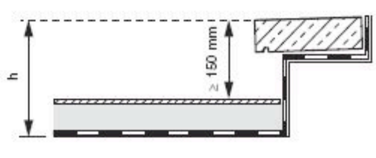
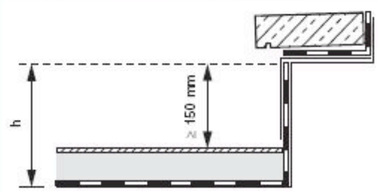
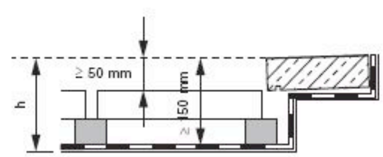
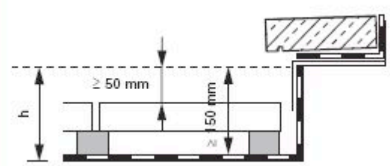
Type vloerbedekking	Uitvoering van de afdichting	
	De afdichting loopt door onder en achter de dorpel.	De afdichting stopt onder de dorpel. Afwerking met een metalen slab.
Hechtende vloerbedekking		
Niet-hechtende vloerbedekking		

Table 1 *Schematic overview of necessary vertical elevation of thresholds at balconies*

In order to avoid moisture problems in the wall or under the roof (moist insulation materials loose their performance when humid, damage in the rooms under the roof or floor has to be avoided), special attention is required with regard to the detailing and execution of the threshold and the position of the moisture barriers. In general, 2 cases may be encountered in new construction:

• The continuity of the cavity membrane is preserved under the threshold. This situation is illustrated in figure 4 (Mahieu, 2006).

• The threshold is lowered, and as such the continuity of the moisture membrane is not preserved. In that case the cavity and sealing membranes have to overlap in order to avoid moisture penetration, as illustrated in figure 5 (Mahieu, 2006). It may be clear that from the execution point of view this is not easy to realize.

The efficiency of both solutions is based upon the supposition that there is a sufficient difference between internal and external level as a protection against sudden and unexpected

events such as heavy rainfall, a blockage of the water piping, etc. When it comes to an equal level between internal and external floors, or a difference of not more than 2 cm, other solutions have to be sought. Our research has shown that products for barrier-free door openings have been developed in neighbouring countries (Danschutter & Vandooren, 2008).
These products, of which the efficiency often still has to be investigated, are apparently not fit for use in the traditionally used Belgian exterior cabinetwork. They also implicate a major change in construction practice as the traditional bluestone has to be replaced by or combined with a threshold profile. During a workshop organised by BBRI in February 2008 construction companies and architects communicated that most clients are not yet ready to make that shift.

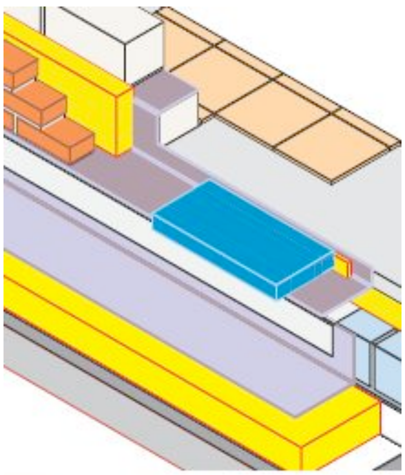


***Figure 4** The continuity of the cavity membrane is preserved under the threshold*

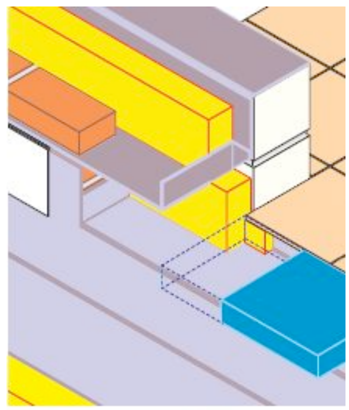


***Figure 5** Non-continuous cavity membrane. Cavity and sealing membrane have to overlap*

4. Information and Marketing on Accessibility

For the user obtaining reliable information on the accessibility of built environments or buildings is a major issue. Especially in tourism the lack of reliable information has been a major obstacle to people with disabilities planning to take a holiday or break. Internationally, lots of initiatives have been taken to deal with this situation. Organisations have been developing databases on accessibility of tourism infrastructure, hotels, campings, etc. Others have launched campaigns to get to a kind of accessibility label. Harmonisation of criteria against which buildings and infrastructure have to be checked in order to give them a label or take them up in the database, is clearly an important area of work.
The accessibility community should however also realize that they are surrounded by other preoccupations, which often get more attention. In the construction field much is currently done in the area of energy performance certification. Due to the Kyoto-protocol low energy buildings, passive buildings, CO2-neutral or even energy positive buildings get a lot of political attention. Another topic of major interest is the environmental performance of buildings. A technical committee at CEN is working on standards and technical reports which should allow

in the long run calculating the environmental performance. In the meantime, tools as BREEAM, HQE or LEED are already on the market and used to label buildings.
Sustainability has however 3 pillars: economy, social and environmental. As such, when evaluating buildings or infrastructure, one should not only concentrate on the accessibility of the building, which is clearly a social item, or on the energy performance (an environmental issue with an economic consequence). Instead an integral approach is necessary. In that area it is interesting to have a look at the results of the European LEnSE-projects[30]. The main objective of the project was to develop a methodology for the assessment of the sustainability performance of existing, new and renovated buildings. The framework of the methodology consists of a long list of sustainability issues and associated potential indicators, arranged in 11 categories, one of them being accessibility. Another interesting development, very close to the market, is the work of BBRI and SECO in which a methodology for the attribution of a sustainability label to offices is defined. Also here, accessibility is an essential part of the methodology. In order to stimulate progress in the area of accessibility, a minimum level has been defined based upon the local legal requirements. Offices with accessibility properties which go beyond the legal requirements will be able to have a higher score. In communication not only the global score will be important, also the individual scores will be highlighted.

5. Conclusions

Putting accessibility requirements in legal texts, normative documents or guidelines without thinking about the technical and economic consequences is not a sensible thing to do. This paper illustrates that although the problem may seem to be simple from the accessibility point of view, this is not always the case if one takes into account the technical consequences. As the building and construction habits differ from country to country, solutions can not always be transferred as such. The paper also illustrates that the uptake of accessibility requirements in legislation will not solve all problems relating to accessibility. Other initiatives are necessary, most of them voluntary. The demands of the clients, and especially of the ageing population, will probably be a major factor in these developments. They will push the search for solutions which combine accessibility, comfort and technical performance and will ask for information about the overall sustainability performance.

6. Acknowledgements

This paper has been realised with the support of the Flemish Innovation Agency (IWT) in the context of the Thematic Innovation Support action on accessibility, adaptability and innovation in the housing industry.

References

Danschutter S. and Vandooren O. (2008), Toegankelijkheid van Buitenschrijnwerk (Deel 2), WTCB-Dossier 1/2007, Katern nr. 12, Belgian Building Research Institute, Brussels (only available in French and Dutch).

Desmyter, J. and Lechat, I. (2006), Accessibility Policies: An Overview, Proceedings of the POLIS Conference, http://www.polis-ubd.net, Bruges.

[30] http://www.lensebuildings.com

Expert Group (2003), 2010: A Europe accessible to all, Report from the Group of Experts set up by the European Commission, Brussels.

Mahieu, E. (2006), Spouwdrainering ter hoogte van een dorpel, WTCB-Infofiche nr. 20, Belgian Building Research Institute, Brussels (only available in French and Dutch).

Mahieu, E. (2004), Infiltraties aan de voet van spouwmuren, WTCB-Infofiche nr. 7, Belgian Building Research Institute, Brussels (only available in French and Dutch).

Stationary Office (1999), Accessible thresholds in new housing: Guidance for house builders and designers, Norwich, UK.

THE COSTS OF ACCESSIBILITY SOLUTION APPLICATION IN RESTORING OLD BUILDINGS: PALACIO DA LUZ - CURITIBA – BRAZIL

Sidart Gaia
civil engineer- MBA at Security Engineer
MSc civil engineer-Building Environment
sidartgaia@hotmail.com

Keywords: accessibility, building,

Abstract

There is an increasing necessity to preserve old constructions in order to preserve community history and culture. In many cases, old buildings in big cities, especially downtown, are abandoned and used as either trash deposits or home for drug addicts and homeless people. This very often decreases the quality of life and the living standards of a large proportion of the population who live and work in the surroundings.

The purpose of this work is to show a project which happened in Curitiba in 2007 as a model to how the living standards of major big cities can be improved by revitalizing old buildings to be used as social sites to enhance the quality of life of the poorest portion of the population.

Universal design principles were used to implement accessibility solutions to the revitalization of PALACIO DA LUZ in particular, but, as there was not enough sponsorship to execute the whole process, the costs towards creating accessibility facilities were the major issue to the process, which had to be handled by creating either cheap solutions or ones which demanded no cost at all.

1. Introduction

Perhaps the major architectural challenge of the new century might be handling the issue of a rocketing amount of old forgotten sites and buildings in all major cities. Independently of the country, big cities have a significant number of old constructions, most of them located downtown and very often under poor maintenance or even totally abandoned.

Public efforts to preserve these buildings are limited. Lack of resources and interest from the government and the community are regularly the cause to the problem. As the lack of awareness towards the cultural and economical importance of these buildings continue to grow, it seems urgent to address to the lack of interest in maintaining and preserving such constructions (Ramamurti, 2000).

Another cause to the problem is the lack of structural planning in major urban centres. Historically speaking, the best houses and buildings were located downtown, whereas industries and poor houses were located in the periphery of the cities.

The expansions of these cities togheter with the unplanned redevelopment of these areas were the main causes of the abandon suffered by these buildings. The downtown area, which used to be mainly residential, was occupied by commerce and small industries.

At the same time, huge number of families moved downtown to the surroundings to run away from the noise and violence which invaded their lives, looking for better living standards and avoiding the huge number of poor immigrants which were invading the centre of the cities in the search for work and surviving.

In this process, many buildings, which became useless by that time, were either abandoned or simply forgotten. These buildings very often became sites for illicit purposes such as usage of drugs and prostitution. This can result in damaging the image of the neighbourhood and creating an atmosphere of both fear and disgust among the population.

Restoring these buildings and redeveloping them to be used as museums, hospitals or even schools may change not only the neighbourhood atmosphere but also the quality of life of the population in its surroundings can be one way to solve these problems.

2. Palacio da Luz

PALACIO DA LUZ (Light Palace) was built and projected by the Catholic Church to be used as a residential building which would provide resources to support the Christian Hospital needs. It was built in 1941 only 99 steps away from the zero ground mark of Curitiba, the capital city of the state of Parana in Brazil.

By that time, the building was occupied only by the wealthiest families of the city. This scenario changed in the 1970's when these families moved to the suburbs and the building was re-occupied by middle-class households. In the 1980's the construction became an office building and it was finally closed and abandoned in 1990 becoming a site for drug dealing and prostitution.

In 2006 two organizations got together to find a solution to the problem of misusing of the building which had been happening to the building since its closure. This association between HABTO/ESPAÇOS OFFICES and the Catholic Church intended to revive the construction to be used for educational purposes by providing room for two universities and also for social organizations.

It was planned to upgrade all infra-structural features and modernize all support equipment by governmental and industrial support and sponsorship (pictures 1 to 3).

***Picture 1** The original facade*

***Picture 2** The projected facade*

Picture 3 *The final facade*

3. The Building's Accessibility Project

During the restoration, the accessibility improvement was one of the main concerns. Due to its old project, which was not according to the standards of construction and accessibility demanded now by the government, the task began by a deep analysis of the construction: small corridors, many stairs, inappropriate doors and other architectural elements which were problems to apply proper accessibility solutions inside the construction.

The steps to solving this issue are listed below.

1) *Step One - Defining the purpose of future occupation*

The building would be an office environment. The visitors and workers would be varied so that installations would be used by all kinds of people.

On the second and third floors a medical clinic would be installed. The equipment varied from tiny to huge. The doors and corridors were supposed to have enough dimensions for transportation needs.

2) *Step Two - Architectural project*

The building had no plants. All the interior dimensions were established by manual measurement, so that an "as built" project was found as a result.

During this process, problems were detected and possible solutions were decided. Some parts could not be changed or upgraded because of architectural limitations.(limited corridors wide, elevators, stairs, and no space for ramps).

The Seven Principles of Universal Design were used as a guide to the improvements needed. Guides for accessibility improvement provided by ONU and the National Laws of Accessibility were also taken into account in defining the project.

3) *Step Three - Applying Solutions*

Applying the solutions decided during the architectural analysis was divided in two parts: the first ones was that solutions easy to apply as change electric complements (as switches) by more visible and easy to use ones, or enlarge doors at rooms. The second ones consist at more dramatic changes at the architecture (a new elevator system) that asks more investments.

Most of the problems which seemed to be solved had to be re-thought and new solutions had to be found. The main concern was to be able to apply accessible improvements with no rise to the costs of implementation. Some changes to the type of products and appliances were inevitable. (Christophersen, 2002)

4) The final product

Fortunately, almost all changes were feasible. Small interventions were done to improve accessibility in all possible levels (from selected constratation colours to improve visual to new voice system to indicate the different levels).
Some of them were not noticed by users but had their importance to the appropriate usage of the building (the non slippering tiles at floor or the ramp at the main entrance).

4. Problems and solutions
There is a list of the problems detected and solutions applied below:

a) Main Entrance
Two ground shops were demolished to become a room of 6,00mt high and 14mt wide.
Wheelchair entrance – Located in a lateral door due to architectural impossibilities to construct it by the main entrance. Non-slippery tiles were used and appropriate signs were provided.

Painting and walls - Contrasting colours were used to help visual clearness. Both signs written in black and Braille instructions make the circulation inside the building easier for visitors. Alarm and monitoring system inform security staff about the presence of visitors on all floors.

Lighting – Indirect light was used to avoid visitor's confusion due to intensity of luminosity. Direct light was used to signs only.

Floor –Non-slippery tile were used. Invisible silicon lines help blind people to access elevators or others entrances.

Elevators - Unfortunately the structure of the elevators was too old and could not be changed. Improvement was limited to changing signs, sound systems, colours and signs for blind people. Wheelchair users might have problems with the elevator dimensions. The idea to build a new elevator was not well accepted by the building commissions and the fire department. Due to lack of financial resources, as this might probably be one of the most expensive implementations to the project, improvement to the elevator system will have to wait.

b) First Floor - The museum
The first floor will give room to a museum and exhibition sites. Only the corridors, lights and doors were changed. The corridors have plenty of space for usage. The colours of the walls were change to help better visualisation. New signs were planned but not installed and the

light system was specially manufactured to be eye-catching to visitors. A sound system indicates different usages of all rooms.

c) Second to sixth floors

The corridors were featured with different colours and non-slippery tiles. Bars were installed in all stairs. A sound system indicates the usage of each floor. The bathrooms were adapted to all kinds of users (e.g. children, elderly, disabled).Their doors are larger with rectangular knobs. All faucets are automatic. Signs were written in two different languages and a Braille Board will be installed on each floor.

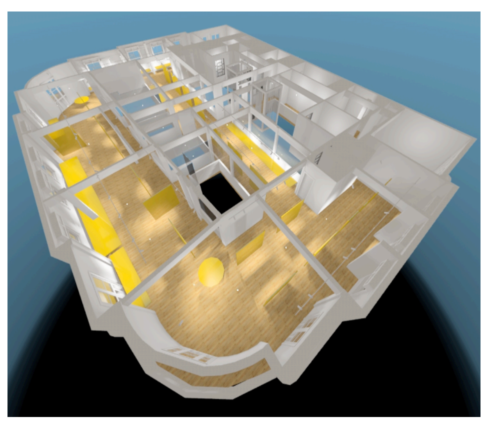
Stair and corridor systems could not be adapted because of architectural problems. Elevators also suffered from the same problem. Although the previous doors were kept as they were according to the accessibility standards, the knobs had to be changed from the round type to the rectangular one. Light switches were changed to help their usage by children and elderly. The inner weight system of windows was revised and maintained.

***Picture 4** The old entrance*

***Picture 5** The works at the entrance*

***Picture 6** The entrance finished*

***Picture 7** The first floor, museum*



***Picture 8** The project of the museum*

Picture 9 *The museum finished*

5. The Costs Towards Accessibility Solutions

The cost predictions

An important step during the restoration process was the cost prediction of the works. At Brazil, the use of certains tools to define the cost of a work is very common. At this restoration was decided to use the Pini Tables Book. This tool consists on groups of tables divided by kind of works. These tables have the amount of materials used at each work and also the value of taxes and workers costs.

For instance, at paint activity, with the total m2 of walls to be paint and the kind of paint decided, we can predict how much will be spent at paint, the painters' costs and the taxes.

All the constructions were analysed and the amount to be spent at different phases were predicted.

Later on the project was analysed by the Universal Design seven principals and also using the direction of international and national accessibilities guidelines. The necessaries changes were made and a second cost report was made.

