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Widening the Circle: Is There an Eighth Principle for Universal Design?

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Abstract. The advantage of Universal Design (UD) over mere barrier-free design is that it can benefit everyone, regardless of age or ability. The imperative to include design for personal safety even outranks accessibility as a design precept. Evolved almost four decades ago, Ron Mace's Seven Principles did not anticipate advanced standards of safety in today's world. Whilst Principle Five - *'Tolerance for Error',* states that *'the design minimizes hazards and the adverse consequences of accidental or unintended actions'*, this notion of 'error' implies that it is the user who is at fault, rather than the provider. This may lead to inhibition and fear, hampering one's lifestyle in a multitude of ways. Fear of falling, inhibition of being unable to find a public toilet, forgetting a password or simply being made to feel old and incapable can all have an adverse effect. A cross-disciplinary group of experts undertook a number of studies on design for age-friendly cities in Ireland, through empirical research, experiential exercises and dissemination into third-level design education. Studies on design and facilities that lead to an individual's lack of confidence are discussed, including a research programme undertaken for the National Disability Authority on the Universal Design of Fall Detection Technologies. The paper proposes that an additional Principle: "Reduction of Fear" should be a basic design parameter in all aspects of the built environment as well as IT and services. By broadening its scope and joining forces with health and safety issues, UD becomes more inclusive, desirable to client bodies and attractive to everyone. The paper identifies areas where improvement in design is urgently required, suggesting the breadth of benefits accruing from more inclusive design, particularly in reducing fear through safer home zone environments.

Keywords. UD Principles, Safety, Ageing

Introduction

In the time since Ron Mace forged the influential Principles of Universal Design (UD) [1] things have moved on significantly. The increase in global ageing underscores the importance of built environments that are designed to meet the needs of older people: accessibility, comfort, security and, most importantly, the safety of the individual. The 2015 "Shaping Ageing Cities" [2] emphasizes aspects of safety and security in optimizing living standards for the elderly. Health and safety standards, once seen only as necessary in the public realm, are now demanded in the home zone, especially for

vulnerable sectors of the population. Whilst ageing is not a disability in itself, some diminishing of physical and mental faculties will occur; added together these may significantly reduce a person's abilities overall, increasing over time. Although not limited to ageing, awareness of potential risks and hazards about the environments that one uses can cause anxiety or fear, affecting attitudes on living and engaging socially.

A better understanding of the nature and causes of such fears will inform design towards reducing aspects of anxiety and inhibition that limit independence and quality of life in diverse ways. A research programme undertaken for the National Disability Authority on Universal Design of fall detection technologies [3] set out to i) assess the impact of falls, both on people at risk of falling, their families and carers and the need for Fall Detection Technologies, ii) to investigate the design state of fall detection solutions and services through a UD lens and iii) to understand how this technology can support lifetime community initiatives. Further unpublished aspects of this research include results of interviews with various stakeholder groups regarding the causes, consequences and impact of falling on those at risk and their carers. Salient aspects of the built environment that present threats have been identified through this work and from multi-disciplinary research and observation. Through an understanding of a person's lifestyle, appropriate UD measures can significantly reduce barriers, both mental and physical. Design professions must inculcate awareness-raising in current practice and in education, in order to reduce fear for everyone. This paper proposes the need for an Eighth UD Principle, the Reduction of Causes of Fear and Inhibition.

1. Widening the Circle of Universal Design

While the necessity to improve the built environment through the application of UD principles is clear, it is important that this not just limited to providing access for people with disability, but that it also encompasses the widest range of ages and abilities As ageing populations increase the need for optimally designed built environment is imperative. While it is important to demonstrate the advantages of safety through inclusive design, it is also necessary to point out the high cost, both monetary and social, of not doing the right thing, at the right time. Encouraging greater attention to designing for safety into the UD remit will widen the circle of beneficiaries, with consequential reduction in fear, in all sectors of the population. The greater number of people who are seen to benefit from UD, the stronger the argument for its continuing promotion and the more value it will gain worldwide.

