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Introduction

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The topic of this book concerns everybody. It is a topic that people tend to avoid in normal conversation, though daily are finding themselves confronted with: their toilet-room. It is a taboo-subject in our modern society and certainly not the thing to talk about so frankly. Well, maybe when the toilet-room is perceived through the glasses of modern architecture and interior design; there are quite a few coffee-table photo books showing the toilet-room as an architectural space in which designers can go loose on colour, mirrors and trendy accessories [1–5]. However there are only few who pay attention to the daily activity of toileting itself and the variation of human behaviours that go with it. And that is logical, because when you are young and vital, you normally do not need – and neither want – help inside the toilet area. The few who did study this topic are famous for it; the book ‘The Bathroom’ written by Alexander Kira [6] was published in 1966 – so 45 years ago – and still his work is considered the main and sole source for scientific data of human behaviour inside the bathroom, considering the different functions and the fixtures in it, like sinks, bathtubs and toilet bowls. Another source – though focusing on the issues on public toilets – is ‘Inclusive Urban Design-Public Toilets’ written by Clara Greed [7]. It provides a deep understanding of toilet issues and gives many useful suggestions and guidance to industrial designers, urban designers, architects, municipality technicians. The conclusion that can be drawn from both books is that there is a lot to improve when it comes to designing the toilet room. As a result of gender or culture the human toilet use behaviour varies tremendously. But the little variation in existing fixed ‘product’ components (toilet bowl, seat, flush, sink etc.) only allow for a few of those behaviours. And the healthy and fit human beings are able to adapt their behaviour when products fail... those who are mentally or physically challenged are not; they are left to the support of others. With it they lose a little independence, a little dignity, a little self-esteem.

This book is addressing the topic of toilet design, but instead of looking at the typical able-bodied user, it takes the various needs and limited abilities of older and/or disabled people as a focus point (human centered design). Thus following the ‘Inclusive Design’ principle, which promises that a design that is taking into account the needs of the ones most challenged, will be beneficial to the ‘healthy’ rest as well.

For the most part this book has been a spin-off of an EU-funded research and development project called the ‘Friendly Rest Room for Elderly People’ project (throughout the book the project’s acronym ‘FRR’ will be used). The FRR project was part of the Quality of Life and Management of Living Resources Programme, under Key Action 6 ‘The Ageing Population and Disabilities’ and proposal number: QLRT-2001-00458. The project ran from 2001 until 2005 and during that period a consortium of 10 institutions in 7 European countries collaborated on the research, design and de-

velopment of a friendlier toilet for elderly/disabled users. The contributions of the FRR consortium partners to this book therefore show the results of about 5 years of empirical work in different cultures, countries and disciplines.

The goal of this project was to carry out the necessary research and design, build and test prototypes for a Friendly Rest Room for older people and for persons with a disability to allow them to gain greater autonomy, independence, self-esteem, dignity, safety, improved self-care and therefore enjoy a better quality of life.

The result would be a Friendly Rest Room where all the components are adjustable to the needs of older persons with varying degrees of functional impairment. The methods and technologies involved to fulfil this objective included contact-less smart card technologies with read-write capabilities, voice activation interface, motion control and sensor systems, mechanical engineering and robotic techniques, mathematical modelling, as well as ergonomic research, design for all philosophy, gerontechnology and medical and social sciences.

The project involved broad user driven research, needed to define the user parameters for designing and developing the FRR systems. Users were involved in all stages of the research and problem solving process of the FRR prototype development and testing, as well as there was involvement of secondary users, care takers and rehabilitation professionals. Prototypes were tested with involvement of industrial-marketing companies and end-user organisations to improve the independence, dignity, safety, self-care and quality of life of the older persons in the European community.

Since the idea for this book dates from the beginning days of the FRR project, it certainly took a long while to make it actually happen. Many excuses may be given; writing and composing a book is a time-consuming activity that often loses in the competition with other obligations in our daily living, either work or family. This time lapse has provided us as editors the opportunity to involve other 'toilet-minded' authors to contribute to this book as well. We believe that the book as it is gives a good overview of what has occurred in the last couple of years concerning the design and development of toilets for elderly and other physically challenged. What can be learned from these stories, hopefully will inspire all who can make a difference – designers, architects, care-providers – and proof its value in the design of future toilets.