Few items had significant changes (mainly items as elevators that had to be built all new).Below there is an accessibility solutions list that show the principal changes.

Accessibility solutions

Floor – Non-slippery covers (Brazil, 2000) (NBR 9050, 1994)
Rectangular Knob at doors (Mace, 1998)
Larger doors for bathrooms (1, 20 m larger) (NCSU, 1997)
Bigger switches (ADAGG, 2000)
Automatic faucets for bathrooms (ADAGG, 2000)
Bars at bathrooms (ADA, 2002)
Ramps (short one only - about 3,00m) (ADA, 2002)
Bigger signs (used on all floors and at the main lobby) (Husbanken, 2006)
Contrasting colours (at rooms and corridors) (Husbanken, 2006)
Indirect lighting (at corridors and bigger rooms) (Husbanken, 2006)
Silicon straps (for blind users) (Hypponen, 1997)

Voice system – provided for free by the telephone company (at all floors)

(Ministerio da Saude, 2003)
Braille signs for elevators and main signs for floors and lobby (Husbanken, 2006)
Handrail for ramps and stairs (at both sides) (Hypponen, 1997)
Automatic entrance doors (CORDE, 2001)

Comparing the amount predicted to be invested at the restoration to the one calculated with the accessibilities interventions:

Amount predicted to renewing the construction:
US$ 289,370.00
Amount spent with accessibility intervention:
US$ 298, 581, 25
Difference used to accessibility solutions:
US$ 6,168.75 about 2, 1 % of the value predicted.

These numbers show that accessible interventions at old constructions are not expensive. All the spaces of the building received some kind of accessible upgrade (from floor covering to wall colours, sound systems, doors and knobs).These ones were hardly noted by users but caused a positive impact during daily use).
The 2,1% difference was caused mainly by new constructions necessary at some areas (as new stair systems or new speakers systems).These items were chosen in order to modernize the constructions, not as an accessible solutions.
This difference could be diminished or even disappeared if these particular upgrades were not considered as specifically accessible ones.

6. Conclusion
Accessibility solutions are much easier to be executed when defined during the project. At old constructions, as PALACIO DA LUZ building, some accessible solutions recommended by national and international guidelines could not be implemented due to physical limitations (stairs cases that could not be changed, elevators that could not be replaced by moderns ones)
After a careful analysis of the building, several solutions and/or functionality of the building. Some parameters were considered as aesthetic impact, the duration of the work, the operation of the service or appliance, the space taken, principally the associated costs. All considered under the legal requirements stated at national legislations.
Some structures as corridors and doors, at some places, could not be because as a historical building, the district laws forbidden to change these parts of the construction. Costs of accessibility implementation are insignificants and even can not be noted if planned during the project phase.
At the end of the project, every room received some accessible change: from the kind of the floor covering to appliances as bars or sound systems.
The result of this intervention was noted during the daily use of the installations. The users hardly noted the accessibilities solutions and some solutions
were used by them at theirs homes, but these ones were not considered as accessible ones but modern architecture ones.

The final conclusion is that accessible solutions are mainly simple and easy to apply. What appear to be the main problems is the lack of information about how and where the consumers can use these. By information programs and direct product marketing this situation can be change, raising awareness of both government and population.
Education efforts are necessary to creating a better understanding of the importance of these buildings to transforming the big cities landscape and avoiding misusing of this kind of constructions.

References

ABNT. NBR 9050 Acessibilidade de pessoas portadoras de deficiências a edificações, espaços, mobiliários e equipamentos urbanos**,** Rio de Janeiro,1994.

ADA, American with Disability Act, *Check-list for* Existing Facilities, Adaptative Environments Center, 1995-2202.

ADAGG. American with Disability Act Accessibility Guidelines for Buildings and Facilities, http://access-board.gov/adaag/html/adaag.htm, 2000.

BRASIL. Decreto-Lei n.10.098 de 19 de dezembro de 2000.Estabelece Normas Gerais e Critérios Básicos para a Promoção da Acessibilidade das Pessoas Portadoras de Deficiência ou com Mobilidade Reduzida,e dá Outras Providências.
http://www.soleis.adv.Br/deficiente.htm

Christophersen, Jon, Promotion of Barrier Free Design and Universal Design in Norway, Universal Design Symposium, Seoul, Korea, 2002

Coordenação para a Integração das Pessoas Portadoras de Deficiência**,** Ministério da Saúde, 2003.

CORDE, Normas e Recomendações Internacionais sobre Deficiência. Segunda edição, Brasília, 2001.

Estatuto do Idoso, Decreto 1003/2003 Projeto de Lei n. 57.

HUSBANKEN, Universal Design at Building Construction.

Hypponen, Hanmelle**,** Disability and Ageing, Stakes, 1997.

Mace, Ronald, Universal Design in Housing, Accessible Technology, Volume 10, vol 01, RESNA, 1998.

North Carolina State University, The Center of Universal Design, The Seven Principles of Universal Design, 1997, v2.0, 4/1/97, USA, http://www.ncsu.com

Ramamurti, P.V, 2000. Introduction; Ageing in Developing Countries, Ageing International, The Journal of the International Federation on Ageing, Volume 25, Number 4, Spring 2000,USA.

GATED COMMUNITIES: USER SATISFACTION IN HOUSING ENVIRONMENT IN ISTANBUL

Lale Berköz
Istanbul Technical University
Faculty of Architecture
Department of Urban and Regional Planning
Istanbul/Turkey
e-mail: lberkoz@itu.edu.tr

Keywords: gated residential developments, satisfaction of housing and environmental quality, Istanbul

Abstract

Since the 1970's, construction of the Bosphorus Bridge and the new highways, the rise in the use of private cars have increased the accessibility in Istanbul. Besides, Istanbul has gone through a structural transformation, becoming a multi-centred city. Such factors have naturally accelerated the decentralization of housing areas in Istanbul.

Since the 1990's, the preferences of the people from the elite social classes in Istanbul have shifted from the heterogeneous housing areas to homogenous places isolated from the dense central areas of Istanbul. As a result, mass housing areas have spread rapidly in the peripheries of the city. In this new transformation, the elite people living in such mass housing areas have found a chance to obtain their cultural and social expectations.

This phenomenon has gained significance due to the demand for the northern and north-eastern districts of the city since the 1999 earthquake in the Marmora Region. Since we know the patterns of housing area development and density change, the potential future developments can be anticipated.

The researches carried out until now have demonstrated that quality of the residence and residential environment is influential in the overall resident satisfaction. In terms of environmental quality variables such as basic urban services and amenities, it has been determined that the housing areas within the scope the project have high standards. As a result of this fact, people from high income group tend to choose housing areas in the peripheries of the city.

Because of the lack of comprehensive survey of gated communities at a local and metropolitan scale, this paper analyses the sprawl of gated residential communities in Istanbul metropolitan area and aims to study spatial distribution of these communities and locational preferences. The study compares single-family and multi-family gated developments. In this study, in order to assess the factors that improve housing and environmental quality satisfaction, both the concepts of housing and its environment, and the subject of housing and environmental quality satisfaction have been investigated.

1. Giriş

Gated communities which have the potential to transform the urban environment in the 21st century. Gated communities represent an urban phenomenon that is spreading all over the world. The popularity of living in gated communities has been rising last decades. In a global context, gated communities are sprawling not only in the U.S., but also in Latin America, Europe and Asia (Blakely and Snyder, 1997). The subject has been given most attention in the United States, where the highest valuations estimate that nowadays more than 32 million Americans (12 percent) live in a gated community. There is little available information about the growth of GCs in the UK (Atkinson et al. 2003).

The physical form of gating exists in the history for a long time and is widely seen in East Asia and Latin America. The gate and walls can at least date back to the walled city when the city was used for military defense (Wu, 2003). During the middle Ages, many towns built extensive walls to protect their citizens. With changing military technology and expanding political alliances, city walls gradually became unnecessary.

Gated communities can be defined as residential areas for upper-class families who look for security, comfort, a better life quality and social homogeneity. They consist of neighborhoods closed by walls, barriers, fences and gates (Roitman, 2003). The concept includes residential areas with restricted access and defines a self-sufficient environment with swimming pools, private bars, children's play areas and a full accompaniment of care-taking staff and security forces (Landman, 2000). The GCs life-style is mainly inspired by the historical golden-ghettos found in industrial-era cities, in New York, London and Paris. Those enclaves are now mainly suburban neighborhoods emphasizing on a "community life-style" and security features (Le Goix, 2003).

Gated neighborhoods have greatly developed since the 1970s, thus becoming one of the symbols of the metropolitan fragmentation and one of the increases of social segregation (Blakely and Snyder, 1997). There are different causes for arrival of gated communities, which can be divided into two groups: structural and subjective ones. Within the first group the most important ones are the raise of insecurity and fear of crime, the failure of the state to provide basic services to citizens, increasing social inequalities, an advancing process of social polarization and international trend encouraged by developers (Roitman, 2003). Urban violence and fear of crime are mentioned as the main reasons for moving to a gated community within the body of literature on the topic (Blakely and Snyder, 1997; Caldeira et al., 2000). But some researchers suggest that gated communities are not safe places (Blakely and Snyder, 1997).

The literature of gated community is divers. Insights have been drawn from a wide range of studies on the conditions upon which gated communities have been created. These have been explained through different perspectives: the critique of fortress city (Davis, 1990), transformation of civil to consumer spaces (Christopherson, 1994), the end of public space (Mitchell, 1995), social polarization and segregation (Caldeira, 1996), the fear of the crime and surveillance (Low, 2001), private governance and homeowners' association (McKenzie, 1994), and the club realm of service delivery (Webster, 2001). They are criticized as exclusive, reactionary, and socially isolating (Low, 2001; Marcuse, 1997; Wilson-Doenges, 2000). The academic planning literature would seem to suggest that gating contravenes professional planning principles of openness, access, diversity, and equity.

Some early academic works on gated communities also offered harsh critiques, depicting them as symbols of America's lost sense of community life (McKenzie, 1994).

2. Residential Satisfaction in Housing Areas

The research of residential satisfaction and environmental quality has become one of the important objectives of city policy and urban planning. Since the 1970s researchers have increasingly examined the relationship between resident satisfaction and physical and social aspects of the residential environments. Some of these studies are theoretical, while others are practical. In the theoretical approach, satisfaction studies have been concerned with developing the RS model, which intends to find out the process of RS. User satisfaction has been discussed in various empirical studies which examine personal characteristics (cognitive, affective or behavioural) or physical and social features of residential environment (Amerigo, 2002).

Francescato et. al. (1974) have considered that RS in dwelling is composed of objective-individual and objective-physical features, as well as user expectations from the housing environment. Galster and Hesser (1981) have provided a model of housing user satisfaction by using path analysis. Their model has been defined by summarizing the relationship between objective-independent and subjective-interventional variables. When the conceptual model of Marans and Spreckelmeyer (1981) is examined, the objective features of the physical environment are used to understand the correlation between housing user satisfaction and behaviour. Their model not only shows that housing satisfaction is influenced by perceptions and evaluations of objective environmental features, but also user behaviour is affected by environmental satisfaction.

In the definitions underlining effective component, user satisfaction in housing means reflecting the sentiments of satisfaction and happiness to the housing place which also creates these feelings (Gold, 1980; Weidemann and Anderson, 1985). In the definitions underlining cognitive component, however, user satisfaction in housing is constituted by the correspondence between the current conditions of the users and the standards they expect and demand (Campbell et al, 1976; Marans and Rodgers, 1975; Wiesenfeld, 1992). In the cognitive approach, Bardo and Hughey (1984), Canter and Rees (1982), Morrissy and Handal (1981) have suggested that if the gap between demands and needs decreases, housing area user satisfaction increases. Amerigo and Aragones (1997) presented a theoretical and methodological approach to the study of residential satisfaction, and gave a general view of the relationships between people and their residential environment. Amerigo's model (2002) is based on the subjective user evaluations about the objective housing area environment that is defined in terms of physical and social features. Kamp et al. (2003) constructed a multidisciplinary conceptual framework of environment quality and quality of life for the advancing of urban development, environmental quality and human well-being. Marans (2003) described subjective and objective indicators for measuring the quality of community life.

There is a strong relationship between residential preferences and satisfaction (Ge and Hokao, 2006). Garling and Friman (2002) noted that residential satisfaction is a natural criterion to judge the success of residential selection. In their research, activities leading to the achievement of life values were identified as objectives. Carvalho et al (1990) first measured residential satisfaction in gated communities in Brazil. Their study was based on a conceptual model developed by Weidemann and Anderson, (1985) which combines personal characteristics with objective environmental attributes in predicting and measuring residential satisfaction in gate-guarded neighbourhoods in Brazil.

3. Research Area and Methodology

The data was collected by a questionnaire survey selected through a systematic random sampling in Istanbul. In the scope of this study 802 questionnaires were responded in face to face interviews in single-family and multi-family residential areas in Istanbul.

In the scope of this study 401 questionnaires have been made by personal interviews with the heads of the single-family gated communities' households. In order to specify the determinants of residents' satisfaction in single-family gated estates, samples have been chosen in 11 districts of Istanbul (Avcılar, Bakırköy, Beşiktaş, Beykoz, B. Çekmece, Eyüp, Kartal, Pendik, Sarıyer, Tuzla, Üsküdar), which are single-family gated housing areas around the peripheries of Istanbul (Berköz, 2008). These housing estates have been situated in the periphery of Istanbul since the 1999 earthquake in the Marmora Region. This questionnaire survey was carried out in the year 2006.

In order to specify the determinants of user satisfaction in housing and environmental quality, samples have been chosen among the multi-family mass housing areas (constructed by National Housing Authority, Emlakbank and Municipality of Istanbul Metropolitan Area) with a population of over 5000 inhabitants. These mass housing areas are situated in zones 10-15 km, 15-20 km, 20-25 km, and 25+ km far away from Eminönü centre, which are located in non-core areas of Istanbul in the peripheral districts. This questionnaire survey was carried out in the year 2004 (Kellekci and Berkoz, 2006). While selecting these samples, questionnaire quota has been applied proportional to the population of each mass housing (Table 1a).

Distance from Eminönü center (km)	Population of Mass Housing Area	Total area (ha)	Density of housing area (person/ha)	Number of questionnaires	District of Mass housing area
35	59	0,60	99	4	Avcılar
15	181	1,85	89	5	Bakırköy
3	122	1,90	63	2	Beşiktaş
33	10.293	346,10	38	102	Beykoz
45	2.813	57,37	65	141	Büyükçekmece
22	4.323	125	34	15	Eyüp
54	211	8	26	4	Kartal
62	1.201	16,55	64	12	Pendik
30	6.594	126,80	52	101	Sarıyer
9	1.325	14,1	94	15	Üsküdar

***Table 1a** Characteristics of selected Gated Single-Family Gated Communities*

Distance from Eminönü center (km)	Population of Mass Housing Area	Total area (ha)	Density of housing area (person/ha)	Number of questionnaires	District of Mass housing area
12	80.000	450	225	64	Kadıköy
15	75.000	377	200	60	Bakırköy
20	234.000	1153	213	187	Küçükçekmece
25	60.000	470	130	48	Avcılar
35	44.000	165,9	273	36	Büyükçekmece
40	9.300	14,3	650	6	Pendik

***Table 1b** Characteristics of selected Gated Multi-Family Communities*

In the first stage of the study the arithmetic mean and the standard deviation values have been analysed based on the answers related to accessibility to function areas and satisfaction in the various facilities in the housing environment, which affect the overall satisfaction in housing and housing environment. In the questionnaire form, the degree of user agreement is indicated on a continuous scale from 1 to 5, which has enabled us to calculate the arithmetic mean and the standard deviation value for each answer. Arithmetic mean value reflects the degree of agreement to a statement/subject matter. This enables the subject matters to be ranged meaningfully. Thus, it is possible to determine which question in the questionnaire form the participants have agreed with a higher level.

In the second stage of the study factor analysis has been used in order to specify the determinants of user satisfaction in housing and environmental quality. As a result of factor analysis, factor groups that increase the level of user satisfaction in housing and environmental quality have been specified. The elements influencing these factor groups include accessibility to various function areas in the residential area, environmental features of the housing, satisfaction in the various facilities in the inhabited environment, environmental security, neighbor relationships, and the appearance of the housing environment.