Accessibility and safety are not always synonymous. Whilst one of the most valuable outcomes of UD is that of providing accessibility, in practice the need for safety may override this. Principle 5 of the Seven UD Principles states "*The design minimizes hazards and the adverse consequences of accidental or unintended actions."* advising to *"arrange elements to minimize hazards and errors" and "provide fail safe features. Discourage unconscious action in tasks that require vigilance."* [1]. The notion of 'error' suggests that the fault lies with the user, rather than laying the real responsibility on the provider. Is it an 'error' for an individual to have chosen a route without handrails on a slippery ramp? Although Principle 3 advises *"provide warnings of hazards and errors",*

if we see a sign saying "*Mind Your Step"* where a change of floor level presents a hazard, we could justifiably respond: *"No; it's YOUR step - YOU are responsible for our safety - it should not be there at all".*

Universal Design seeks to include the widest spectrum of users, not just people with a disability or the ageing population. If we acknowledge that fear and anxiety can result from poor design, negatively impacting an individual's life choices, the challenge is how to design to reduce these fears, improving the quality of life for an individual of any age or ability. Experienced designers can identify elements in the built environment that exhibit poor design or have occurred by default, through ignorance or false economy. One hidden quality of UD is that where good design has been seamlessly integrated into the environment it is, to an untrained eye, not easily recognizable. Only a designer's informed eye is able to perceive the inclusive qualities, bearing out an old proverb that *"the good shoes are the ones you don't know you are wearing".* Achieving this level of expertise requires awareness through experiential exercises, directed observation and dissemination into professional education curricula.

An example of such awareness might be in the design of a balustrade One with bars arranged vertically would be seen by an experienced eye to be eminently safer than one with horizontal bars, even though both may comply with building codes. To a small child, horizontal bars afford an exciting climbing opportunity, which a parent may recognize with dread. Thus an element intended to prevent falling may be a deathtrap if designed without an appreciation of the perception of all users.

Older people may be the main beneficiaries of safer design, for various reasons. Ageing brings body changes and increasing limitations in different aspects of a person's ability. Though conditions such as Irritable Bowel Syndrome (IBS), incontinence or a sprained joint may not define a person as having a disability it may significantly reduce their ability to live as they did before. Decline in cognitive, physical, motor and sensory systems are also part of the ageing process [4]. Adaption to these changes may be a challenge, depending on how rapidly they occur [5]. Increased vulnerability through decreased vision, slower reaction times, lack of balance or reduction in limb sensation, all may increase the risk of falling.

A person's awareness of their vulnerability may increase to the extent that they may become inhibited about leaving the safety of their home or partaking in activities which they feel may endanger them, possibly as a result of a previous fall. Conversely, there will be independently-minded individuals who continue to go about their lives as they did when they were younger, unaware of the risks that changes to the body may present. Fear is a natural and necessary reaction to emotional, cognitive or physical threat, real or perceived. Such reaction may produce fear avoidance behaviors. Although not the only area, the most researched factor is the fear of falling, described as a negative experience, directly linked to perceived or real fall consequences, such as physical injury, loss of autonomy, fear of dependence or of humiliation, significantly impacting a person's physical, emotional and mental state.

The generation of fear may be due to the inability to cope with a physical, social or emotional challenge, particularly compounded by the environment's ability to conceal a

threat. Lesser inhibiting factors may range from a person with a weak bladder being unable to find toilet facilities, to a fear of being unable to read instructions on an ATM screen and losing one's credit card. Such fears stem from a perception that one's physical, mental or emotional abilities may be inadequate to manage these challenges, whether real or imagined. Additionally, fear of real danger, less definable fears, lack of security, loss of dignity or being aware of increasing personal limitations, being forgetful or appearing senile 'being a burden' to others, can inhibit someone from leading a full and active life.

Falls are common in adults aged 50 years and over. According to The Irish Longitudinal Study on Ageing (TILDA), 1 in 4 older people reported a recent fall, with 1 in 5 experiencing recurring falls. The rate of reported recurrent falls was highest in women aged 75 years and older [6]. During the study on the Universal Design of fall detection technologies [3], semi-structured interviews were carried out with 82 people from 4 different category groups (people at risk of falling, informal carers, formal carers and healthcare professionals). The analysis of data resulted in some interesting findings on the causes and consequences of falls, not previously published. Participants reported many factors that lead to a fall within and outside the home. Often the cause is influenced by health issues impacting on a person's life. These include vision, balance, frailty, weakness, low blood pressure and cognitive issues. Many participants highlighted the home environment as harboring diverse causes of falls, such as loose furnishings, rugs, cables or inadequate lighting. Daily activities such as dressing, using the bathroom, stairs and mobility aids, gardening and even domestic pets, are risk factors. The community environment, such as the condition of sidewalks, negotiating ramps and curbs or travelling on public transport were also noted as fall hazards.

Participants reported physical effects as a result of falls, such as direct bodily harm, cuts and bruises, broken limbs and more serious injuries requiring hospitalization, with long-term physical effects and an increased risk of further illness. The immediate consequence for many participants after falling was a change to their activities of daily living and general lifestyle. This may also impact the daily life of carers, particularly for informal carers, who must fit the care of a relative or friend around their career or other responsibilities. The emotional effect on both people at risk, their family and carers is evident, due largely to the perceived risks of falling in both the home and community environment.