The book contains four sections, each section combining several articles written by different authors, coming from different institutions, universities or companies.

Section 1 'General, organizational and developmental issues' describes the issues that are shaping the base of the FRR project and the base for this book. In 'Meeting the Challenges of Demographic Change' by G. Dayé, the greying of society is addressed and the need to adapt products to the needs of older people. In 'Design for All: Not Excluded by Design' by Molenbroek, Groothuizen and de Bruin this need is marked again, reasoning that following this principle will lead to better products for us all. Then Van Berlo in 'Experiences with Smart Homes for Older People' shows how elderly people can benefit from new technology in their homes with examples from practice. Provided the applied technology is adapted to the needs and abilities, it can help elderly to sustain their independent living longer. The last paper of this section, 'Health Data Security Issues' by Mantas and Liaskos, addresses the precautions regarding safety and privacy to be thinking about when applying new technology in products and environments.

Section 2 'The Friendly Rest Room Project' is – as the title says – devoted to the FRR project and its outcomes. In 'Overview of the FRR Project; Designing the Toilet of the Future' by Molenbroek and de Bruin, a general introduction to the FRR project

is given. In the paper ‘When Ethical Guidance Is Missing and Do-It-Yourself Is Required: the Shaping of Ethical Peer Review and Guidance in the FRR Project’ Rauhala describes what ethical challenges were faced during the project and how researchers and developers in the FRR project coped with the sensitive topic of toileting and product-testing with frail users. In ‘User-Driven Research – How to Integrate Users’ Needs and Expectations in a Research Project’ C. Dayé and Egger de Campo elaborate further on this topic as seen from sociological point of view, and in ‘The FRR-Questionnaire – Assessing Who Needs What Where’ C. Dayé illustrates of the tools that were used in the project to discover potential problems that elderly in the toilet room experience, e.g. with the fixed products or spatial dimensions. This and other questionnaires were digitally presented to the test persons involved. In ‘Computer Based Information Gathering’ by Alm et al. goes deeper into this topic. Former studies have proven that the digital questionnaire provides a feeling of anonymity more than a paper questionnaire, which seems especially useful when studying this sort of sensitive topics.

In ‘Knowledge Management’ by Mantas, Liaskos and Charalampidou evaluate how the knowledge created in the project (research and project data) was managed in a file sharing-server and how a résumé thereof could be edited into a gradually growing knowledge base.

In the last two papers of this section the design and development of the FRR toilet are presented: The paper ‘Rapid Prototyping of Interface and Control Software for an Intelligent Toilet’ by Magnusson et al. explains how the user interface design of the smart ‘FRR’ lift toilet was developed and tested. In ‘The Final FRR Components’ by Groothuizen et al. all other physical components of the FRR toilet environment are presented, including a new door and door handle design easy to open and manoeuvre for wheelchair users, a communication unit that is connected to the smart lift toilet to move it automatically in the preferred position (height and tilt), body supports around the toilet – horizontal as well as vertical –, a toilet seat that is enlarged to allow for an easy wheelchair transfer and stable seat, a newly designed and patented moveable ‘comfort’ washbasin, as well as wall mounted grab bars to provide for – easy to clean – balance support in every spot of the toilet room.

While in Section 2 mainly the developmental outcomes of the project were discussed, in Section 3 ‘FRR Case Studies and User Tests’ the focus lies on the user research outcomes of the project. In ‘Elderly and People with Disabilities – Limitations in their Everyday Life’ by Sourtzi and Menezello an inventory of problems that elderly and disabled people daily experience in their bathroom and toilet environment is made and illustrated by three case studies from Italy. In ‘Experience of Testing with Elderly Users’ Knall, Sourtzi and Liaskos evaluate their findings of testing the product prototypes developed during the course of the project with actual users, being of age and physically challenged. In ‘Laboratory Tests of an Adjustable Toilet System with Integrated Sensors for Enhancing Autonomy and Safety’ Panek et al. elaborates on the approach and results of user tests held with the smart FRR lift toilet inside a laboratory environment. In ‘Concept, Setting up and First Results from a Real Life Installation of an Improved Toilet System at a Care Institution in Austria’ by Gentile et al. the same smart FRR lift toilet is main subject. In this case the smart toilet was installed in a real life setting and shows the results of user behaviour inside the toilet room, unbiased by an unnatural laboratory environment or the presence of a researcher.