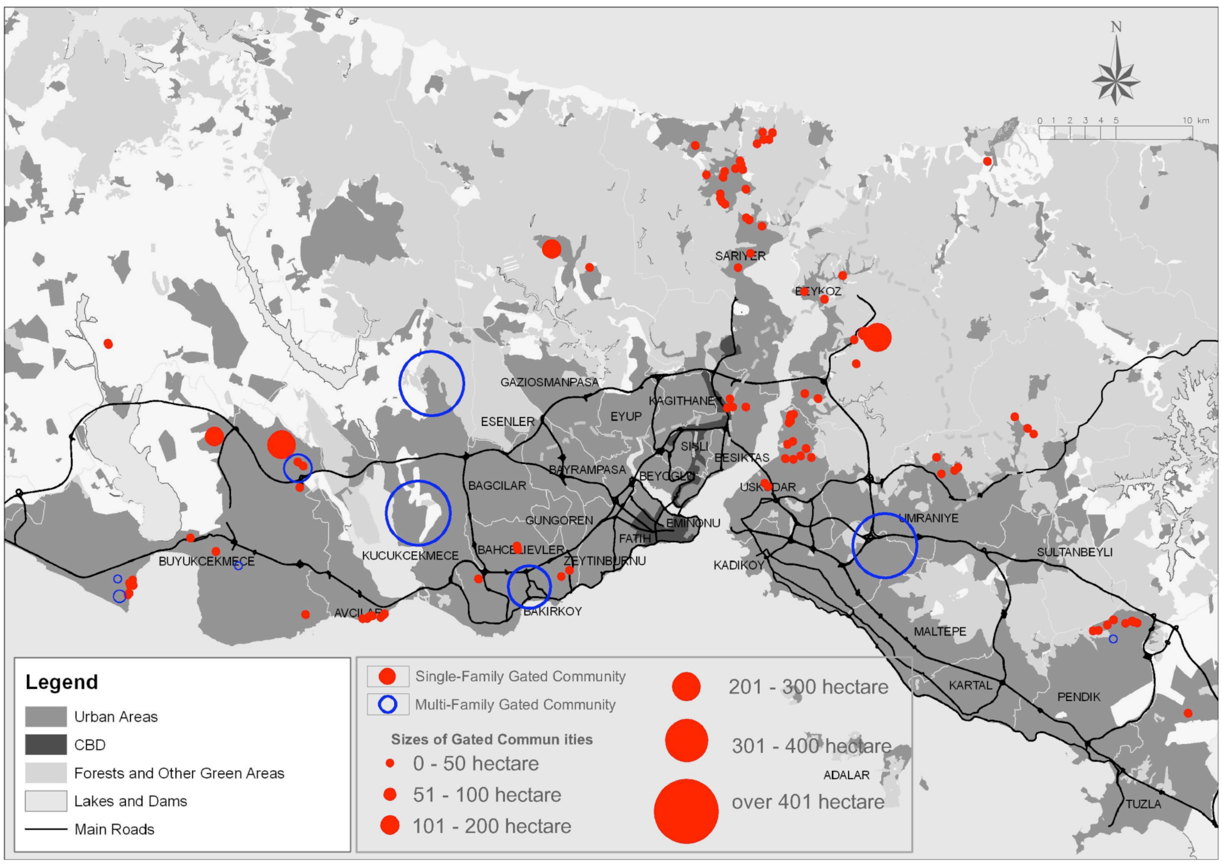


***Figure 1** The locations of the study area*

3.1. Descriptive statistics

Respondent profiles and residence quality of gated single-family houses are summarized in Table 2 (a, b). In the survey studies, 14,0% of housing users come from high-income and

44,4% from upper middle income groups. Concerning the level of education, a great majority of the heads of the families (75%) and their spouses are university graduates (50,1% and 35,4 % respectively) in their middle ages (81,8% and 74,6% respectively). It has been found out that about 59.4% of the families responding to the questionnaire are nuclear families of 3-4 members with 1 child or 2 children. Within the housings where the questionnaire survey is made, the figure for the average family size is 3,3, and 40,1% of the surveyed housing users are housewives. 82,8% of the housing users in the sample are owners. On the other hand, 43,5% of the sample housings have 5 rooms, but all (100%) of their building structure is concrete.

Profile of the multi-family GCs respondents and the quality of residence are summarized in the Table 3 (a, b). In the survey studies, 52.9% of housing users come from high-income groups, while the size of 59.4% of the families consists of 3 or 4 members. 74.6% of the surveyed housing users are in the age groups of 30-59, 40.6% of whom are vocational school graduates. Moreover 43.6% of the surveyed housing users are housewives. 50.4% of the housing users in the sample are owners. When the sample group is considered in terms of housing quality, it is found that 98% of these users live in multi- family houses. On the other hand, 49.6% of the sample housings have 3 rooms, but all (100%) of their building structure is concrete.

District	**Number of questionnaires**	**%**
Avcılar, Bakırköy, Beşiktaş, Beykoz, B. Çekmece, Eyüp, Kartal, Pendik, Sarıyer, Tuzla, Üsküdar	401	100
Family Income	**Frequency**	**%**
Low income	2	0,5
Lower middle	5	1,2
Middle income	160	39,9
Upper middle	178	44,4
High income	56	14,0
Household Size	**Frequency**	**%**
1-2	64	15,9
3-4	301	75,0
5-6	34	8,5
7 and +	2	0,5

Age of Parents	Father Frq.	%	Mother Frq.	%
0-29	28	7,0	83	22,4
30-59	328	81,8	276	74,6
60 +	45	11,2	11	3,0

Age of children	1st child. Frq.	%	2nd child. Frq.	%	3rd child. Frq.	%
0-6	100	39,1	218	68,8	379	96,9
7-14	91	35,5	66	20,8	7	1,8
15-17	33	12,9	23	7,3	3	0,8

18+	32	12,5	10	3,2	2	0,5

Family Education	Father Frq.	%	Mother Frq.	%
Primary school	16	4.3	30	8.1
Secondary school	6	1.6	29	7.8
High school	132	35.9	150	40.6
Vocational school	30	8.1	30	8.1
University	185	50.1	131	35.4

Occupation	Father Frq.	%	Mother Frq.	%
Manager	11	2,9	4	1,0
Civil servant	11	2,9	28	7,2
Tradesman				
Artist	4	1,1	8	2,1
Artisan	-	-	4	1,0
Housewife	-	-	155	40,1
Retired	33	8,7	36	9,3
Tradesman	26	6,9	2	0,5
Academics	14	3,7	5	1,3
Teacher	-	-	17	4,4
Self-employed	124	32,7	37	9,6

House Ownership	Frequency	%
Renter	46	11,5
Owner	332	82,8
Family House	23	5,7

Table 2a *Respondent's Profile (Gated Single-Family)*

Building Type	**Frequency**	**%**
Single Family houses	401	100
Number of Rooms	**Frequency**	**%**
1	1	0,2
2	2	0,5
3	90	22,4
4	134	33,4
5+	174	43,5
Building Structure	**Frequency**	**%**
Concrete	401	100
Heating Type	**Frequency**	**%**
Central heating	401	100

Table 2b *The Quality of Residence*

District	**Number of questionnaires**	**%**
Ataşehir, Ataköy, Başakşehir, Halkalı, Bahçeşehir, Bizimkent, Mimaroba, Sinanoba, Kiptaş-Pendik	401	100
Family Income	**Frequency**	**%**
Low income	16	4
Middle income	173	43.1
High income	212	52.9
Household Size	**Frequency**	**%**
1-2	109	27.2
3-4	238	59.4
5-6	54	13.4

Age of Parents	**Father Frq.**	**%**	**Mother Frq.**	**%**
0-29	73	19.7	83	22.4
30-59	265	71.6	276	74.6
60 +	32	8.6	11	3,00

Age of children	**1st child. Frq.**	**%**	**2nd child. Frq.**	**%**	**3rd child. Frq.**	**%**
0-6	48	16.3	43	21.2	3	5.9
7-14	84	28.6	65	32	3	5.9
15-17	47	16	23	11.3	8	15.7
18+	115	39.1	72	35.5	37	72.5

Family Education	**Father Frq.**	**%**	**Mother Frq.**	**%**
Primary school	16	4.3	30	8.1
Secondary school	6	1.6	29	7.8
High school	132	35.9	150	40.6
Vocational school	30	8.1	30	8.1
University	185	50.1	131	35.4

Occupation	**Father Frq.**	**%**	**Mother Frq.**	**%**
Worker	17	4.6	9	2.4
Civil servant	42	11.3	55	14.9
Tradesman	12	3.2	3	0.8
Artisan	19	5.1	10	2.7
Housewife	0	0.0	161	43.6
Retired	15	4	19	5.1
Tradesman	56	15	9	2.4
Lecturer	23	6.2	27	7.3
Self-employed	167	44.7	46	12.4

House Ownership	Frequency	%
Renter	131	32.6
Owner	202	50.4
Family House	66	16.5
Lodging	2	0.5

Table 3a *Respondent's Profile (Gated Multi-Family)*

Building Type	Frequency	%
Single Family houses	8	2
Multi-Family houses	393	98
Number of Rooms	**Frequency**	**%**
1	27	6.7
2	99	24.7
3	199	49.6
4	66	16.5
5+	10	2.5
Building Structure	**Frequency**	**%**
Concrete	401	100
Heating Type	**Frequency**	**%**
Central heating	401	100

Table 3b *The Quality of Residence*

3.2. Perception of Housing and Environmental Quality: Arithmetic Mean and Standard Deviation

"Accessibility to Parking Areas", "Accessibility to Recreation Areas and "Accessibility to Walking Areas" have yielded the highest arithmetic mean of the variables that affect housing area users' satisfaction in the housing area they live in. On the other hand, the lowest criterion of accessibility in the table has been determined to be "Accessibility to Work Place" for single-family GCs. This outcome has arisen due to the fact that single-family housing areas are built in the peripheries of Istanbul. An analysis of the issue in terms of standard deviation values reveals that the criteria of "Accessibility to Parking Areas", "Accessibility to Recreation Areas" and "Accessibility to Walking Areas", which bear the highest arithmetic means, correspond to the lowest standard deviation values, denoting the high level of reliability.

Regarding the environmental characteristics where housing area users live, the variables with the highest arithmetic means have been determined, with high agreement, to be the criteria relating to maintenance of the environment such as "In this environment night lighting is adequate", "In this environment maintenance of open areas is adequate", and "In this environment maintenance of green areas is adequate" (Table 5). Since middle and high-income groups generally live in the gated communities in Istanbul, the field study has ascertained that housing environment is regularly maintained in these housing areas. Users' positive agreement to the statements above as an expression of their satisfaction also supports that maintenance of the environment is adequate in gated communities. In the Table 5 the statement of lowest agreement has been found to be "This housing area is small with respect to its population", which reveals that residents are satisfied with the density of the housing area.

	Single-Family GCs Mean/St Deviation	Multi-Family GCs Mean/St Deviation
Accessibility to parking areas	4,02 (1,053)	4,06 (0,714)
Accessibility to relaxing areas	4,00 (0,929)	4,04 (0,765)
Accessibility to walking areas	3,97 (0,895)	3,98 (0,638)
Accessibility to the market where daily needs are obtained	3,88 (0,870)	4,06 (0,695)
Accessibility to sports centres	3,77 (1,043)	3,85 (0,817)
Accessibility to local clinics	3,57 (0,988)	3,91 (0,515)
Accessibility to bus stops	3,49 (1,134)	3,00 (0,958)
Accessibility to shopping centre	3,8 (1,003)	3,65 (1,021)
Accessibility to elementary schools	3,37 (1,346)	4,04 (0,765)
Accessibility to city centre	3,20 (1,084)	3,46 (1,024)
Accessibility to places of entertainment	3,18 (1,134)	3,26 (1,129)
Accessibility to hospitals	3,17 (0,994)	3,47 (1,017)
Accessibility to high schools	3,08 (1,317)	3,90 (0,512)
Accessibility to work places	3,00 (1,404)	3,67 (0,811)

Table 4 *Arithmetic mean and standard deviation values of the accessibility to function areas in the housing area*

	Single-Family GCs Mean/St Deviation	Multi-Family GCs Mean/St Deviation
In this environment night lighting is adequate	3,91 (0,921)	3,98 (0,680)
In this environment maintenance of open areas is adequate	3,66 (1,083)	4,09 (0,525)
In this environment maintenance of green areas is adequate	3,60 (1,133)	4,03 (0,672)
The buildings are too close to mine	2,60 (1,184)	2,55 (0,963)
In this housing area traffic density (motor vehicles) is high	2,49 (1,132)	2,76 (1,071)

This housing area is small with respect to its population	2,26 (1,057)	2,47 (0,992)

***Table 5** Arithmetic mean and standard deviation values of the the features of inhabited residence environment*

Once the issue is considered in terms of standard deviation, the variable "In this environment night lighting is adequate" and "In this environment maintenance of open areas is adequate", which bear the highest arithmetic means, have been observed to correspond to low coefficient of variation values, and in this respect to mark high level of reliability.

Adequate lighting in gated communities is an important variable in terms of security. In gated community areas, good maintenance of open and green areas in the inhabited environment and the low density of people and buildings in the housing area have been determined to be the criteria promoting user satisfaction in gated communities.

Among the criteria relating to user satisfaction in the inhabited environment, "Satisfaction in open areas", "Satisfaction in green areas", and "Satisfaction in infrastructure (water, electricity, natural gas, telephone, cable TV)", which yield the highest arithmetic means, have been determined to be the statements of highest gratification (Table 6).

In the single-family gated communities user sample, "Satisfaction in accessibility to city center" with the lowest arithmetic mean (x=3.07) signify dissatisfaction of housing users. Gated single-family housing areas are generally located in the peripheral districts of Istanbul close to highways. Considering the multi-centered structure of Istanbul, accessibility to all the function areas of the city can be provided via the highways for private car owners. Generally, public transport stops are available at the entrance of these housing areas. As a result of the disadvantage of long distance, accessibility to city centers can take more than 45-60 minutes. Considering the traffic congestion in Istanbul, this length of time can be doubled especially in peak hours. With these assessments we see that among all the other facilities, open and green areas, and infrastructure and parking areas play an important role in user satisfaction in housing areas.

As Table 7 shows, housing area users have stated the highest agreement to the variable "Family's general safety in the housing area", which accordingly bears the highest arithmetic mean. This statement has been followed by "Safety from natural disasters". Therefore, these two criteria have been determined to relate to environmental security. Although the criterion of "Safety from robbery" is observed to bear the lowest agreement regarding environmental security of the inhabited area, the result does not signify dissatisfaction as the related arithmetic mean is above 3.0. As a result of the recent increase in robberies in Istanbul, housing area users seem to comply with the prevalent opinion and do not see the inhabited housing area secure against robberies.

In the housing areas where surveys have been implemented, "maintenance of life safety in the inhabited environment" and "the sense of safety in the housing area in general" have been determined to the criteria that increase user satisfaction in gated communities.

Among the criteria regarding neighborhood relationships in gated communities, "Receiving help from neighbors when necessary" has been determined to be the variable with the highest arithmetic mean, and this criterion has been followed by "Satisfaction in neighborhood relationship". It is evident from the table that "Acquaintance with many people in the building and environment" is the least agreed statement regarding neighborhood relationships. Especially the high density of multi-family gated communities limits residents' acquaintance with others in the building and the environment. Moreover, women's participation in work life reveals that "neighborhood relationships" are below the desired level. "Adequate privacy from the neighbors in the immediate surroundings", and "general satisfaction with the neighbors in the housing area" have been determined to the criteria promoting housing area user satisfaction.

As Table 9 indicates, "In general my housing is a good future investment in terms of the area it is situated in", with the highest arithmetic mean, is followed by "This housing estate area looks beautiful", and together these two statements have been determined the criteria regarding the housing environment appearance and economic value. On the other hand, it can be seen in the table that "In this housing area monotony is prevalent; buildings are all the same" has been assessed to be the statement of lowest agreement.

In housing estate areas, the housing's future investment value in terms of the area it is situated in, and the beautiful appearance of the housing have been determined to be the criteria promoting user satisfaction. "Assessment of housings as good investment means for the future" by users has brought about a speculative rise in the housing sale values especially in big cities as a result of high inflation rates after the 80's in Turkey. This, in return, has resulted in the conception of housings not only as a sheltering space but also a means of investment.