According to a TILDA study 43% of those who report a fall report that they were afraid of falling. Such fears are also common even in those with no history of falls, with 29% of this group reported fear of falling [7]. However, the recent study on fall detection technologies [3] indicates that this fear may be even higher. Previously unpublished analysis of the interviews with 28 older people at risk of falling and 24 informal carers of those at risk indicated very high levels of fear. More than 4 in 5 people at risk reported this fear. One older person explained, *"We are all more aware of falling as we get older,"* with another mentioning that "*I'm very nervous of falling in the shower"*. Falls also impact on a person's ability to continue living at home. One participant who cares for her mother, reported: "*She's very nervous about falling again. She is afraid she will end up in a nursing home, if her family can't look after her anymore".* Some participants felt their family member did not express their fears of falling to them. One informal carer explained about her elderly father, *"He is more afraid when he's alone… he could be*

worried but wouldn't tell you". Such fears also impact on those who care for people who have fallen or are at risk of falling, with 3 in 4 of informal carers interviewed having this concern. One participant described her worries about her parents *"I worry about both my parents falling again, especially as I don't live close to them."* Some carers worry more than the person at risk. One participant said when describing how he felt about his mother *"I was more worried about her falling than she was herself".*

Fear of falling can significantly impact how people live, leading to activity restriction, where people may isolate themselves. One participant described his fear of falling in bad weather: "*During the recent bad weather, I didn't move out of the house for three days, as I was afraid of falling".* Older people with fear of falling walk more slowly, cautiously and take shorter steps to increase stability. However such changes in how a person walks may be associated with an increased risk of falling [8]. Research demonstrates both the gait pattern and visual scanning patterns of people with a fear of falling is significantly different from people without this fear. A slower walking pattern can increase the risk of falling when combined with the focus on scanning visually for a nearer threat, as threats may be seen too late, and the size of the person's step could no longer be adequate to avoid the trip or slip hazard. Additionally, when people experience anxiety, their ability to process the threats cognitively is also reduced, decreasing their ability to identify, solve and avoid the problem. Research has identified that people experiencing fear of falling are more likely to miss a 'real' falls risk, due to the constant vigilance of identifying threats closer to them, which may not exist. Both in research and published literature, people with a fear of falling describe avoiding certain activities, particularly out of home. This both increases social isolation and decreases meaningful engagement with others, and also impacts their physical endurance and muscle strength. In the example cited above, "*not moving out of the house for three days"* due to the weather, can significantly affect muscle strength and endurance. The avoidance of outdoor activities is wide-ranging in its effect on health and wellbeing. A lack of nutrition and medication, due to avoiding shops during bad weather, or avoiding social gatherings in premises where stairs do not have a handrail, all impact on a person's overall wellbeing.

It is natural for people to wish to continue living in their own homes as they age. However, the fear of falling, for both the person and their families, often influences the longevity of home life. Recent developments in technology have started to change these concerns, such as the Smart Home, with inbuilt falls monitoring. Historically the drawback of technology has been the difficulties or perceived difficulties in its use, but Telecare's simple technology provides confidence and safety in the person's own home. Recent developments, such as personal fall sensors or smart home sensors, also provide confidence and security for people with a fear of falling [9]. Evidence shows that the implementation of assistive technology can play a significant role in the reduction in the fear of falls, where the design of the environment and technology can merge to make people feel safe, confident and well at home. UD Principle 5 says *"Provide fail safe features"*. For some time, alarm devices have been in common use by elderly people, particularly those living alone. However few existing fall detection technologies work well outdoors so, if a fall occurs, then serious consequences may follow. New sophisticated technologies offer great promise but are at a low maturity level, although advances in consumer electronics such as smartwatches have great potential.

Although much research has been done on fear of falls and its link with the increased risk of falls, there is limited research on how to address this as a specific intervention. Many publications, including 'Global Age-Friendly Cities: A Guide' [10] encourage barrier-free cities, green spaces, community, as well as mobility, but mention the advantages of safer environments only in a limited way, citing problems such as poor maintenance of pavements, danger from skateboarders, vehicles and other *"barriers to physical access, which can discourage older people from leaving their homes".*

A major aim of the World Health Organization's Sustainable Goals is to optimize health for all ages [13] with the concept of maintaining independence and increasing social and economic participation as fundamental to these goals for ageing populations. But social participation can be negatively impacted by poor design. 'Ageing-in-place" and personal independence are fundamental to UD but may bring their own problems, particularly following the death of one partner. Rowles cautions that: *"The elderly gradually become prisoners of space. Certainly some individuals remain active and mobile into their advanced old-age… For many older persons, physiological decline, economic deprivation and traumatizing effects of rapid social change, herald physical, psychological and social withdrawal. This withdrawal… is accompanied by progressive constriction of the individual's geographical life-space and associated intensification of attachment to the proximate environmental context"* [14]. Reviewing the design of the environment is imperative. Does it encourage community engagement or does it lead to the withdrawal of the person or avoidance due to stigma? Will I look disabled using this? These considerations will impact a person's independence, activity and socialization.

