“Population ageing is a process without parallel in the history of humanity.”
This a quote from the World population ageing report published by the United Nations. Since 1950, the proportion of older persons over 65 has been rising steadily in the world, passing from 8 per cent in 1950 to 11 per cent in 2009, and is expected to reach 22 per cent in 2050.
The social-economic effects such as rising health care and pension expenses have been widely published in the media and issues related to housing, mobility, health- and social care have been the subject of many academic publications. However, the effects of these ageing issues on the built environment of our cities and vice versa, while very pressing, have hardly been covered. Therefore this graduation thesis part of the master Urbanism at Delft University of Technology focuses on the spatial consequences and solutions for greying cities and their inhabitants in the Netherlands and Spijkenisse is particular. In order to find the solutions for the built environment this book combines findings from GPS trackings, interview and physical activity diary data, urban analysis and literature reviews in an unique way. Next to the urbanism department at Delft University of Technology this thesis is supported by Erasmus Medical Centre in Rotterdam, TNO in Utrecht and SVP architectuur en stedenbouw in Amersfoort.
part III. bibliography
Colophon
Design principles. Greying cities
January 2012

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Keywords
Ageing population, urban redesign, elderly, frailty, active ageing, public space,

cover image by F. Muller in 2011
This is the design principles catalogue which is part of my graduation project Greying Cities. This graduation project is part of the master Urbanism at the faculty of Architecture at Delft University of Technology and guided by Remon Rooij, member of the chair of Spatial Planning and Strategy and Maurice Harteveld who is a member of the Urban Design chair. Further support is given by members of the Public Health department at the Erasmus MC in Rotterdam, SVP architecture and urbanism in Amersfoort and Frank Plierik and Reinier Sterkenburg at TNO in Utrecht. I would like to thank them for their time, knowledge and support.

Charlotte Cammelbeeck

figure 1.
Sun city, an elderly city in the state of Arizona, U.S.A.
(Google, 2011)
Contents

PREFACE

PART I. INTRODUCTION
CHAPTER 1. MOTIVATION: AGEING POPULATION 9
CHAPTER 2. PROBLEM FIELD WHEN DESIGNING ELDERLY FRIENDLY CITIES 11
CHAPTER 3 AIM OF THE DESIGN PRINCIPLES 13
CHAPTER 4 APPROACH: PATTERN THEORY 15
CHAPTER 5. FORMAT OF CATALOGUE 17
5.1 Indexes
5.2 Pattern field
5.3 Principles format
CHAPTER 6. IMPLEMENTATION 19

PART II. DESIGN PRINCIPLES
CHAPTER 7. INDEXES 21
CHAPTER 8. PATTERN FIELD 23
CHAPTER 9. DESIGN PRINCIPLES 25

PART III. BIBLIOGRAPHY 27
figure 2.
Walking aids in a hallway (Brugge, 2007)
PART I.
INTRODUCTION
The amount of elderly over 65 years of age is growing harder in the Netherlands (CBS, 2010) than in the world (United Nations, 2010),

Figure 3.

1950
8%

1950
7.5%

2010
11%

2010
15.3%

2040
22%

2040
25.9%
1. Motivation: ageing population

“Population ageing is a process without parallel in the history of humanity.” (Zlotnik, 2009) This a quote from the World population ageing report published by the United Nations. Since 1950, the proportion of older persons over 65 has been rising steadily in the world, passing from 8 per cent in 1950 to 11 per cent in 2009, and is expected to reach 22 per cent in 2050 (Zlotnik, 2009). However, in the more developed regions the population ageing is far more advanced. One of these greying counties is the Netherlands. Here the elderly population over 65 will increase from 15 percent in 2012 to almost 26 percent in 2040 (see figure 3). This is the result of the baby boom after the Second World War and the rising life expectancy (Jong and Duin, 2009).