	Single-Family GCs	Multi-Family GCs
	Mean/St Deviation	Mean/St Deviation
Satisfaction in open areas	3,87 (0,932)	3,89 (0,802)
	3,86 (0,961)	4,15 (0,527)
Satisfaction in infrastructure (water, electricity, natural gas, telephone, cable TV)	3,86 (0,930)	3,92 (0,904)
Satisfaction in walking areas	3,83 (0,922)	3,76 (0,774)
Satisfaction in traffic roads	3,82 (0,968)	3,71 (0,755)
Satisfaction in the scenery	3,81 (1,011)	3,70 (0,878)
Satisfaction in parking areas	3,78 (1,084)	3,92 (0,780)
Satisfaction in pedestrian paths	3,78 (1,010)	3,76 (0,774)
Satisfaction in relaxation areas	3,76 (1,039)	3,89 (0,882)
Satisfaction in social and neighborhood relationships	3,65 (0,991)	3,83 (0,927)
Satisfaction in sports centers	3,63 (1,104)	3,70 (0,843)
Satisfaction in children's playgrounds	3,60 (1,103)	4,03 (0,429)
Satisfaction in social activities	3,27	3,38

	(1,066)	(1,015)
Satisfaction in educational areas	3,24 (1,130)	3,78 (0,654)
Satisfaction in public transportation facilities	3,20 (1,119)	3,61 (0,974)
Satisfaction places of entertainment	3,15 (1,137)	3,33 (1,101)
Satisfaction in health facilities	3,14 (1,055)	3,73 (0,692)
Satisfaction in accessibility to city center	3,07 (1,068)	3,40 (0,993)

***Table 6** Arithmetic mean and standard deviation values of the satisfaction in various facilities in the residence environment*

	Single-Family GCs	Multi-Family GCs
	Mean/St Deviation	Mean/St Deviation
Family's general safety in the housing area	4,05 (0,813)	3,81 (0,602)
Safety from natural disaters	4,00 (0,879)	3,71 (0,922)
Housing area's safety against traffic accidents	3,98 (0,900)	3,71 (0,836)
Safety from criminals	3,94 (0,960)	3,84 (0,518)
Housing area's protection against fire	3,89 (0,909)	3,77 (0,689)
Safety from robbery	3,89 (0,963)	3,58 (0,848)

***Table 7** Arithmetic mean and standard deviation values of environmental safety*

	Single-Family GCs	Multi-Family GCs
	Mean/St Deviation	Mean/St Deviation
Receiving help from neighbors when necessary	3,92 (0,805)	3,82 (0,819)
Satisfaction in neighborhood relationship	3,90 (0,812)	3,82 (0,799)
Satisfaction in neighbors	3,83 (0,872)	3,78 (0,880)
Sufficient privacy from te neighbours nearby	3,82 (0,869)	3,98 (0,811)
Satisfaction in social relationships	3,79	3,68

	(0,851)	(0,934)
Similarity among inhabitants of the housing area in terms of income level, education and origin	3,77 (0,875)	3,61 (0,870)
Acquaintance with many people in the building and environment	3,72 (0,903)	3,30 (1,048)

***Table 8** Arithmetic mean and standard deviation values of neighbourhood relationship*

	Single-Family GCs	Multi-Family GCs
	Mean/St Deviation	Mean/St Deviation
In general my housing is a good future investment in terms of the area it is situated in	4,03 (0,860)	3,79 (0,941)
This housing estate area looks beautiful	3,85 (0,838)	3,76 (0,737)
This housing estate reflects my income level and career	3,70 (0,950)	3,52 (0,962)
This housing estate area has an interesting appearance	3,11 (1,077)	3,32 (0,984)
In this housing area monotony is prevalent; buildings are all the same	3,00 (1,187)	3,23 (1,211)

***Table 9** Arithmetic mean and standard deviation values of residence environment and economic value*

Factors	Factor Loading	Eigen Value	Explained variance (%)
1. Factor: Satisfaction in open and green areas		5,939	11,6
Satisfaction in open areas	,861		
Satisfaction in green areas	,853		
Satisfaction in traffic roads	,781		
Satisfaction in pedestrian paths	,779		
Satisfaction in walking areas	,748		
Satisfaction in relaxation areas	,728		
Satisfaction in children's playgrounds	,654		
Satisfaction in the scenery	,595		
Satisfaction in the sports centres	,517		
Satisfaction in parking facilities	,502		
2. Factor: Security of residential environment		4,112	8,0
Security against robbery	,808		
Housing area's protection against fire	,783		
Security against natural disasters	,782		
Transportation safety	,780		
Security against criminals	,762		
Family's general safety in the housing area	,647		

3. Factor: Satisfaction in Social and Neighbourhood Relationships		3,145	6,1
Satisfaction in neighbourhood relationships	,921		
Satisfaction in social relationships	835		
Receiving help from neighbours when necessary	,812		
Acquaintance with many people in the building and environment**.**	,792		
4. Factor: Satisfaction in accessibility central facilities		3,112	6,1
Accessibility to various functional areas	,710		
Accessibility to city centre	,698		
Accessibility to relatives and friends	,665		
Accessibility to places of entertainment	,645		
Accessibility to shopping centre	,644		
5. Factor: Propriety to user status		2,776	5,4
This housing estate reflects my income level and career	,787		
Satisfaction in appearance of housing estate	,759		
This housing estate area looks beautiful	,750		
In general my housing is a good future investment in terms of the area it is situated in	,624		
This housing estate area has an interesting appearance	,563		
6. Factor: Accessibility to open areas		2,674	5,2
Accessibility to walking areas	,767		
Accessibility to relaxing areas	,759		
Accessibility to relaxing areas	,708		
Accessibility to parking areas	,594		
7. Factor: Satisfaction in Social and Public Facilities		2,591	5,0
Satisfaction in social activities	,782		
Satisfaction in places of entertainment	,723		
Satisfaction in health facilities	,652		
Satisfaction in educational institutions	,601		
8. Factor: Maintenance of the residential environment		2,344	4,5
Maintenance of open areas is adequate	,851		
Maintenance of green areas is adequate	,831		
In this environment night lighting is adequate	,690		
9. Factor: Accessibility to Educational Institutions		,2,322	4,5
Accessibility to elementary schools	,848		
Accessibility to high schools	,780		
Accessibility to Universities	,687		
10. Factor: Building and Traffic Density		2,160	4,2
This housing area is small with respect to its population	,795		
The buildings are too close to mine	,782		
In this housing area traffic density is high	,756		
11. Factor: Accessibility to health facilities		1,698	3,3
Accessibility to local clinics	,781		

Accessibility to hospital	,696		
12. Factor: Satisfaction in Public Transport		1,520	2,9
Satisfaction in public transport facilities	,711		
Accessibility to bus stops	,711		

Table 10 *Results of the Factor Analysis (Gated Single Family House)*
Extraction method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization KMO: 0,85

3.3. Factor analysis results

Factor analysis method has been applied to the analysis of data's by using the SPSS package program. In the questionnaire form, among factor analysis techniques "Factor Processing Technique" has been applied to the following variables: 51 variables related to user satisfaction of single and multi-family gated communities in housing and its environment.

As a result of factor analysis of single-family sample, factor groups that increase the level of user satisfaction in housing and environmental quality have been specified. The elements influencing these factor groups include satisfaction in open and green areas, security level of the inhabited environment, satisfaction in social and neighbourhood relationships, satisfaction in accessibility to central facilities, propriety to user status, accessibility to open areas, satisfaction in social and public facilities, maintenance of the residential environment, accessibility to educational institutions, building and traffic density, accessibility to health facilities, satisfaction in public areas.

In this research, gated single-family housing users who participated in the questionnaire rated the "satisfaction in open and green areas" the primary factor affecting housing environment satisfaction, which indicates that the standards of green and open areas in gated single-family residences are sufficient in terms of user satisfaction. In Istanbul, the density of housing areas leads to green and open areas' being below standards, which also results in a decrease in quality of life. The most significant reasons of users for choosing especially these housing areas are low density, the high standards of open and green areas, and the easy accessibility to the nearby green areas such as the woods or forests. The proximity of such residences to forested areas explains this situation.

According to the results of factor analysis, being the point of departure for gated residential areas, **"security of residential environment"** has appeared to be the aspect to which gated single-family housing users in Istanbul attach the highest importance.

According to the statistical values presented Table 11, (Multi-family gated communities sample) the elements influencing these factor groups include satisfaction in accessibility central facilities, satisfaction in educational institutions, satisfaction in social and neighbourhood relationships, satisfaction in open areas, satisfaction in health facilities, satisfaction in parking facilities, building and traffic density, security of residential environment, satisfaction in public transport, satisfaction in infrastructure, satisfaction in social and neighbourhood relationships, satisfaction in open areas. "Satisfaction in accessibility to central facilities", and "Satisfaction in educational institutions" as the most important factor groups affecting multi-family GC user satisfaction with the housing environment they live in can only be explained by the fact that these housing areas are closer to all kinds of urban facilities as a result of their proximity to city centers with respect to single-family housing areas. Especially the majority of single-family GCs are located in the peripheral districts in the north of Istanbul. In this respect, they are not directly connected to sea and railway access. Despite the good connection of large-scale multi-family GCs to the city's railway and land public transportation systems, the high rate of car ownership leads to the preference of private car use by high-income groups.

Factors	Factor Loading	Eigen Value	Explained variance (%)
1. Factor: Satisfaction in accessibility central facilities		3,494	9,7
Satisfaction in places of entertainment	,767		
Satisfaction in accessibility to city centre	,762		
Accessibility to places of entertainment	,755		
Accessibility to shopping centre	,684		
Accessibility to various functional areas	,671		
Accessibility to city centre	,594		
2. Factor: Satisfaction in Educational Institutions		2,904	8,0
Accessibility to high schools	,931		
Accessibility to elementary schools	,924		
Satisfaction in educational institutions	,736		
Accessibility to Universities	,682		
3. Factor: Satisfaction in Social and Neighbourhood Relationships		2,800	7,7
Satisfaction in neighbourhood relationships	,966		
Satisfaction in neighbours	,952		
Satisfaction in social relationships	,921		
4. Factor: Satisfaction in Open Areas		2,446	6,7
Satisfaction in walking areas	,834		
Satisfaction in relaxation areas	,808		
Satisfaction in the sports centres	,789		
5. Factor: Satisfaction in health facilities		2,107	5,8
Satisfaction in health facilities	,974		
Accessibility to local clinics	,965		
6. Factor: Satisfaction in parking facilities		2,079	5,7
Satisfaction in parking facilities			
Accessibility to parking areas			
7. Factor: Building and Traffic Density		2,057	5,7
This housing area is small with respect to its population	,873		
The buildings are too close to mine	,821		
In this housing area traffic density is high	,699		
8. Factor: Security of residential environment		1,962	5,4
Family's general safety in the housing area	,825		
Security against natural disasters	,779		
Transportation safety	,719		
9. Factor: Satisfaction in Public Transport		1,843	5,1
Accessibility to bus stops	,828		

Satisfaction in public transport facilities	,732		
Accessibility to relatives and friends	,672		
10. Factor: Satisfaction in infrastructure		1,743	4,8
Satisfaction in infrastructure (water, electricity, natural gas, telephone, cable TV)	,881		
Satisfaction in shopping facilities	,861		
11. Factor: Satisfaction in Social and Neighbourhood Relationships		1,523	4,2
Satisfaction in social activities	,837		
Satisfaction in Social and Neighbourhood Relationships	,779		
12. Factor: Satisfaction in Open Areas		1,491	4,1
Accessibility to relaxing areas	,862		
Satisfaction in children's playgrounds	,574		
Accessibility to walking areas	,510		

Table 11 *Results of the Factor Analysis (Gated Multi Family Houses)*
Extraction method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization KMO: 0,63

4.4. Conclusion

Satisfaction evaluations are frequently required in order to determine the propriety of a residence environment to user expectations, needs and goals. Any evaluation we consider in grand scale is determinant in user satisfaction. In other words, user satisfaction in the residence environment reflects people's response to the environment they live in. The term environment is related not only to the physical components of residence environment consisting of housing, development of the housing area, and neighborhood, but also to social and economic conditions. The findings of this study have ascertained that accessibility to green and open areas, maintenance and quality of the housing area, and security and the variety of facilities are significant to gated community user satisfaction. This result is parallel with the study results by Roitman (2003) and Landman (2000, 2003). According to the results of factor analysis, although there is a ranking difference between the factor groups that single-family and multi-family gated community users give the highest importance in the housing areas they live in, "accessibility to urban facilities", "security", "neighborhood relationships", "user status", and "accessibility to green areas" have been determined to be the issues of significance. The factor analysis results obtained in this study support the "definition of gated residence characteristics" that has been determined in the researches on gated residences in different countries of the world. This study has disclosed the necessity that the factors determining housing and environmental quality satisfaction should be taken into account during the planning process in order to increase user satisfaction in housing and environmental quality. Having considered the factors determining housing and environmental quality satisfaction, it will be possible to plan a more livable and more sustainable city life, which will thus provide higher a level of user satisfaction.

References

Amérigo, M., Aragonés, J.I. (1990). Residential satisfaction in Council Housing. Journal of Environmental Psychology (10), 313-325.

Amérigo, M. (2002). A Psychological Approach to the Study of Residential Satisfaction, In: Aragonés, J. I., Francescato, G. & Garling, T. (ed.), Residential Environments: Choice, Satisfaction, and Behavior, Westport, Bergin&Garvey, 81-99.

Amérigo, M., Aragonés, J. I. (1997). A theretical and methodological approach to the study of residential satisfaction. J. Environ. Psychol. (17), 47-57

Anderson, J., Weidemann, S., Butterfield, D.I. (1983). Using residents' satisfaction to obtain priorities for housing rehabilitation. Renewal, rehabilitation and maintenance. (vol 1), Galva, Sweden: The National Swedish Institute for Building Research.

Atkinson, R., Blandy, S., Flint, J. & D. Lister, (2003). *Gated communities in England*, new Horizons research series, London: ODPM.

Bardo, J. W. & Hughey, J. B. (1984). The structure of community satisfaction in a British and an American community. The Journal of Social Psychology (124), 151-157.

Becker, F. D. (1974). Design for Living: The residents' view of multifamily housing. Ithaca, New York, Center for Urban Development and Research, Cornell University.

Berköz, L. (2008). “İstanbul'da Korunaklı Tek-Aile Konutlarının Yerseçimi Özellikleri“, İTÜ BAP Destekli Araştırma Projesi (pr. No: 31981)

Berköz, L., Eyüboğlu, E. (2007). Intra Metropolitan Location of Producer-service FDI in Istanbul. European Planning Studies 15 (3), 357-381.

Berköz, L. (2006). Sprawling of Single Family Housing in Istanbul, Paper presented at the XXXIV IAHS World Congress-Sustainable Housing Design, Napoli (CD-Rom, Book of Abstracts, pp.210).

Berköz, L., 1994. İstanbul'da Merkezi İş Alanında Hizmet Sektörü Faaliyetlerinin Yerseçimi Özelliklerinin Saptanması. İstanbul, Report for ITU Research Project (in Turkish).

Blakely, E.J. & Snyder, M. G. (1997). *Fortress America: Gated Communities in the United States,* Washington, DC: Brookings Institutions Press.

Caldeira, T. (1996). “Fortified enclaves: the new urban segragation”, *Public Culture*, 8, 303-328.

Calderia, T. & Teresa P.R. (2000). *City of Walls: Crime, Segregation, and Citizenship in São Paulo*, California: University of California Press.

Campell, A., Converse, P.E. & Rodgers, W.L. (1976). The quality of American life New York, Russell Sage Foundation.

Canter, D. & Rees, K. (1982). A multivariate model of housing satisfaction. International Review of Applied Psychology (31) 185-208.

Carvalho, M., George, R. V. and Anthony, K. H. (1990). Residential satisfaction in Condominios Exclusivos (Gate-guarded Neighbourhoods) in Brazil. Environment and Behaviour 29 (6) 734-768.

Christopherson, S. (1994). The fortress city: privatized spaces, consume citizenship. In: Amin, A. (ed.), Post-Fordism: A Reader, Oxford: Blackwell.

Cook, C.C. (1988). Components of Neighborhood Satisfaction: Responses from Urban and Suburban Single-Parent Woman. Environment and Behavior 20 (2), 115-149.

Coy, M. (2006). Gated communities and urban fragmentation in Latin America: the Brazilian experience. GeoJournal (66), 121-132.

Dalkey, N.C. (1972). Studies in the Quality of Life. MA: Delphi and Decision Making Lexington Books.

Deutschman, H. D. (1972). The Residential Location Decision: Study of Residential Mobility. Socio-economic planning Sciences (6), 349-364.

Enosh, N., Leslau, A., Shacham, J. (1984). Residential quality assessment: A conceptual modal and empirical test. Social Indicators Research (14), 453-476.

Francescato, G., Weidemann, S., Anderson, J.R. & Chenoweth, R. (1974). Evaluating residents' satisfaction in housing for low and moderate income families: A multi-method approach. In: D.H. Carson (ed.), Man-Environment interactions: Evaluation and Applications: Environmental Design Research Association, Washington, D.C. (5), 285-296.

Francescato, G., Weidemann, S., Anderson, J.R., Chenoweth, R. (1979). Residents' satisfaction in HUD-assisted housing: Design and management factors. Washington D.C., Office of Policy Development of Housing and Urban Development

Galster, G.C.& Hesser, G.W. (1981). Residential satisfaction: Residential and compositional correlates. Environment and Behavior (13), 735-758.

Garling, T., Friman, M. (2002). A psychological approach to the study of residential choice and satisfaction. In: Aragonés, J. I., Francescato, G. & Garling, T. (ed.) Residential Environments: Choice, Satisfaction, and Behavior, Westport: Bergin & Garvey, 55-80.

Ge, J., Hokao, K. (2006). Research on residential lifestyles in Japanese cities from the viewpoints of residential preferences, residential choice and residential satisfaction. Landscape and Urban Planning (78), 165-178.

Gold, J.R. (1980). *An* Introduction to behavioural geography, Oxford, University Press Oxford.

Gurin, G., Veroff, J., Feld, S. (1960). American View Their Mental Health. New York, Basic Books.

Hourihan, K. (1984). Context-dependent models of residential satisfaction: An analysis of housing groups in Cork, Ireland. Environment and Behavior (16), 369-393.