Section 4 ‘Aspects of Human-Product Interaction in the Toilet Environment’ gives an overview of the studies about the spatial behaviour that (elderly) people inside the

toilet environment show, focusing on the interaction with toilet and the toilet attributes in search for data to build design guidelines for the FRR toilet.

Buzink et al. describe in 'Fall Prevention in the Toilet Environment' the need for more appropriate fall preventive measures and explain how a model was developed to identify basic toilet activities with an increased fall risk. Next a new toilet support was developed following the guidance of this model. In 'User Preferences Regarding Body Support and Personal Hygiene in the Toilet Environment' by Dekker et al. the search for design guidelines continues. The paper covers the most sensitive subject of personal hygiene and the balancing problems occurring when sitting down and rising from the toilet. Tests were performed with a setup that consisted of an height adjustable toilet bowl and various adjustable supports around it. The results give insight in the preferred type and position of supports as well as more knowledge about personal hygiene routines. In 'Biomechanical Aspects of Defecation with Implications for the Height of the Toilet' by Snijders et al. the suitability of a higher toilet for elderly is questioned from a biomechanical point of view, followed by an anthropometric analysis to determine the optimal height range for an adjustable toilet.

In Section 5 'Design for Improved Toilet Environments' an overview is given of various studies – not exclusively limited to studies performed within the FRR project – which can offer valuable knowledge, techniques or inspirational stories, helpful in designing, improving or evaluating a toilet environment.

In 'Older People's Experience of Their Bathrooms' by Boess a report is made of design work for the interior of an assisted bathroom for older people and conclusions are drawn on a useful approach to the design of assistive environments. Molenbroek and De Bruin explore in 'Anthropometrical Aspects of a Friendly Rest Room' the toilet environment from anthropometrical point of view. In 'Involvement of Users and Practitioners in Anticipating Future Usage with Design Models' M.J. Rooden describes how testing product ideas with users with the help of models or mock-ups can be powerful, though what to bear in mind when doing this. Followed by 'Key Dimensions of Client Satisfaction with Assistive Technology: A Cross-validation of a Canadian Measure in The Netherlands' by Demers et al. in which a cross-validation of the bidimensional structure of a satisfaction measure with assistive technology is subject of study; in other words a questionnaire to assess the helpfulness or expected success of an assistive product or service.

Musch and Den Hartog show in 'Plea for Use of Lowered Toilet for All' the development of an innovative toilet, based on the idea that the squatting position is the most natural and healthy position for defecating, especially for elderly people since they often suffer from constipation due to a predominantly sitting lifestyle. The squatting position is also favoured in 'Alla Turca: Squatting for Health and Hygiene' by Oya Demirbilek and explains about the cultures – in this case specifically the Turkish culture – that prefer the squat toilet. It shows many examples and closes with some modern design solutions for these types of toilets.

This book is about developing a perfect toilet environment. For them; elderly and otherwise physically and/or mentally challenged individuals, because it is plain to see that standard toilets do not fulfil their needs. But actually for us all, because we all have our special needs from time to time (and sometimes all the time), since we differ from each other. We have different age, different sexes, different cultures, in short: different needs.

Nevertheless our greying society is expressing the urgent need for research data on the use behaviour and special needs of people in the toilet environment. This book hopefully will add to the knowledge needed to develop a perfect friendly rest room, a toilet of the future that enables disabled and elderly people to maintain their independence, a toilet that is more flexible to the needs of the large variety of human beings, a perfect toilet for everyone.

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