The social-economic effects such as rising health care and pension expenses have been widely published in the media and issues related to housing, mobility, health- and social care have been the subject of many academic publications. However, the effects of these ageing issues on the built environment of our cities and vice versa, while very pressing, have hardly been covered. Therefore this design principle catalogue focuses on the spatial consequences and solutions for greying cities and their inhabitants.
Badly designed or maintained streets can be a problem for anyone but especially for older people (Burton and Mitchell, 2006).
2. Problem field when designing elderly friendly cities

With greater life expectancy and an increasing proportion of elderly people of the age of 65 or older, population ageing has become a process without parallel in the history of humanity (Borst et al., 2008; Zlotnik, 2009). Sadly, older persons often become part of a process of an accumulation of physical, psychological and/or social deficits in functioning such as reduces strength, slowness, poor vision, feeling down, problem with memory and low participation in social networks such as neighbourhoods (Campen, 2011). This process is known as the process of frailty and increases the chance of adverse health outcomes such as functional disabilities, admission to an institution, and even death (Campen, 2011).

In Western countries such as the Netherlands the solution for physical, social and psychological ageing related problems is thought to lie in new types of housing and residential care homes. However this will not meet the needs of elderly and is simply unfeasible for this rapidly growing population (Garssen, 2011; Iersel and Leidelmeijer, 2010).

Empirical research has shown that this process of frailty can be postponed by healthy and active ageing (Ruuskanen and Ruoppila, 1995). However, large portions of the elderly population in the Netherlands is not sufficiently active. Hereby putting themselves at risk of going further in the downward spiral of frailty which can lead to admission into an institution or even death (Campen, 2011; Borst et al., 2008).

A solution to this problem can be found in the built environment and neighbourhood design. Research done by van Lenthe, Burg and Mackenbach in 2005 shows that the built environment, in particular neighbourhood design, influences the amount of physical activity undertaken by inhabitants of urban neighbourhoods. Consideration of the built environment is particularly pertinent for older people: as they age, they are likely to spend more time in their home and community environments, and declining health and functional status can make them more susceptible to barriers in them (see figure 4) (Burton, Mitchell and Stribe, 2011). For example, barriers such as narrow sidewalks, great changes in height, uneven pavement and great distances to shops might be surmountable for healthy and active people. However they can be the reason for frail elderly to stay at home and become of remain inactive putting them at risk of adverse health outcomes (see figure 3) (Burton and Mitchell, 2006).

Hence, attention needs to be paid to needs of frail elderly in the field of urban design. However, frail elderly have hardly been the focus of studies into urban design (Cannuscio, Block and Kawachi, 2003; Jong and Duin, 2009). Furthermore, while research has been done on the effects of the physical environment of frail elderly in field such as environmental gerontology, these have not been successfully translated into the current research and application related to neighbourhood design (Michael, Green and Farquhar, 2006). Therefore this design principle catalogue translates and combines findings on neighbourhoods design and elderly of different fields. Hereby including frail elderly into the design of neighbourhoods.
part II. design principles

figure 5. Neighbourhood designs for elderly are just as beneficial for parents with buggies, people who are physically impaired and so on (Burton and Mitchell, 2006)
3. **Aim of the design principles**

This catalogue puts forward design principles for the built environment that can be used for design interventions to encourage the vastly growing population of frail elderly to be active. Thereby reducing of or preventing frailty from worsening and enhancing their independence.

The first aim of this catalogue is to add to the general body of knowledge about elderly friendly public spaces and making it utilizable for the daily practice of urban planners and designers. Therefor the design principles are based on findings in literature and practise, containing design principles which practitioners can use and contribute to. Thus making it more graspable for urban designers how to (re)design elderly friendly public spaces to promote active ageing.

The second aim of the design principles is to make it possible for people with (physical) impairments to move freely through their living environment and make use of the facilities. Because older people are likely to spend more time in their home and community environments, and declining health and functional status can make them more susceptible to barriers in them the public space shouldn’t have any unavoidable physical obstacles. Varying from no uneven pavement up till a sufficient amount of facilities and service points for health care and support on a walk able distance. Furthermore, easily accessible public transport that is connected to the necessary facilities on city level links should be offered. Hereby enhancing the mobility of frail elderly and consequently their independence.

The starting point for the use of the principles in interventions should be the neighbourhood scale because of the fact that the main mode of transportation for elderly is walking and therefore their action space is mainly within their neighbourhood.

The third aim of the principles is to make it possible for practitioners in the urbanism field to adapt existing neighbourhoods because in this time of crisis it is more economical and it reinforces existing social networks and the sense of community which is so important for frail elderly with social deficits. Furthermore, it responds to the whishes of elderly to age in their existing neighbourhoods. Hereby creating generation proof neighbourhoods.