Jacobs, J. (1961). The Death and Life of Great American Cities. New York, Random House, Inc.

Jirovec, R.L., Jirovec, M.M., Bosse, R. (1985). Residential satisfaction as a function of micro and macro environmental conditions among urban elderly men, Research on Aging 7 (4), 601-616.

Kamp, I.V., Leidelmeijer, K., Marsman, G., Hollander, A. D. (2003). Urban environmental quality and human well-being towards a conceptual framework and demarcation of concepts; a literature study, Landscape Urban Plan. (65), 5-18.

Kellekci, Ö. L., Berköz, L. (2006). Mass Housing: User Satisfaction in Housing and its Environment in İstanbul,Turkey. European Journal of Housing Policy 6 (1), 77-99.

Landman, K. (2000). An international review of gated communities, CSIR Publication, Pretoria.

Lansing, J. B., Marans, R. W., Zehner, R. B. (1970). Planned Residential Environment, Ann Arbor, and Institute for Social Research.

Low, S. M. (2001). The edge and the center: gated communities and the discourse of urban fear. American Anthropologist 103 (1), 45 – 58.

Lawton, M.P., Yaffe, S., (1980). Victimization and fear of crime in elderly public housing tenants. Journal of Gerontology (35), 768-779.

Le Goix, R. (2003). "Gated communities sprawl in Southern California and social segregation?", paper presented at '*Gated Communities: Building Social Division or Safer Communities? Conference* on 18 & 19 September 2003, Glasgow.

Marans, R.W. & Rodgers, S.W. (1975). Toward an understanding of community satisfaction. In: A. Hawley & V. Rock (ed.) Metropolitan America in contemporary perspective. New York, Halstead Press, 299-352.

Marans, R.W. (1979). The Determinants of Neighborhood Quality: An Analysis of the 1976 Annual Housing Survey, U.S. Department of Housing and Urban Development, Housing Survey Studies, 3, U.S. Government Printing Office, Washington.

Marans, R.W., Spreckelmeyer, K. F. (1981). Evaluating Built Environment: A Behavioral Approach. Ann Arbor, University of Michigan.

Marans, R.W. (2003). Understanding environmental quality through quality of life studies: the 2001 DAS and objective indicators. Landscape Urban Plan. (65) 73-83.

Marcuse, P. (1997). "Walls of fear and walls of support" , in N. Ellin (Ed.), *Architecture of fear*, New York: Princeton architectural Press.

McKenzie, E. (1994). *Privatopia: Homeowner Associations and the Rise of Residential Private Government*, New Haven: Yale University Press.

Michelson, W., 1977. Environmental Choice, Human Behavior, and Residential Satisfaction. New York, Oxford University Press.

Mitchell, D. (1995). "The end of public space?", *Annals of the Association of American Geographers,* 85:108 – 133.

Morrissy, E., Handal, P.J. (1981). Characteristics of the residential environment scale: Reliability and differential relationship to neighborhood satisfaction in divergent neighbourhoods. Journal of Community Psychology (9), 125-132.

Newman, O. (1972). Defensible Space. New York, Macmillan.

Perkins, N., 1987. Residents' Perception of Vandalism, Safety, and Maintenance at Four St. Louis Low Income Housing Developments. Master's Thesis, University of Illinois at Urbana-Champaign.

Rent, G.S., Rent, C.S. (1978). Low Income Housing: Factors Related to Residential Satisfaction. Environment and Behavior , 10(4), 459-487.

Roitman, S. (2003). "Who Segregates Whom?" paper presented to the conference on *"Gated Communities: Building Social Division or Safer Communities?*" held at the University of Glasgow.

Savasdisara, T. (1988). Residents' Satisfaction and Neighborhood Characteristics in Japanese Urban Communities. Landscape and Urban Planning (15), 201-210.

Türkoğlu, H.D. (1997). Residents' satisfaction of housing environments: the case of Istanbul: Turkey. Landscape and Urban Planning (39), 55-67.

Webster, C. (2001). "Gated cities of to-morrow", *Town Planning Review* **72**(2) 149 – 170.

Weidemann, S., Anderson, J. R., (1982). Residents' perception of satisfaction and safety: A basis for change in multifamily housing. Environment and Behavior (14), 695-724.

Weidemann, S., Anderson, J. (1985). A Conceptual framework for residential satisfaction. In: Altmann, I., Werner, C., (Ed.) Home Environments. New York, Plenum Press, 153-182.

Wiesenfeld, E. (1992). Public housing evaluation in Venezuela: A case study. Journal of Environmental Psychology (12), 213-223.

Wilson-Doenges, G. (2000). "An exploration of sense of community and fear of crime in gated communities", *Environment and Behavior* 32(5): 597 – 611

Wu, F. (2003). Rediscovering the 'gate' under market transition: from work unit compounds to commodity housing enclaves, paper presented at *'Gated Communities: Building Social Division or Safer Communities? Conference* on 18 & 19 September 2003, Glasgow.

FIGHTING THE DESTRUCTION OF URBAN SPACES THROUGH UNIVERSAL AND ALTERNATIVE DESIGN

Doina Mira Dascalu
IASI Technical University
IASI Romania
doinamira@yahoo.com

Keywords: green spaces, urban landscape, sustainable solutions, Universal Design, regeneration

Abstract

Despite the European Community tendency into creating urban spaces for larger users groups, the destruction of many Romanian urban spaces represent nowadays a chronic and common process. The results of this annihilation are well-known: an emphasis of urban pollution and urban microclimate warming, added to a particular physical, psychic and esthetical urban pollution. In the context of nowadays scientific knowledge in this domain and taken into consideration the necessity of a complex view over the degrading urban landscape problems, a main goal is to conceive sustainable solutions for the regeneration and for the efficiency of degraded-wasted spaces. This could be an answer to the existent critical situation. The impact will be on many directions, focus to enhance the urban comfort degree, the quality of life and the zonal welfare. The efficiency can be obtained elaborating multifunctional urban landscape solutions, using alternative, sustainable and universal design. The simple presence of harmonious design details in the public spaces constitutes a powerful weapon. This presence will give back to the city population an important territorial feeling, creating a new urban awareness. The virtues of design details can educate people, can restore all citizens identity and can restore their responsibility towards the city and its aspects. And, this citizen's restored sense of urban responsibility will constitute a very efficient instrument, because they will be motivated to defence their rights fighting against corruption and disinterest for the comfort of all inhabitant, without discrimination.

Introduction

Being one of the most stringent problems of our cities, the degradation process of urban landscape constitutes an important objective for International and European Sustainable Urban Development Strategies. In the sustainable urban development context, a major goal of the scientific researches is the regeneration, the improvement and restoration of degraded urban landscapes. Related to that, one of the most important measures, for Romanian integration within European politics and strategies for urban landscape protection, was the ratification (by no. 451.08/07/2002 law) of European Landscape Convention, adopted in the year 2000 in Florence. The Landscape Convention represents the expression of a new attitude toward natural and urban landscape, considering the landscape as a major part of human history and culture. This Convention promote the salvage, protection, management and planning of the natural and urban landscape, but also the control of urban landscape transformation and also a valid European cooperation regarding landscape design. Unfortunately and despite these Europeans proposals, the accelerated destruction of many urban spaces, mainly those with plantation and landscape arrangements, in order to build different constructions, became an alarming situation in many Romanians towns.

Existing situations and caution signals

In Romania, the urban rehabilitation solutions focus mainly on the buildings. Many spaces of our towns are waiting to be rehabilitated, designed and transformed, replacing the destructed ones. Many kinds of urban spaces have been destroyed or degraded, spaces as streets, plazas and transition urban spaces. Their environment and their layout were almost entirely subordinated to the needs of traffic. They became mainly utilitarian spaces, often unfriendly and contaminated, loosing the real contact with its inhabitants. As a consequence of the built space and traffic expansion, we are confronted today with a high level of saturation of the constructed areas and, as a result, with a huge waste of public space and pollution. This waste can be translated particularly as waste of public spaces for larger users groups, waste of spatial qualities, waste of urban comfort and waste of urban life quality [1].

Despite the European Community tendency into creating urban spaces for larger users groups, the destruction of many Romanian urban spaces represent nowadays a chronic and common process. Using aggressivety and corruption, avoiding and defying the human rights to urban comfort and a better urban life, many city fathers try to spread fear, creating a pessimistic attitude in order to inhibit the citizen's protests and defence. The destruction of urban spaces could be official or unofficial, a subtle avoidance or an aggressive defiance of the existent urban and landscape lows, being achieved in different degree: starting with urban dereliction and degradation, then a gradual amputation, finishing with total demolition of these spaces. What effect can have the urban spaces destruction, their gradual degeneration, the presence of dirtiness and kitsch at the urban scale?

The main result of this annihilation is the emphasis of urban pollution and urban microclimate warming. Beside this, the aspects of wasted and degraded urban spaces and their architectural and urbanistic layout, are generally full of visual, physical and psychological shocks, creating a particular physical, psychic and esthetical urban pollution [2].

All these aspects, well known to urbanists, are nowadays well known to the municipality's deputies but, despite of this knowledge, the destruction/degradation of urban spaces is ever-growing under their eyes, or worse, with their assent.

For an exploratory research project CNCSIS [3] I have done some urban analysis in my town Iasi (Iassy). I will present two critical situations.

Iasi is an important cultural centre, the capital of Romanian eastern area known as Moldavia. Iasi city has nowadays 450 000 inhabitants and will celebrate this year 600 years since his first historical attestation, in 1408, as an important medieval commercial settlement. During the communist regime many historical areas was demolished, destroying the city personality and identity. Unfortunately, after the 1989 revolution the urban destruction follow on, using other methods, already mentioned. Not only were the old urban spaces destroyed, but also the new ones, in order to build dwellings or business buildings, mainly in the central historical area. As a result of this extinction, the lack of central public spaces creates a stressing zonal atmosphere for the inhabitants. There are national and European founds given for the rehabilitation of destructed or wasted urban spaces. Unfortunately, the results of these investments are only on papers, with small hopes to be materialized. Or, worse, sometime as a result of municipality's disinterest, injudicious design solutions were performed by designers and executants. As a result, not only the destructed spaces, but also some new rehabilitated urban spaces offer many visual, physical and psychological shocks.

In our town, the rehabilitation of two public plazas in the central zone – as municipality's investments – was finalized with flagrant design mistakes of the designers and constructors (Union Plaza and Nation Plaza). They ignored the technical parameters, norms and the simple design details for urban public spaces, with critical consequences over the safety of citizens. I should mention also a complete lack of universal design details, result of a complete disinterest for the comfort of elders and people with special needs. Some examples of dysfunctional design details from these rehabilitated plazas: side-slip urban floor dangerous for the rainy and snowy days circulation (photo 1 and 2); excessive declivity dangerously combined with side-slip urban floor (photo 2); excessive declivity of urban floor leading dangerously from plaza directly to the roadway;bench-stairs (which should be horizontal) having absurd sidelong declivity (photo 3);stylistic dissonance and furniture redundancy – bench in front of sitting places (photo 4 and 5); the lack of trees and a big procent of impermeable floor; the presence of traffic and parking crossing the plaza, carrying away and subordinating to the needs of traffic an important surface of plaza (photo 6).

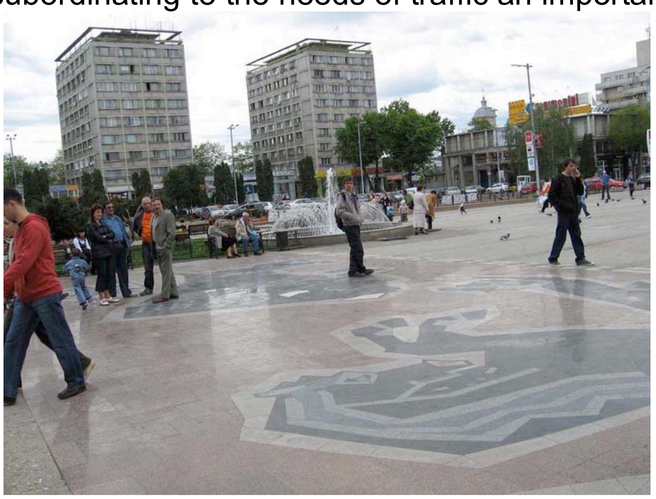


***Photo 1** Union Plaza of Iasi*
Dangerous side-slip urban floor

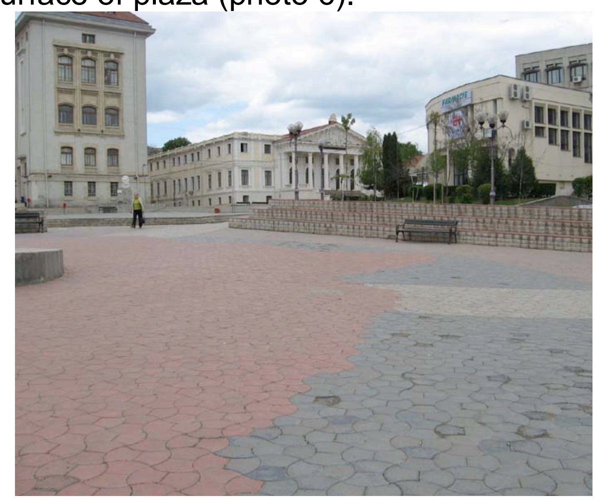


***Photo 2** Nation Plaza of Iasi*
Excessive declivity of side-slip urban floor

***Photo 3** Nation Plaza of Iasi - Bench-stairs with sidelong declivity*

***Photo 4** Nation Plaza of Iasi - Stylistic dissonance and furniture redundancy*

Photo 5 *Union Plaza of Iasi - Parking occupying important surface of plaza*

Photo 6 *Nation Plaza of Iasi - Furniture redundancy*

Beside the urban discomfort and insecurity, the daily presence of these dysfunctional design details inside two central plazas constitute a dangerous inoculation of wrong ideas about urban design in citizen’s mind. Missing the proper information and education in the domain of judicious urban design and landscape arrangements, the inhabitants are not aware of the effects over their safety and sanity, they don’t know about their daily visual pollution. They don’t know that they can and should protest, fighting for their right to urban security and comfort.
The recent destruction of one of the central green square, from the 60’s époque, constitutes another example, related to the municipality corruption. In this case, despite the public protests of the inhabitants (photo 7), the municipality assigns a green square to a hotel of neighbourhood, in order to build a big parking. This green square hardly satisfied the needs of a dwellings complex, having around 180 apartments. The inhabitants of this complex are 75%, elders, which cannot easily walk to other green places to rest and have fresh air. Beside that, on psychological level it is known the attachment of elders to their old residential and public places, which can give them an important territorial feeling, urban identity and self respect. The corruption was obvious from the very beginning of this project: in the urbanism certificate they don’t specify the existing function of the place, it is not specified that the place is an urban green square with landscape arrangements and furniture for relaxation and for children games. An Urgent Government Decree (OUG) 195/2005, ratified through the Low 265/2006 and improved by OUG 114/2007, forbids the destruction of urban green spaces or the changing of this function. The destruction of the square started already, despite the fact that the elders inhabitants arraign in public process the hotel and the municipality and the civil case is not yet finish; they already started to destroy the children games and cut the trees (photo 8).

Photo 7 *Public protests of the elders*

Photo 8 *They already started to destroy children games and cut the trees*

A great interbelic Romanian architect G.M. Cantacuzino stated, in his article entitled „The City of Iasi in Romanian Art": „Under the veil of mediocrity and of burocratic insensitiveness, under the dust of roads and of oblivion, there still is here a treasure that we must cherish all the more as it is unique in its kind in all of the country of Romania...

The time has now come to analyse what we could learn from this city" [4].

And we can add ... *what we could learn from our mistakes...*

Can we fight the destruction of urban spaces using universal and alternative design details?

An urban place is defined by several elements, some of them being urban design details, creating many times important spatial coordinates and volumes of the urban spaces. These elements have, besides their urban functional meaning, a symbolic, historical or cultural meaning, becoming urban landmarks [1]. A comfortable public space should be that one where all the people, with or without special needs, old or young, poor or rich, can meet, can socialize, can enjoy nature and can recharge with energy their bodies, minds and souls.

Since the 80's, the urban psychologist studies revealed the strong connection between the urban landscape layout and aspects and the citizens urban awareness and behaviours [2].

For the urban and personal identity of all the inhabitants, mostly for the elderly people and for people with different abilities or needs, the aspect of their exterior living places and of their neighbourhood is very important. Man's sense of identity is closely related to the image of the places where his personality was formed [2]. These places, ranging from home to district or town, constitute an important part of the urban environment that provides inhabitant's feeling of safety and belonging.

The urban life in the middle of a harmonious and aesthetical urban frame creates gradually a civilized and responsible urban behaviour. Per contra, in the daily presence of urban spaces destruction, of uncomfortable urban design details, in the absence of green spaces, etc., we assist to a degradation of urban behaviours, a degradation of self-confidence and self-respect. Some details become evident: the inhabitant's contribution to the urban dirtiness shows their lack of respect for the urban spaces; the lack of self-respect generates the lack of urban communication desire and the emphasis of agresivity and discriminative urban behaviour, etc.