Causes of fear and inhibition may occur at both macro and micro level. Urban townscapes with picturesque alleys or luxurious landscaping may be desirable during daylight but, after dark, could suggest the menace of a dark downtown underpass, unless well-lit and overlooked. Places such as pedestrian short-cuts or bus shelters where youths may 'hang out' can be inhibiting for anyone to approach alone. The fault may be due to a lack of provision by city authorities of anywhere more suitable where young people can meet, just as much as the need for design for 'defensible space' [15].

Any element in the built environment should not only provide safety but also reassure users of this safety. Handrails are the most obvious example, having the advantage that, being commonplace, do not mark anyone who uses them as being old or incapable. Specifying materials for floor surfaces is also crucial; highly polished floors, where reflection can make even a dry surface appear wet and slippery, can be intimidating. Changes in floor material, where two different tones or degrees of reflectivity occur, can confuse even a person with good vision.

The Sixth UD Principle, 'Low physical effort', requires that "*the design can be used efficiently and comfortably and with a minimum of fatigue by all users"* [1]. Climbing stairs can be tiring. Landings with resting places are welcome for those with heart or weight problems. Users may feel that being seen to need to rest amounts to a loss of dignity; such elements might be more acceptable if there are other reasons to justify the pause, such as a notice board or pleasant view, thus removing the stigma that the resting place is only for the elderly.

In professional design education, it might be expected that principles of safety are emphasized as a matter of course, but this is not always so. Seductive views of minimalist design precedents lacking basic safety features may be presented to students as good exemplars, with staircases having open treads and no handrails. Good design, where the reduction of fear is imperceptible, is best taught with an interdisciplinary approach, working with real 'users', healthcare and design professionals, to allow different lenses to be applied to design learning.

Fear-avoidant behaviors can also be a result of fear of a loss of dignity or embarrassment. In ageing, changes to the body occur, such as the weakening of bladder control. People may avoid going out for fear of having an "accident" due to not being able to locate a toilet, or then finding it locked. Impassive and impersonal websites make no allowance for error. Dependence on IT continues to increase for many daily activities, reliant on systems actively designed to be disruptive. Poor design of IT hardware and software also engenders technophobia where problems range from difficulty in manipulating small controls or viewing miniature screens, forgetting passwords, running out of battery power to operate devices, or the fear of being controlled or spied on by unseen agencies.

2. Conclusion

From previous experience we learn to recognize potentially hazardous or embarrassing situations in our daily lives. This vital skill allows us to identify the cause, assess the potential risk and take appropriate evasive action. But one bad experience can turn this to overwhelming anxiety about real or imagined dangers, inhibiting a normal life course. Intervention by design or by management then becomes crucial. UD can not only effectively remove physical barriers in the built environment, but also reduce inhibiting mental barriers, particularly fear caused by the threat of danger, pain or loss of dignity. Many such causal factors are avoidable through intelligent, inclusive design, in both the built environment and in services to support independent living. Building codes and safety standards are only able to legislate for one element at a time, often leading to 'bolt-on' solutions that are both ugly and stigmatizing. The potential of UD lies in its capacity to integrate supportive elements without further modification.

Although people live longer, unless they have an adequate quality of life, they may become prisoners in their own homes, vulnerable, isolated and inhibited by dangers and fears, real or imagined. This may be due not only to a lack of awareness on the part of those responsible for realizing the physical world around us, but also to a lack of appreciation of how important the requisite measures are and, most significantly, how these may be achieved through informed design. Research findings on this may not be groundbreaking, but they do signal the urgent need for inter-professional design education and continuing professional development on this issue. The costs of not doing so now are surely unacceptable, in terms of an 'accident waiting to happen'.

For many people, even the home environment can seem to be a threatening place. Restoring personal confidence by providing safe environments will add to people's quality of life. UD is responsive to global trends so it is fitting that its scope might now be extended to make it ever more effective. The influence that Ron Mace has had on

attitudes to design continues to grow, through dissemination of best practice and through research and design education. With this in mind, the authors believe that it is timely to widen the circle of beneficiaries of UD and to propose that an addition be made to the Seven Principles, to further augment "Design for Tolerance for Error" by including a new Eighth Principle: "Design to Reduce Causes of Fear and Inhibition".

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