These design principles have been tested in the case of Spijkenisse as part of the graduation project Greying Cities of the author (Cammelbeeck, 2013).

Finally, it is important to underline the fact that while these principles are meant to create easy accessible public spaces for elderly, the designs are just as beneficial for parents with buggies, people who are physically impaired and other population groups which can be considered to be frail (see figure 5).
part II. design principles

figure 6. the cover of the three books that form the core of the pattern language, written by Christopher Alexander (Alexander et al., 1975; Alexander et al., 1977; Alexander, 1979)

figure 7. a language for a garden. ‘In this network, the links between the patterns are almost as much a part of the language as the patterns themselves’ (Alexander, 1979, 314)
4. Approach: Pattern Theory

One of the aims of this design principles catalogue is to translate findings from literature, empirical and design research into comprehensible spatial interventions which are usable for practitioners in the urbanism field. One of the approaches used is that of Christopher Alexander, the founder of the pattern language. While it originally was used as a design method, in this catalogue it will be used as a basis to organise and give an overview of design principles which can be used in a flexible manner. This chapter will go deeper into the theory of Alexander while chapter 4 explains how the theory has been used as the basis for the format of this design catalogue.

“The Timeless Way of Building”, “A Pattern Language” and “The Oregon Experiment” written in respectively 1979, 1977 and 1975, from the trilogy at the core of the pattern language (see figure 6). Volume 1, The Timeless Way of Building, lays the foundation of the series. It provides the theory and the instructions for a movement in architecture, building and planning, the pattern language (Alexander, 1979).

Volume 2, A Pattern Language, describes the detailed patterns for towns and neighbourhoods, houses and gardens and rooms. Alexander’s goal was to provide an archetypal language which allows any lay person or group of people to design a part of the environment for themselves (Alexander et al., 1977).

Volume 3, The Oregon Experiment, is the first of series that followed that describes in full detail how this theory may be implemented (Alexander et al., 1975).

Alexander describes patterns as certain entities where every town and building is made of. He underlines that everything can be decomposed to become a set of pattern, they are ‘a set of atoms of our man-made universe’ (Alexander, 1979, p. 99). Every pattern causes a different reaction; some patterns can help us to resolve our conflicts and others prevent us. However, while these patterns can be distilled from its source and do have their own character, that doesn’t mean they are autonomous and monotonous. In fact, patterns are a part of a system, and this system makes them work in a unique way. This system takes shape in the form of a language, the pattern language.

A pattern language gives a person who uses it, the power to create an infinite variety of new and unique buildings, neighbourhoods or towns. Just as his ordinary language gives him the power to create an infinite variety of sentences appropriate for different circumstances, at will (Alexander, 1979, p. 167).

The structure of a pattern language is created by the fact that individual patterns are not isolated. Each pattern sits at the centre of a network of connections which connect it to certain other patterns that help to complete it. And it is the network of these connections that creates the language. It is the structure of the network and the sequence of patterns which makes sense of individual patterns, because it anchors them, and helps make them complete. And in this structure the principal components need to be defined and that is what completes the language (Alexander et al., 1977).

In this catalogue the different components called patterns by Alexander are named design principles. And just like the patterns the design principles are connected to each other (see figure 7). To make the design principles and their connections explicit, we have to make the inner structure clear. This makes it judge able, which is essential in a public and academic practice like urbanism. That is why each principle has the same format and they are all collected in this catalogue. The format is derived from ‘A Pattern Language’, written in 1979 by Christopher Alexander and is shown in a figure on the next page and will be further explained in the next chapter.
Titel Each pattern has an introductory paragraph, which sets the context for the pattern, by explaining how it helps to complete certain larger patterns.

A headline of the problem statement The body of the problem, the longest section. It gives the empirical background of the pattern. The evidence for its validity, the range of different ways the pattern can be manifested, and so on.

Then, the solution - the heart of the pattern - which describes the field of physical and social relationships which are required to solve the stated problem, in the stated context. This solution is explained in the form of an instruction.

A diagram, which shows the solution in the form of a diagram, with labels to indicate its main components.