In this context we can affirm that the simple presence of harmonious design details in the public spaces constitute a powerful weapon [1]. The condition is that the design details should be multifunctional (covering many urban necessities), with proper dimensions and proportions (adapted to all users groups), with an aesthetic image, occupying a judicious place.

This presence will give back to the city population an important territorial feeling, creating a new urban awareness. The virtues of design details can educate people, can restore all citizens' identity and can restore their responsibility towards the city and its aspects. And, this citizen's restored sense of urban responsibility will constitute a very efficient instrument, because they will be motivated to defence their rights fighting against corruption and disinterest for the comfort of all inhabitant, without discrimination [3].

In the context of finding sustainable method to minimize urban spaces loss, the universal design constitute an ideal instrument, contributing to the improvement of urban comfort degree, creating a special environment for all. The universal design can offer very efficient tools for the urban regeneration. The urban space will acquire magnetism and will generate direct social contacts, attracting larger users groups of other areas, bringing together inhabitants with and without special needs, different ages, ethnics, cultures, economical levels, enhancing the quality of their urban life. It will be a favourable place for all inhabitants' communication, whatever being their degree of dependence or their differences. These places will offer proper space for many human activities, will constitute an escape of anonymity and isolation.

From urban morphological and compositional point of view, alternative means not conventional and routine solutions, existent and applied until now [3]. Alternative landscape design can follow the highlight of landscape morphological elements, offering solutions that can be adapted to any specific environment problems, giving multiple efficiency to many urban design details; for example: photos 9, 10 and 11 illustrate how the urban protection of trees or green spaces can have also the function of sitting place. Finally, the presence of design details will contribute also to the re-appropriation of the degraded urban spaces.

***Photo 9** Multifunctionality*

***Photo10** Multifunctionality*

Photo 11 *Multifunctionality*

Judicious solutions for a complex approach of the urban spaces degradation impose interdisciplinary researches. The interdisciplinary researches can contribute, on a preventive level, to the protection of the urban environment against the degradation, and on a curative level, to the regeneration-efficiency of the areas. The design details should be judiciously chosen and adapted to the problems of each wasted urban area. The projects wanting to solve the problems of wasted urban spaces should have some specific objectives, as following [3]:

1. General typological analysis:
1. a. the identification and analysis of the general characteristics specific to different types of wasted urban areas;
1. b. the identification and analysis of the urban space's types of degradation and of the natural environment elements as well as of the build environment present in the degraded areas.
2. The evaluation of the characteristics and necessities of the studied town's wasted areas.
3. The evaluation of the landscape conventional compositions and solutions, used in the existing urban areas.
4. Specific studies and analysis, regarding the sustainable attributes of all the morphological landscape elements, in order to conceive alternative solutions.
5. The identification and the conception of specific alternative and universal design details, integrated to the existing landscape.
6. The conception of multifunctional compositional solutions, for the analyzed types of degradation, adapted to the investigated zonal typological characteristics.
7. The identification of the possibilities to apply solutions in some pilot area and the elaboration of a pilot project.
8. The identification of the possibilities for generalized application of the proposed solutions and the perspective problems.
9. The dissemination and capitalization of the made researches and results.

Conclusions

The alternative and universal solutions of regeneration will contribute to the quality of life in many ways and will bring benefits on multiple levels: urban, economic-utilitarian, sanogen, social, cultural, forming-instructive, scientific, recreational, decorative-aesthetic [3].

The urban, utilitarian-economical and social impact - The proposed solutions will assure the efficiency of the urban regeneration process, will eliminate the urban dysfunctions through multifunctional solutions adapted to the zonal identified necessities; thus new jobs will be created; the quality of life shall improve as well as the level of comfort of the urban space, the quality of the human behaviour will also improve in the new urban environment. The solutions will have important impact in the context of the relation between social communities and landscape settlements, the impact envisaging the improvement of the civic sense and the affiliation feeling. Through the universal design it is followed the development of the interhuman communication, beyond barriers and accessibility for all.

The impact over the environment – The solutions will have a sanogen effect, reducing and eliminating pollution, improving the zonal microclimate, offering protection and enhancing the quality of all the surrounding landscape elements; also will offer the improvement of the urban decisions regarding the sustainable use of the regenerated areas. It will promote also the consumption of green energy through innovative alternative solutions.

The cultural, instructive-formative, recreational and decorative aesthetic impact – Landscaping solutions will be created for active and attractive spaces, for spare time recreation, multifunctional spaces equipped for recreation as well as for culture and instructive-formative education of the inhabitants, taking an active roll in the development of human creativity. There will be created and selected solutions so that the landscape regeneration will improve the urban aesthetic aspects, having as effect the growth of the urban comfort level and the quality of life. The solutions will promote the urban culture of the respect towards the nature and the urban spaces.

References

1.Doina Mira Dascalu, 2006, "Peisagistica: o posibilă terapie pentru problemele mileniului al III-lea" (Landscape Architecture: possible therapy for the III Millennium problems), Iaşi, Editura Societății Academice "Matei - Teiu Botez", (in Romanian)

2. Broadbent Geoffrey, Bunt Richard, Llorens Thomas, 1980, Meaning and behaviour in the built environment, John Wiley & Sons, Chichester-New York-Toronto.

3. Doina Mira Dascalu, 2008, Urban analysis for CNCSIS Exploratory Research Project: "Urban regeneration through alternative and universal design proposals".

4. Cantacuzino G. M., 1977, Arcade, firide şi lespezi, Ed. Eminescu, Bucureşti, (in Romanian)

5. Doina Mira Dascalu, 2007, Landscape architecture offer in industrial patrimony rehabilitation, Proceedings of 5th International Conference and workshop on Industrial Archaeology, Ed. Ministry of Culture and Culet-Department of Historical Monuments, Bucharest.

CIB W084
"Building Comfortable and Liveable Environments for All" International Meeting
"Universal Design At The Urban Scale"
Georgia Tech University, Atlanta, USA
15-16 May 2008

SOCIAL SERVICE FOR ELDERLY PEOPLE BY UTILIZING EXISTING FACILITY CASE STUDY IN KOUSA TOWN IN KUMAMOTO

Kazuhisa IKI
Professor, Dr. Eng, Graduate School of Science & Technology,
Kumamoto University, Japan
e-mail: iki@arch.kumamoto-u.ac.jp

Riken HOMMA
Associate Professor, Dr. Eng., Research Center for Higher Education,
Kumamoto University, Japan
e-mail: homma@ge.kumamoto-u.ac.jp

Keywords: Aging society, Social service, Existing facilities, NPO, GIS

Abstract

Because of recent sagging economy and increasing elderly population, most of all local governments in Japan require efficient service providing method for elderly with spending fewer budgets. The purpose of this study is to propose social service providing method to elderly people by utilizing existing facilities such as district public halls, district meetinghouses, private vacant houses and vacant commercial facilities. These existing facilities are evaluated in their usability by accessibility, parking space, floor size and other conditions by using GIS. Services for elderly people are classified into four levels as for household, for district, for village and for whole town. Elderly people can take various kinds of and scale on social services near their house. Organizations of facility management and service providing operation are also proposed by the combination of public organizations and NPOs (Non Profitable Organization). The proposed method was examined by the case study in Kousa town, typical local town in the countryside of Kumamoto prefecture located near Kumamoto city. Kousa town has 12,000 populations with 57.9km2 area and 20% grand is forest. Elderly ratio over age 65 is 29.2% in 2005. Major industry is farming but most labors are working in Kumamoto city. Local government staffs and existing NPOs' staffs evaluated the proposed methods and their effectiveness and possibility were admitted. By utilizing existing facilities, we will be able to spend fewer budgets for providing social services compared to build new facilities. And also we can avoid that vacant houses become local negative legacy without proper maintenance.

1 Introduction

The elderly ratio over age 65 becomes 20.1% in Japan at 2007 and estimated 25% at 2015, 33% at 2050. And increasing elderly population with their social cost becomes a large burden to the national and local governments budget. Japanese government introduces social insurance for elderly care by the age over 40 people at 2000 to overcome this shortage of social care cost.

On the other hand, more than 80% of elderly people do not require any care and independently living in their home. Japanese government expressed "Gold Plan 21" at 1999 for promoting to increase independently living elderly people and to provide social care at their home. We have to keep these healthy elderly people's activity with providing social services by the local governments. Local governments are providing several social services such as weekly elderly peoples meeting with meals, home visiting services etc., and most of all local government established silver job center for active elderly people. In this situation,

because of recent sagging economy, most of all local governments in Japan require efficient service providing method for elderly with spending fewer budgets.
To correspond to this requirement, Kumamoto University conducted a university wide project named "Town Planning for Elderly People" with Kumamoto prefecture and Japanese Red cross Kumamoto. The Ministry of Education, Culture, Sports, Science and Technology financed this project. The purpose of this budget is to support the local national university making assistance to the local government policy devise. We established six special interest groups in our university as follows.

1) Local demography, agriculture and industry
2) Conservation of natural environment and creation of information society
3) Local welfare, medical treatment and public insurance
4) Local education and culture
5) Local habitation and living environment
6) Local government policy devise

Each group was consisted by some department professors in our university. Whole group readers, from No. 1 to No. 5, conducted the theme No. 6. The research introduced in this paper was conducted by the No. 5 group, mainly consisted by the staffs of the department of architecture and department of education.
The purpose of this study is to propose social service providing method to elderly people by utilizing existing facilities such as district public halls, district meeting houses, private vacant houses and vacant commercial facilities. Providing services for elderly people are classified into four levels as for household, for district, for village and for whole town. Elderly people can take various kinds of and scale on social services near their house. The proposed method was examined by the case study in the Kousa town of Kumamoto prefecture.

2 Introduction of the Kousa town

Kousa town is a typical local town in the countryside of Kumamoto prefecture located near Kumamoto city. Kousa town was established in 1955 merged by 5 villages, Kousa, Miyauchi, Otome, Shirahara and Tatsuno. So that current Kousa town's community unit under whole town is consisted by 5 villages. There are 5 elementary schools as each village community center. Characteristics of each village are as follows.

1) Kousa: Central part of Kousa town with flat land and may governmental, social, commercial and housing facilities.
2) Miyauchi: Mountain area with highly slope, few commercial and housing facilities.
3) Otome: Entrance area of Kousa town with flat farming land and housing facilities like Shirahata.
4) Shirahata: Entrance area of Kousa town with flat farming land and housing facilities like Otome.
5) Tatsuno: Hilly and mountain area with few commercial and housing facilities.

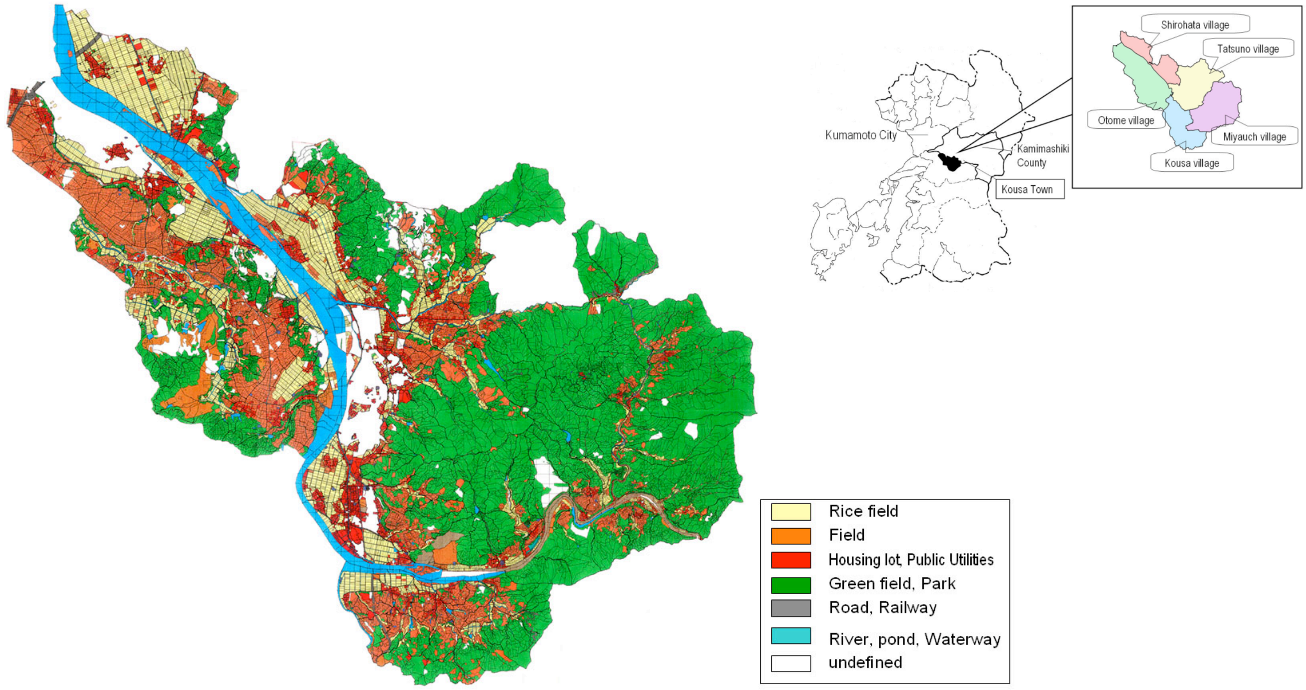


Figure 2.1 *Location of the Kousa town and subdivision of 5 villages and Land use*

Kousa town has 12,000 populations with 57.9km2 area and 20% grand is forest. Elderly ratio over age 65 is 29.2% in 2005. Major industry is agriculture but most labors are working in Kumamoto city. Figure 2.1 shows the location of the Kousa town and subdivision of 5 villages and the land use of Kousa town. Figure 2.2 shows the population by each age in Kousa town and distribution of elderly people and commercial facilities are shown in Figure 2.3.

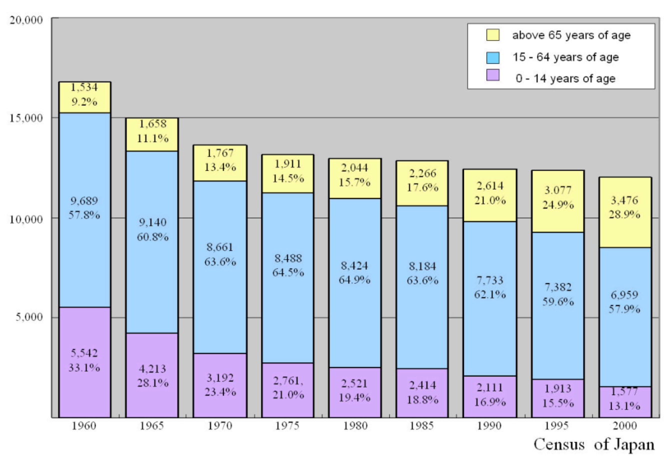


Figure 2.2 *Population by each age in Kousa town*

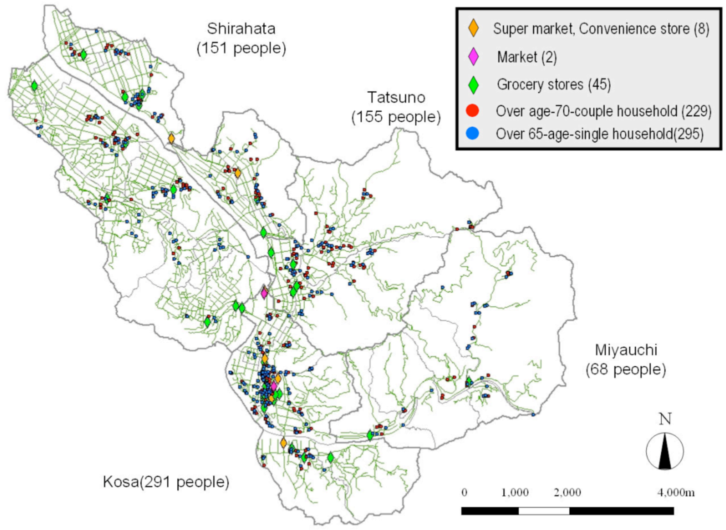


Figure 2.3 *Distribution of elderly people and commercial facilities*

3 Survey on the demand of elderly people

We made two kinds of survey on the demand of elderly people in Kousa town. First one was the investigation on daily living environment, their own healthy and communication among neighbors of elderly people. Social welfare commissioners visited each elderly home and made inquiry by interview. Examination was made by the inquiry for all elderly households partly over age 70 couple and over age 65 single living elderly. Total numbers of subjects were 524 households. Table 3.1 shows attributes of subjects.

The second one was the Focus Group Interview (FGI) on the demand of daily life for elderly. FGI is an inquiry method by group discussion with concerning members. Interview is taken by free talking of members and chairperson conduct talking topics is not going out of the concerning theme. FGI has following characteristics as group members' synergy for each others talking idea, snowballing triggered by one talking idea with other member and discovery of new idea not expected before interview. We made seven times FGI shown in Kousa town.