This part ties that particular pattern to all those smaller patterns which are needed to complete, embellish of fill it out. As has been made visible in the first part of the pattern language, the pattern fields map.

Other beneficiary population groups

The degree to which the pattern is frail elderly specific. On a scale of one till five.

The format of the design principle catalogue based on the pattern language of Christopher Alexander (by the author)
5. Format

5.1 Indexes
Firstly, part II begins with indexes which arrange the principles. The design principle catalogue suggest that all patterns are linear ordered. However, as has been explained in the previous chapter, the principles should be seen as part of a language. And a language knows not one linear order. In practice the designer will leap from one principle to another, configuring their own language. To assist this process, the principles are arranged by different topic, scale or interest. Hereby the indexes help the designer or planner in the search for a solution.

5.2 Pattern field
The indexes will be followed by an illustration showing the pattern language, a so called a pattern field map. This map illustrates all connections between the design principles in this pattern field. The field is ordered between two axes with different parameters. What is most important about this field, is that each principle is connected to certain larger principle which come above in the field; and to certain smaller patterns which come below it in the language. The patterns help to complete those larger patterns which are above it, and are themselves in turn supported by those smaller patterns which are below it.

5.3 Principles format
The design principles need to be made explicit. For convenience and clarity, each principle has the same format (see figure 8).
First there is a picture, which shows an archetypical example of the principle.
Second, after the picture, each principle has an introductory paragraph, which sets the context for the pattern, by explaining how it helps to complete certain larger patterns.
Then the second paragraph starts, with the headline of the problem statement which gives the essence of the problem in one or two sentences. And then follows the body of the problem, the longest section. It gives the empirical background of the principle. The the range of different ways the principle can be manifested, and so on.
Then, the solution - the heart of the pattern- which describes the field of physical and social relationships which are required to solve the stated problem, in the stated context. This solution is explained in the form of an instruction. The validity of the principle is supported by a list of literature on the right of the page on which the problem and solution of the principle is based on.
After the text, the solution is illustrated in the form of a diagram, with labels to indicate its main components. After all, as Alexander himself explains it, ‘if you can’t draw a diagram of it, it isn’t a pattern’ (Alexander, 1979, p. 267).
This ends the main body of the principle. However, it is important to show the ties the principle has to other principles. That is why the sixth paragraph ties that particular principles to all those smaller principles which are needed to complete, embellish or fill it out (Alexander et al., 1977). As has been made visible previously in the catalogue by the pattern fields map.
Because of the fact that the design principles will be for the public space which will benefit other users. And the fact that elderly want to stay in contact with other population groups another paragraph has been added. Here the relation of that principle to other beneficiary population groups is stated. Making it possible for urban designers to get an idea of who benefits and possibly look up design suggestion for that particular population group.
Furthermore, while all of the patterns are of importance when designing elderly friendly public spaces, there is a degree to which they are frail elderly specific. For instance, because of the fact that the main mode of transportation of elderly is walking, some of the patterns...
will be beneficial for pedestrians in general. Therefore the last paragraph includes a scale from one till five on how elderly specific the pattern is. The assessment of the elderly specific degree of the principle is based on the focus of the literature the design principle is derived from.

6. Implementation

The approach of the pattern language has been used to translate the findings from literature, empirical and design research into comprehensible spatial interventions made visible by using pictures of examples. This is essential for this project to make it usable for practitioners in the field of urbanism who are very visually oriented and to make it understandable for people outside the academic practise.

Essential for the pattern language to work is that the problem it tends to solve is real and that the configuration solves the problem. This underlines the fact that the research to find the problem is crucial, but the implementation to is just as essential. Therefore the principles have been implemented in the design for the city of Spijkenisse in the authors graduation project (Cammelbeeck, 2013).

This method, as Alexander describes it, can be interpreted as highly generalizing and compulsory. Especially because he describes designing as a process that needs to unfold step by step. However, urban design is more than just a checklist, not in the least because it has to do with people and ever changing local conditions. That is why it should be implemented it in a location-related and flexible way. Therefore these design principles should not be considered as a set of laws. It should be regarded as a growing reference guide that planners can use every day. It is a versatile language which can be used in different ways.
PART II. DESIGN PRINCIPLES
7. Indexes

In practice the user of this design principle catalogue is likely to leap from one principle to another, configuring their own language. To assist this process, the principles are arranged by different topics, scales or interests. Hereby the indexes help the designer or planner in the search for a solution.

There are three categories between which the principles are divided:

- The first is scale which is divided into city, neighbourhood, street and micro (curb) scale.
- The second are the six themes found in literature to be essential when designing elderly friendly public spaces: familiarity, legibility, distinctiveness, accessibility, safety and comfort.
- The third and last category are actors. Because practitioners from different fields and backgrounds will work on the designs of elderly friendly spaces, the most essential principles which should be kept in mind by this type of practitioners is places under the specific actor. The main actors when designing public spaces for elderly are likely to be;
  - The municipality/government as they are likely to be the owner of the public space in countries such as the Netherlands. In this theme, the focus will be on the legislation which needs to be put in place by governments and municipalities.
  - (Strategic) Urban planners dealing primarily with regional and city scale planning.
  - Urban designers, primarily dealing with the design of the public space.
  - Architects who design the buildings surrounding the public space.
  - Industrial design Engineer, dealing with the design of different objects in the public space.

The exact part of the design a certain stakeholder is concerned with is not always straightforward and differ between countries, therefore these indexes should be considered the be a guide instead of a rule limiting a practitioner to which principle they should use.

Furthermore, there are other stakeholders such as elderly associations which are dealing with the interests of elderly, however they are primarily not design based. Therefore the most essential aspects for these type of stakeholders are more extensively explained in part V of the graduation thesis Greying Cities by the author (Cammelbeeck, 2013).

**City**
- 01 incremental and small scale changes
- 02 irregular grid pattern
- 05 direct routes
- 09 walkable distance to facilities
- 10 proximity of public transport

**Neighbourhood**
- 01 incremental and small scale changes
- 03 gently winding streets
- 04 hierarchical streets
- 05 direct routes
- 06 short streets
- 08 quiet routes and zones
- 09 walkable distance to facilities
- 10 proximity of public transport
- 11 mixed use neighbourhoods
- 18 avoid crossroads
- 28 lively green spaces and squares
- 29 informal green spaces and squares

**Street**
- 03 gently winding streets
- 04 hierarchical streets
- 06 short streets
- 07 relatively narrow streets
- 12 mixed use streets
- 13 reflect local style
part I. introduction

14 diverse architecture
15 small blocks
16 landmarks
17 environmental features
19 signal controlled crossings
20 traffic islands
21 clear signs and symbols
23 green barriers and buffers
25 wide sidewalks
26 street lights
27 devoid of clutter
31 buildings facing the street
32 visible and obvious entrances
33 buildings reflecting their use
35 accessible public toilets
36 comfortable public seatings
37 sheltering bus and tram stops

Micro scale (curb)
30 maintenance
34 gentle unavoidable changes in level
38 smooth street pavement
39 small and smooth grates and drains
40 curbes

Familiarity
01 incremental and small scale changes
13 reflect local style
32 visible and obvious entrances

Legibility
02 irregular grid pattern
03 gently winding streets
04 hierarchical streets
06 short streets
07 relatively narrow streets

Distinctiveness
12 mixed use streets
14 diverse architecture
15 small blocks
16 landmarks
17 environmental features
18 avoid crossroads
20 clear signs and symbols
32 visible and obvious entrances
33 buildings reflecting their use

Accessibility
05 direct routes
09 walkable distance to facilities
10 proximity of public transport
11 mixed use neighbourhoods
24 assigned parking spaces
25 wide sidewalks
30 maintenance
31 buildings facing the street

Comfort
08 quiet routes and zones
27 devoid of clutter
29 informal green spaces and squares
35 accessible public toilets
36 comfortable public seatings
37 sheltering bus and tram stops

Distinctiveness
12 mixed use streets
14 diverse architecture
15 small blocks
16 landmarks
17 environmental features
18 avoid crossroads
20 clear signs and symbols
32 visible and obvious entrances
33 buildings reflecting their use

Safety
19 signal controlled crossings
20 traffic islands
22 clear street zoning
23 green barriers and buffers
24 assigned parking spaces
25 wide sidewalks
26 street lights
30 maintenance
34 gentle unavoidable changes in level
38 smooth street pavement
39 small and smooth grates and drains
40 curbes