Type	Sex	Miyauchi	Tatsuno	Kousa	Otome	Shirahata	Total
Single	M	5	3	12	5	4	29
	F	21	46	85	49	47	248
	NA	0	0	15	3	0	18
Couple	M	20	53	61	42	50	226
	F	21	53	65	42	50	231
	NA	1	0	4	0	0	5

Table 3.1 *Attributes of subjects*

	date	Subject	Number of subjects
1st FGI	Feb.18.2003, 10:30 – 11:30	Miyauchi elderly	9
2nd FGI	Mar.4.2003, 13:30 – 15:00	Kousa social service volunteer	7
3rd FGI	Jul.30.2003, 9:30 – 11:30	Shirohata health promotion committee	6
4th FGI	Jul.30.2003, 13:30 – 15:30	Otome health promotion committee	10
5th FGI	Aug.19.2003, 9:30 – 11:30	Miyauchi health promotion committee	9
6th FGI	Aug.19.2003, 13:30 – 15:30	Kousa health promotion committee	8
7th FGI	Aug.22.2003, 13:30 – 15:30	Tatsuno health promotion committee	6

***Table 3.2** Profile of FGI*

Shirahata	Communication of Neighbors / Communication to the Children
Tatsuno	Physical Training / Communication of Neighbors / Farming Place
Miyauchi	Elderly Care / Communication of Neighbors
Otome	Elderly Care / Stay Home for Elderly / Farming Place
Kousa	Not surveying

***Table 3.3** Major demand in each village*

4 Selection of existing facilities and proposal of operating organization

We proposed social service providing method to elderly people by utilizing existing facilities such as district public halls, district meetinghouses, private vacant houses and vacant commercial facilities. These existing facilities are evaluated in their usability by accessibility, parking space, floor size and other conditions by using GIS. Table 4.1 shows the required conditions for existing facilities and the distribution of district public halls and vacant houses.

Services for elderly people are classified into four levels as for household, for district, for village and for whole town. Elderly people can take various kinds of and scale on social services near their house.

Evaluation item	Required condition
Connecting road width	over 2.5m
Total floor area	over 140m2
Parking lots	more than 2 lots
Desirable outside facilities	Garden, Vegetable garden etc.
Desirable inhouse facilities	Kitchen, large room, etc

***Table 4.1** Required conditions for existing facilities*

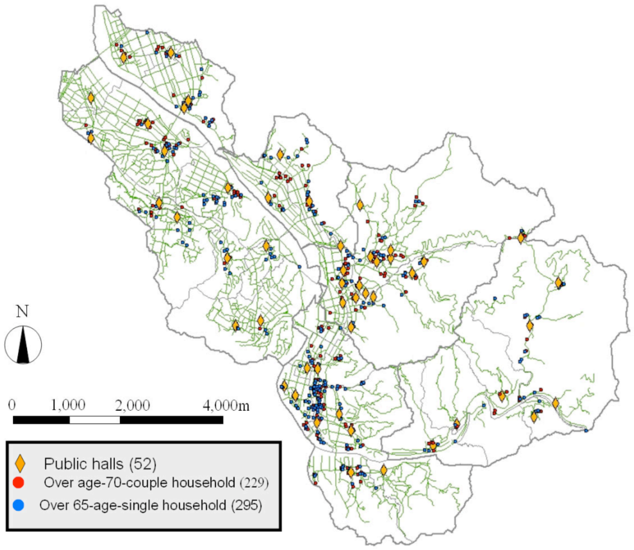


Figure 4.1 *Distribution of district public halls*

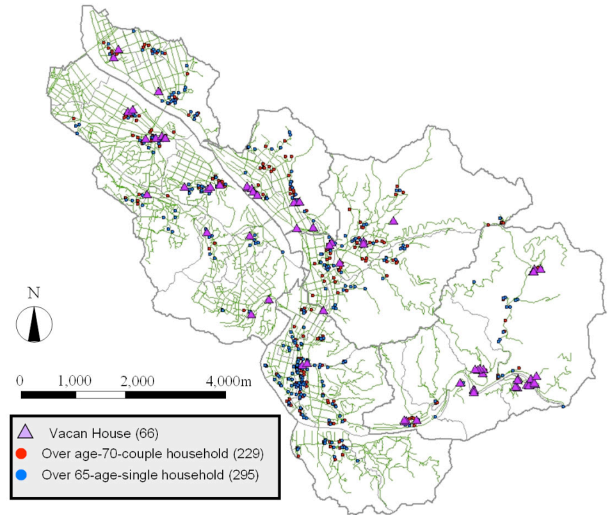


Figure 4.2 *Distribution of vacant houses*

Organizations of facility management and service providing operation are also proposed by combination of public organizations and NPOs (Non Profitable Organization). Figure 4.3 shows the selected vacant houses in Shirahata village for providing household level social services and the proposed operating organization for these houses is shown in Figure 4.4.

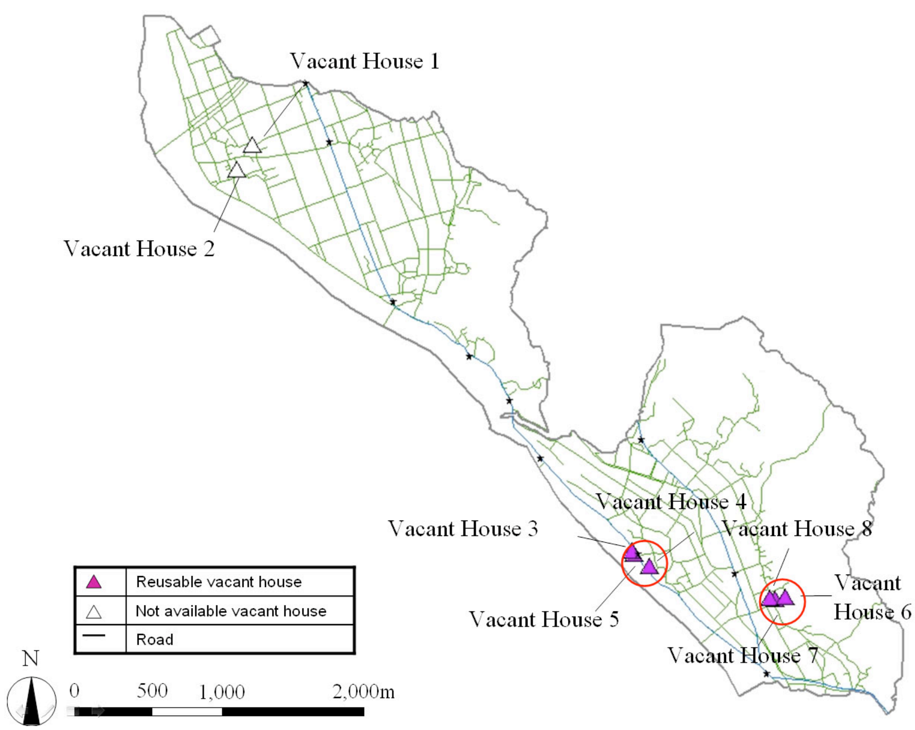


Figure 4.3 *Selected vacant houses in Shirahata village*

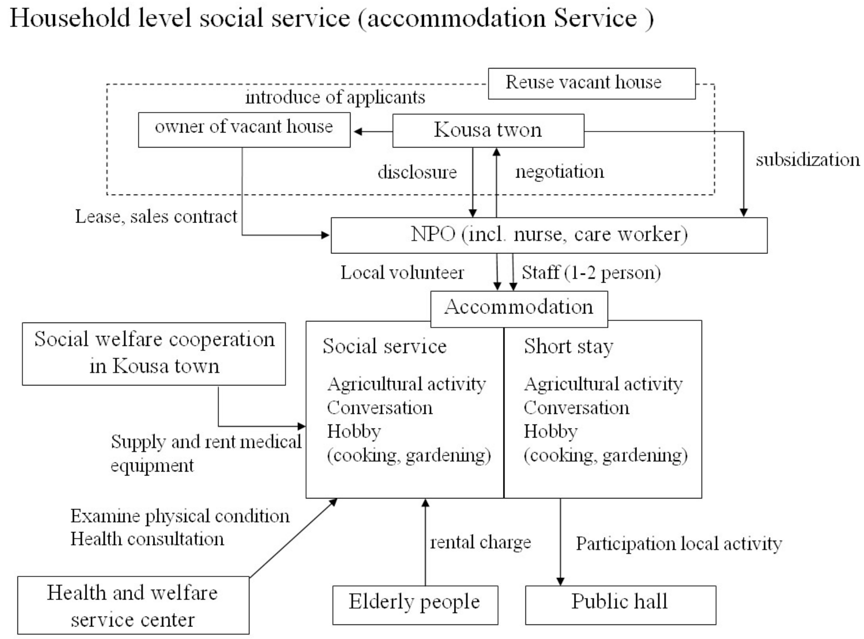


Figure 4.4 *Proposed operating organization for vacant houses in Shirahata village*

Figure 4.5 shows the selected district public hall in Otome village for providing village wide level social services and the proposed operating organization for these public halls is shown in Figure 4.6.

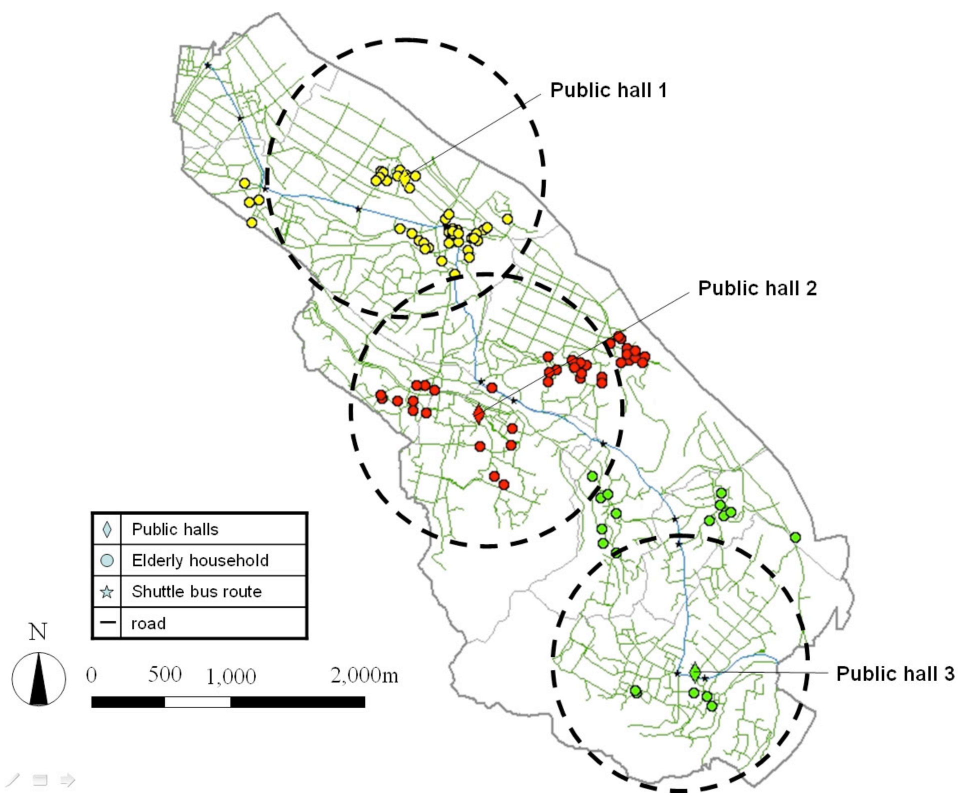


Figure 4.5 *Selected district public hall in Otome village*

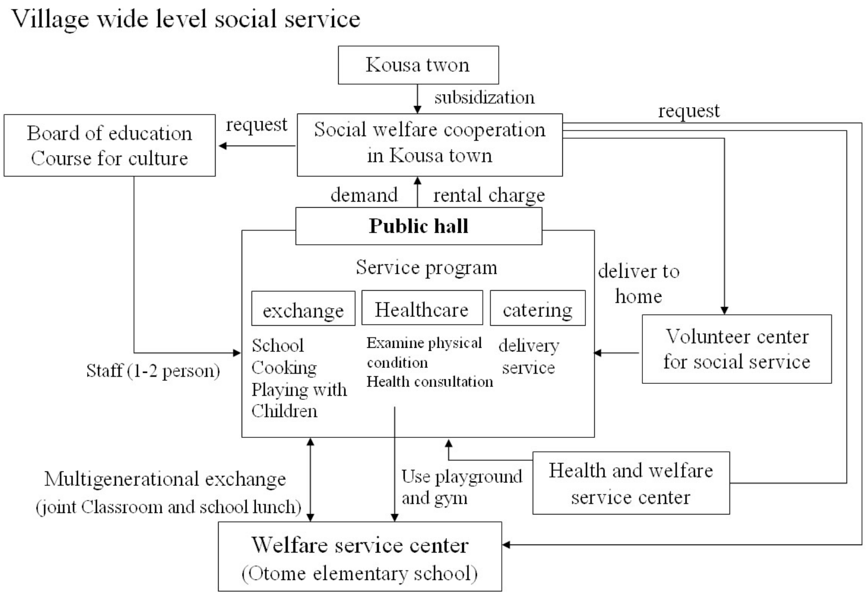


Figure 4.6 *Proposed operating organization for district public hall in Otome village*

5 Conclusion

In this study, we proposed social service providing method for elderly people by utilizing existing district public halls, district meeting houses and private vacant houses. These existing facilities are evaluated in their usability by accessibility, parking space, floor size and other conditions by using GIS. Social services for elderly people are classified into four levels as for household, for district, for village and for whole town. Organizations of facility management and service providing operation are also proposed by the combination of public organizations and NPOs (Non Profitable Organization).
The proposed method was examined by the case study in Kousa town, typical local town in the countryside of Kumamoto prefecture located near Kumamoto city. Local government staffs and existing NPOs' staffs evaluated the proposed methods, and their effectiveness and possibility were admitted.
By utilizing existing facilities, we will be able to spend fewer budgets for providing social services compared to build new facilities. And also we can avoid that vacant houses become local negative legacy without proper maintenance. They will be hazardous with passing time. Classified distribution of social services is efficient way for several groups of elderly peoples compared to traditional service providing method. Elderly people can take various kinds of and scale on social services near their houses.
We have to make further evaluation of reduced cost comparison between traditional way and proposed method including operation organization cost.
We express special thanks to staffs of the Kousa town, NPOs in Kousa town and cooperated FGI elderly people in Kousa town. We hope that the results of this study will contribute to increase elderly people's welfare and the QOL (Quality Of Life).

References

Homma, Iki et al, 2005, Survey on erderly people's demmands for facilities – Town planning for erderly people in Kousa town 2 -, Summeries of Technical Papers of Annual Meeting, Architectural Institute of Japan, vol F1, pp463-464

Iki, Homma et al, 2005, Evaluation method for utilising exisiting facilities – Town planning for erderly people in Kousa town 3 -, Summeries of Technical Papers of Annual Meeting, Architectural Institute of Japan, vol F1, pp465-466

Homma, Iki et al, 2005, Operation organization of exisiting facilities – Town planning for erderly people in Kousa town 2 -, Summeries of Technical Papers of Annual Meeting, Architectural Institute of Japan, vol F1, pp467-468

GATED RESIDENTIAL AREAS IN ISTANBUL: PRIVATE CARS VERSUS PUBLIC TRANSPORT SYSTEMS

Prof. Dr. Lale Berköz
Istanbul Technical University
Faculty of Architecture
Department of Urban and Regional Planning
Istanbul/Turkey
e-mail: lberkoz@itu.edu.tr
e-mail:lberkoz@gmail.com

Emre Tepe
(urban planner)
Tuzla Municipality, 34945,
Tuzla, Istanbul
e-mail:emre.tepe@gmail.com

Keywords: gated residential communities, accessibility, Istanbul

Abstract
The past half-decade has seen a growing academic interest in the worldwide trend towards the spreading gated housing areas in the edge of metropolitan areas. This type of development can be found in every large metropolitan area in the world. Therefore after 1980s multi-family and single-family gated communities started to spread out all around Istanbul.
The emergence of gated communities depends on several reasons and they have a lot of consequences on urban socioeconomic and spatial structures. Living in gated residential areas continues largely to be a privilege of the wealthier urban residents. Thus, the emergence of gated neighborhoods should be interpreted as a product of increased socioeconomic disparities in urban society (Coy, 2006).
This study was conducted to determine accessibility and currently preferred transport modes by comparing multi-family and single-family gated communities. In order to determine this, locations, relations with roads, railways, seaways and also focusing on availability of these communities to public transport systems were investigated. In addition to that characteristics of residents of gated communities were taken in hand. Residents who live in single-family gated communities mainly prefer to use their own private cars for going somewhere and also their locations have limited available public transport systems. On the other hand people who live in multi-family gated communities commonly tendency to use public transport systems versus private cars. As a result of this study it can be assumed that single-family gated communities also increase the appearance of suburban car-based residential sprawl, leading to longer commuter journeys and congestion.