Municipality/Government
09 walkable distance to facilities
10 proximity of public transport
11 mixed use neighbourhoods
12 mixed use streets
30 maintenance
34 gentle unavoidable changes in level

(Strategic) urban planner
01 incremental and small scale changes
02 irregular grid pattern
03 gently winding streets
04 hierarchical streets
05 direct routes
06 short streets
07 relatively narrow streets
09 walkable distance to facilities
10 proximity of public transport
11 mixed use neighbourhoods
12 mixed use streets
15 small blocks
18 avoid crossroads

Architects
13 reflect local style
14 diverse architecture
15 small blocks
16 landmarks
21 clear signs and symbols
31 buildings facing the street
32 visible and obvious entrances
33 buildings reflecting their use

Urban designer
01 incremental and small scale changes
03 gently winding streets
04 hierarchical streets
06 short streets
07 relatively narrow streets

Industrial designers
17 environmental features
21 clear signs and symbols
35 accessible public toilets
36 comfortable public seatings
37 sheltering bus and tram stops
8. Pattern field

The pattern field map on the next page illustrates all connections between the design principles in this pattern field. The field is ordered between two axes with different parameters. The x-axis orders the principles by scale and the y-axis orders them by how elderly specific they are according to the reviewed literature.

What is most important about this field, is that each principle is connected to certain larger principle which come above in the field; and to certain smaller principle which come below it in the language. The principles help to complete those larger principles which are above it, and are themselves in turn supported by those smaller patterns which are below it.

The arrows connecting the principles points towards the principle it is supported by, and if the principles support each other the arrow points both ways.
part I. introduction
# 9. Design principles

- 01 incremental and small scale changes p. 28
- 02 irregular grid pattern p. 30
- 03 gently winding streets p. 32
- 04 hierarchical streets p. 34
- 05 direct routes p. 36
- 06 short streets p. 38
- 07 relatively narrow streets p. 40
- 08 quiet routes and zones p. 42
- 09 walkable distance to facilities p. 44
- 10 proximity of public transport p. 46
- 11 mixed use neighbourhoods p. 48
- 12 mixed use streets p. 50
- 13 reflect local style p. 52
- 14 diverse architecture p. 54
- 15 small blocks p. 56
- 16 landmarks p. 58
- 17 environmental features p. 60
- 18 avoid crossroads p. 62
- 19 signal controlled crossings p. 64
- 20 traffic islands p. 66
- 21 clear signs and symbols p. 68
- 23 green barriers and buffers p. 70
- 25 wide sidewalks p. 72
- 26 street lights p. 74
- 27 devoid of clutter p. 76
- 28 lively green spaces and squares p. 78
- 29 informal green spaces and squares p. 80
- 30 maintenance p. 82
- 31 buildings facing the street p. 84
- 32 visible and obvious entrances p. 86
- 33 buildings reflecting their use p. 88
- 34 gentle unavoidable changes in level p. 90
- 35 accessible public toilets p. 92
- 36 comfortable public seatings p. 94
- 37 sheltering bus and tram stops p. 96
- 38 smooth street pavement p. 98
- 39 small and smooth grates and drains p. 100
- 40 curbes p. 102
INCREMENTAL AND SMALL SCALE CHANGE

+ Context of the pattern
Changes in the built environment should be small, incremental and reflect the local style to help frail elderly to stay familiar with their neighbourhood.

Large scale development is likely to cause disorientation, confusion and anxiety in older people.

+ Problem
Older people generally take longer to remember the names of people, places and objects or to learn new information than when they were younger. This is especially the case for elderly who are less aware of their environment and rely on constant reinforcement.

+ Solution
In the case of a new developments the changes should be on a small scale. Additionally the use of local forms, styles and materials will help older people to become familiar with the new neighbourhood.

+ Relation to other principles
13 reflect local style

+ Other beneficiary population groups
People with cognitive limitations

+ Degree of how elderly specific

1 2 3 4 5
part II. design principles
(by the author)
IRREGULAR GRID PATTERN

+ Context of the pattern
An irregular grid pattern is an appropriate bases for well functioning pedestrian system which organises pedestrian movements in such a way that elderly can follow direct routes to their natural destinations within a walkable distance. All in a distinctive and legible environment.