1. Introduction
The Istanbul metropolitan area is Turkey's principal metropolitan agglomeration with a population of slightly more than 10 million inhabitants in 2000.
Istanbul has received the highest interregional migration. When the national total rate of economically active population is considered, Istanbul's share increased from 10.86% in 1990 to 6.03% in 2000. In 1990 Istanbul held 22.24% of nonagricultural employment in Turkey, this rate slightly decreased to 22% in 2000, roughly corresponding to one fifth of Turkey's nonagricultural employment. In the same year, 32.2% of Turkey's labor force in manufacturing industry, and 53.3% of in-service industry was employed in Istanbul.

As a result of agricultural mechanization and industrialization efforts, Istanbul attracted a high amount of rural-urban migration during 1950s. Istanbul is located at the centre of transportation networks extending into several countries and regions, offers a great variety of job opportunities and provides social and technical means of infrastructure at high levels. These have all affected the mass migration from rural-to-urban. The net migration rate of Istanbul has been accelerating. This percentage was 79 %0 in the period between 1975-80 and 99%0 in the period between 1985-90. While the population increase rate was 4,09% in 1960, it raised by 4,48% in 1990 (DİE, 1998). Istanbul's population increase rate is at high levels due to the reason that there is a high level of rural-urban migration.

Squatter settlements have been developed rapidly and formed around industrial areas. Newcomers live those areas and are employed in the industrial firms. Today 27% of Istanbul's population inhabit in the squatter areas (İ.B.B.P.İ.D.B.Ş.P.M., 1995). The main reasons of the uncontrolled residential development of Istanbul are migration from rural areas and the increase of squatters promoted by continuous reconstruction pardons.

The increase in house demand, parallel to the rapid population growth, has augmented the pressure on local and central authorities. Private entrepreneurs provide a lot of alternatives in order to solve this problem: Mass housing areas (single-family and multi-family gated Communities) and residants. People from high-income groups show a tendency to live in Single-Family and Multi-family gated communities, because these communities provide high-standard urban services to their residents.

2. The rise of Gated Community Sprawl in Istanbul

When the residential developments in Istanbul in different periods are evaluated, it is seen that there have been results other that the planned. The change of the constructed areas and population on both sides of Istanbul metropolitan area between 1955 and 1993 are assessed in Tezer and Gülersoy's study (1996). The population increased by 366% on the Asian side, by 114% on the European side and by 280% in total between 1955 and 1975. The population increased 170% on the Asian side, by 56% on the European side and 85% in total. As it is seen in the table the increase rate of the population between 1955-1990 on the Asian Side is more than that of the European side.

Moreover, the increase rate in the constructed areas between 1955-1975 is 131% on the Asian side and 114% on the European side whereas it is 121% in the total area. Between 1975-1993 that ratio is 257% for the Asian side, 200% for the European side and 226% for the total area. Like the case of population, the increase rate of the constructed areas is more on the Asian side (Tezer, Zeren Gülersoy, 1996). The drastic built-up area development occurred after mid 1980's not only east-west direction but also north-south direction in Istanbul (Figure 1, Tezer, 2004).

Since 1990 residential areas have expanded toward the land side of the city, following the highways connected to the first and the second Bosphorus Bridges. Therefore, sprawling primarily began in the areas between this route and the coastline, gradually spreading toward drinking water basins in the north (Berköz, 2008).

In the 1990's, heterogeneous housing areas inside the city started losing popularity among the urban elite class, who instead showed a tendency towards isolated and homogenous areas far from Istanbul's density. This tendency has resulted in the rapid growth of mass housing areas in the urban peripheries, which include a life style enabling the expectations of living with families at the same cultural and income level and which consist of less dense single-family housings (Berköz, 2008).

Big pieces of land on the urban peripheries that enable the development of such homogenous housing areas and low prices of land are the reasons for the desirability of these areas in the bosom of nature, which meet the demands of high-income groups. The demand on the northern and north-eastern parts of the city in the aftermath of the 1999 earthquake in Istanbul has also enhanced this phenomenon. Safety, social comfort and villa-type walls are the general characteristics of these communities.

As a result, new residences started to spread around the peripheries in Istanbul, whose developmental features complied with the expectations of life shared by families of the same cultural background and income level. These communities were equipped with special amenities such as large variety of leisure activities, higher building standards and high-quality neighbourhood environmental infrastructures. Neighbourhood environmental structures include high-quality roads, walkways and landscapes, false-gated entrance pillars, luxurious street furniture, pocket open spaces. Encouraging car-ownership and use, gated communities have various consequences: congestion and pollution at considerable levels, and a decrease in a sustainable public transport system are two examples of these consequences. They also increase the appearance of suburban car-based residential sprawl, leading to longer commute and congestion (Berköz, 2006).

In his "The Process of Spatial Segmentation" Perouse, J.P. (2003) highlights that there are about 4000 gated residential areas in Istanbul inhabited by 60-70 thousand people. Gated residential areas constructed after 2000 have expanded to 30-million m2 area (Coliers Rescoe, 2003). Gated communities are implemented by 5 institutions: Cooperatives, Mass Housing Administration, Local Administrations, Private Entrepreneurs, and Türkiye Emlak Bank (specialized in real estate).

99 single-family gated communities have been detected within the scope of this study. There are 10.366 housing units in these communities. Most of the GCs in Istanbul (83.8 %) were constructed after 1990 (See Figure 2).

The highest number of GCs is in Sarıyer, Beykoz and B.Çekmece districts which bear communities constructed after 1990. 19.2% of 99 single family GCs are in central districts, while 80.8% are in the peripheral ones. In terms of housing units, 8.5% are in central districts and 91.5% in the peripheral ones (Berköz, 2008). The single-family housings were settled in the vacant fields in the central districts before the 80's (Figure 2), the saturation of city centers with growth, and related to this, the increase in the value of lands have lead GCs to settle in the empty and inexpensive lands in urban peripheries (Berköz, 2008) (Figure 3).

48.5% of GCs in Istanbul accumulate around the districts of Sarıyer, Beykoz and B.Çekmece, which bear the highest number of such communities. Sarıyer and Beykoz districts are situated in the north-western and north-eastern parts of Istanbul, which have the most expensive land prices in Istanbul. Moreover, compared to other districts, the total number of housing units in the above-mentioned ones is very high. 78.2% of the total housing units of GCs in Istanbul are in these districts.

3. Transport Demand of Gated Communities

Single-family and multi-family GCs are the primary sources raising great transport demand in the metropolitan area. Both single-family and multi-family GC user characteristics will be evaluated so as to have a deep understanding of this demand.

The data was collected by a questionnaire survey selected through a systematic random sampling in Istanbul. In the scope of this study 802 questionnaires were responded in face to face interviews in single-family and multi-family residential areas in Istanbul (Berköz, 2008) (Kellekci and Berköz, 2006). Within the scope of this study, 401 surveys have been conducted in 9 multi-family GCs, and 401 in 99 single-family GCs. Approximately 502,300 people inhabit the 9 multi-family GCs, while 34,208 live in the 99 single-family GCs.

When we consider the population, area, and population density in GCs, within the scope of this study we see commonly that the single-family GCs consist of a combination of a few neighborhood units. 88% of the 99 single-family GCs surveyed in this study inhabit housing areas below 20 hectares (the smallest is 0.38 Ha, and the largest 228). In terms of population, there are 42 residential areas whose total population does not exceed 100 people (the lowest population is 13, while the highest is 14,520 people). When population density is considered, it is seen that these settlements generally consist of detached buildings of 2 and 3 stories, which in return leads to low population density in these areas. The average population density is 58 persons/Ha with 352 persons/Ha the highest and 13 person /Ha the lowest.

On the other hand, multi-family GCs are usually seen in wide areas with sheltering dense populations in high-storey buildings. The minimum size of residential area is 45Ha, while the maximum size is 900 Ha. When population size is taken into account, multi-family GCs are observed to provide settlement opportunities for a population of over 10,000. This leads to the dense use of areas. The average population density is 272 persons/Ha (minimum 195 person/Ha and maximum 600 persons/Ha).

The average size of household members is close in the two samples with 3.26 in multi-family GCs and 3.3 in single-family GCs.

Comparing the two GCs in terms of education level, it is seen that in single-family GCs 58% of the household leaders and 45% of their partners are university graduates; besides, 14.5% of the houselhold leaders and 6.3% of their partners have completed a graduate program. On the other hand, 32% of the household leaders in multi-family GCs and 25% of their partners are university graduates.

When users' income level is evaluated, it is seen that 14% of single-family GC users belong to high-income group and 44.5% to middle-high income group, while 16% of multi-family GC users belong to high-income group and 36.9% to middle-high income group. These figures are also verified by high sale rates and high housing ownership rates in the studied areas. (House ownership rate in single family GCs is 82.8% and in multi-family GCs 50.4%).

When working rates and work areas of gated community users, who generally hold nuclear family structure, are evaluated, both samples are observed to possess close values. In single-family GCs, 88.5% of the household leaders, 37.5% of their wives, and 22% of the firstborns work. In multi-family GCs, 88.4% of the household leaders, 43% of their wives, and 21.9% of the firstborns work. When the work fields are considered, 85.6% of the household leaders and 47.9% of their wives in single-family GCs, and 85.6% of the household leaders and 47.9% of their wives in multi-family GCs have been determined to work in service sector jobs.

It is seen that the majority of the population in the sample areas is working. In the survey studies, in response to the question inquiring about "accessibility to work", 46.9% of the inhabitants in single-family housings have said "easy", while 25.9% have assessed the accessibility to be "difficult". On the other hand, 83.8% of multi-family GC users have responded "easy", while 16.4% have given the answer "difficult". As a result, we can remark that house-work commute for single-family GC inhabitants are often long and proceed towards the city center, for these housings are generally constructed in the peripheral districts of Istanbul. In addition to the demand of easy travel, another significant issue is car ownership. According to the survey results, in single-family housings, 31.9% of the inhabitants own 1 car, 47.9% own 2 cars, and 16.5% own more than 2 (which mean that the average number of cars per household is 1.77 at minimum). In multi-family GCs, however, the rate of car ownership is slightly lower with 50.2% owning 1 car, 22.4% 2 cars, and 4.2% more than 2 (which mean that the average number of cars per household is 1.07 at minimum).

4. Transport Infrastructure and Accessibilities of Gated Communities

Along with accessibility, the connection between gated communities and the available transportation infrastructure that would address to their access demand are the most important elements influencing the transport choices of these areas. Within the scope of this study, the connections between GCs and the main land transportation arteries, active piers of sea transport which each of these is a terminal point, and railways have been inquired. In order to assess this connection, the closest geometric distance between each housing area and the related infrastructure unit has been calculated.

4.1. Accessibility of Gated Communities to the Nearest Freeways and Highways

In Tables 2 and 3 the closest distance of the 99 single-family housings and the 9 housing areas that we have determined to the freeway (TEM) and highway (E5), which are the main transportation arteries, has been calculated. When we look at Table 2, it is seen that the single-family housings that are constructed closest to the highway are in Avcılar, and those that are farthest are in Sarıyer district. When their connection to the freeway is considered, the closest district is Pendik, while the farthest is Sarıyer. When the situation with multi-family GCs is regarded, which is demonstrated in Table 3, the closest district to the highway is Bakırköy, and the farthest is Küçükçekmece. As for their connection to the freeway, the closest district is Kadıköy, while the farthest is Bakırköy.

As a result of this study, the average distance of the single-family GCs that have been studied throughout Istanbul to the highway is 7560 meters, and their average closest distance to the freeway is 5275 meters. On the other hand, the distance of multi-family GCs to the highway is 3936 meters and to the freeway is 4468 meters. Single-Family GCs have been constructed far from the highway, closer to the Freeway, while multi-family GCs have preferred to be closer to the Highway, and thus have been constructed along the this road; there are also some settlements on the crossroads closer to the freeway.

4.2. Accessibility of Gated Communities to the Nearest Piers

Tables 4 and 5 demonstrate the closest distance between the gated communities within the scope of this study and active piers. As it is shown in figure 5, GCs' connection to sea transport is available in most districts. However, the distance between GCs and active piers is more than walking distance; for this reason, pedestrian accessibility is not possible. Transportation change is necessary between the piers and settlements. Accessibility to active piers in gated communities in the most of the districts except Çatalca, Eyüp, Ümraniye and Kartal can be assessed to be high.

4.3. Accessibility of Gated Communities to the Nearest Railway

One of the most significant transport systems increasing the overall accessibility of a particular settlement is railway. In this respect, it is important to evaluate the connection and accessibility of gated communities to available railways. For this reason, when we look at Tables 6 and 7, single-family housings in Bakırköy and Çatalca are closest to railways, while the farthest district is Ümraniye. Regarding multi-family GCs, again Bakırköy is the closest district, while Büyükçekmece is the farthest.

As Figure 6 represents, in gated communities the overall accessibility to railways is often low. Especially the single-family housings located in northern Istanbul are not closely connected to railways and thus have low accessibility to other districts of the city, for the available railway line passes along the south of the city parallel to the Marmara Sea.

5. Availability of Dwellers of Gated Communities to Current Transport Systems

Public transportation plays an important role in providing accessibility between the function areas in the city. Istanbul is a large-scale metropolis sheltering a population of approximately 12,000,000 people. For this reason, the available transportation system meets the daily transportation demand integrated with pervasive and various transportation services. However, public transportation does not offer the same convenience in all the areas of the city. The most fundamental reason for this fact can be said to be the insufficient use of sea transport, the limited level of railway network, and as a result of these, the failure of public transportation lines used in land access to meet the transportation demand, which increases day by day.

GCs comprise 4.5% of the total population in Istanbul, and in terms of their locations, are one of the most important actors raising transportation demand. When the subject matter is considered in terms of the available active piers, it is seen that the sea lines only in particular districts work regularly all day long. For instance, Kadıköy, Üsküdar, Eminönü, Beyoğlu, Bostancı and Bakırköy are the most active districts. Yet according to the findings of 2004, their utility in addressing the total demand remains at 15.5% (Istanbul master plan research report). Another striking example is Sarıyer, where sea access to the city center is rare although single-family GCs are most densely located in this district. The available active pier provides only 2 fares throughout the day.

Tables 8 and 9 demonstrate the available bus facilities for single-family and multi-family GCs. As it can be followed in these tables, it is impossible for single-family GCs especially located in the peripheral areas of the city to access to the city center by one bus commute. As Table 8 demonstrates, single-family GCs in the peripheral districts are not able to access directly to the closest centers, while transport changing is not convenient considering the infrequent intervals of bus fare. On the other hand, all the multi-family GCs within the scope of our study are able to access directly to the nearest centers, for they have the advantage of being located near the highway. Besides, municipalities provide high number of bus fares with frequent intervals since these GCs constitute a significant portion of public transport demand. Consequently, frequent intervals of bus fares provide users with flexibility and convenience in their daily lives.

6. Conclusion

In this study, having evaluated the connection between gated communities and the public transportation systems in Istanbul, we have found out that gated communities necessitate a life dependent on private car ownership. The high car ownership in these settlements justifies this finding.

The vast majority of gated communities are located in areas that are more than 30 distant from the core of Istanbul. Especially the majority of single-family GCs are located in the peripheral districts in the north of Istanbul. In this respect, they are not directly connected to sea and railway access. Despite the good connection of large-scale multi-family GCs to the city's railway and land public transportation systems, the high rate of car ownership leads to the preference of private car use by high-income groups.

These residential areas have been planned as local plans independent of the city's master plan, which has resulted in the anticipated traffic intensity in Istanbul's transportation master plan and the additional load on road sections. In this respect, the available transportation system falls short of carrying the extra traffic intensity, which generates congestion in the available system and various types of pollution.

References

Berköz, L. (2006), Sprawling of Single Family Housing in Istanbul, Paper presented at the XXXIV IAHS World Congress-Sustainable Housing Design, Napoli.

Berköz, L. (2008), "İstanbul'da Korunaklı Tek-Aile Konutlarının Yerseçimi Özellikleri", İTÜ BAP Destekli Araştırma Projesi (pr. No: 31981).

İ.B.B.P.İ.D.B.Ş.P.M., (1995), 1/50.000 ölçekli İstanbul Metropoliten Alan Alt Bölge Nazım Plan Raporu.

Coliers Rescue, (2003), Gayrimenkul Piyasası 2003- Türkiye, Istanbul.
Kellekci, Ö. L., Berköz, L. (2006), "Mass Housing: User Satisfaction in Housing and its Environment in İstanbul,Turkey", European Journal of Housing Policy 6 (1), 77-99.

Tezer, A. and Zeren Gülersoy, N., (1996), "İstanbul'un Planlaması ve Kentsel Gelişim Sürecinin Değerlendirilmesi", Habitata Doğru İstanbul 2020 Sempozyumu Bildiriler Kitabı, İ.T.Ü. Mimarlık Fakültesi Baskı Atölyesi, İstanbul, pp. 175-186.

Tezer Kemer, A. (2004), "Modelling of land use-transportation interaction in Istanbul", ITU A/Z Journal of the Faculty of Architecture, 1 (2), 12-25.