Dead end and similar streets are cause for confusion and limit the amount of direct routes which negatively affects the accessibility of facilities for all pedestrians and elderly in particular.

+ Problem
A street pattern with a number of dead-ends (lollipop pattern), such as culs-de-sac, is not only confusing in terms of legibility but also limits the ability to move around on foot. Walking to local facilities in such neighbourhoods often means following a convoluted route that takes much longer than a direct connection would. Additionally, pedestrian footpaths linking dead-ends typically run beyond back gardens fences or rear access garages which are not overlooked and consequently feel isolated and unsafe. Although the uniform grid provides a pattern of well-connected streets the layout of identical streets and cross-roads can be as confusing as the lollipop pattern.

+ Solution
The most legible street pattern for older people, especially those with cognitive limitations, is an irregular grid. The irregular grid creates a more interesting overall street pattern, provides direct, connects routes which are easy to understand and gives people a clearer view ahead than the 90° turns and blind bends created by uniform grids. Additionally it provides a basis for the design of a diverse type of buildings and small building blocks adding to the distinctiveness of the streets.

+ Relation to other principles
03 gently winding streets; 04 hierarchical streets; 05 direct routes; 09 walkable distance to facilities; 14 diverse architecture; 15 small blocks; 18 avoid crossroads

+ Degree of how elderly specific
1 2 3 4 5
GENTLY WINDING STREETS

+ Context of the pattern
Gently winding streets provide elderly to walk comfortably to their outdoor mobility goals.

Long straight streets are viewed as an unprotected and dull path and consequently experienced as longer than the actually are.

+ Problem
Due to their shape, straight street look endless, making the perceived distance longer than the actual distance. Especially when the street is surrounded by long building blocks. In general the action space of elderly is smaller than that of younger persons. Partially because the walking distance acceptable for elderly is shorter than that of a younger person. Therefore if a street is designed as long and straight it, the larger perceived walking distance can cause the action space of elderly to reduce even more.

+ Solution
A windings street closes the space and the distance to be walked is not immediately visible making the experience distance shorter. Additionally, gently winding streets add to the visual interest of a street due to the changing scenery and variation it provides.

+ Relation to other principles
02 irregular grid pattern; 14 diverse architecture; 15 small blocks

+ Other beneficiary population groups
All pedestrians

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Cardoso, 2003)
part II. design principles

HIERARCHICAL STREETS

+ Context of the pattern
Hierarchical streets add to the legibility of a neighbourhood, which would mean less conscious effort is required for elderly to prevent themselves from loosing their way.

When streets look the same frail elderly tend to loose their way, which is one of their biggest fear when going out for a walk.

+ Problem
When all streets look the same in a neighbourhood it is hard for all users to navigate and determine where to go. Similar streets are particularly problematic for elderly with cognitive limitations as they are even more likely to lose their way. And loosing their way is one of the biggest fears of frail elderly when going out for a walk. Frail elderly tend to loose their way at decision points, such as road junctions and crossings. Road crossings and junctions are particularly difficult when there are a number of visually similar routes to choose from.

+ Solution
In terms of legibility the hierarchy of streets helps elderly to know where they are. The maintaining or designing a hierarchy of familiar types of street, from high streets and side streets to lanes, passageways and footpaths gives a clear overall image of an area and what each type of street is likely to offer. Hierarchy can be achieved by making a distinction in profile, length and types of uses.

+ Relation to other principles
02 irregular grid pattern; 07 relatively narrow streets; 08 quiet routes and zones; 18 avoid crossroads

+ Other beneficiary population groups
All users of the public space, especially pedestrians with cognitive limitations

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Greuter, 2012)
part ii. design principles

**DIRECT ROUTES**

+ **Context of the pattern**

Direct routes are essential when creating a well functioning pedestrian system which organises pedestrian movements in such a way that elderly can access their destinations within a walkable distance. Direct routes can be created by using an irregular grid pattern as the basis for the design of a new elderly friendly neighbourhood.

A lack of direct routes can be very disorientating and frustrating for pedestrians.

+ **Problem**

For all pedestrians it is tiring to walk the entire distance to a far destination in sight, however it is even more tiring to be forced to use routes other than the direct one when the destination is in sight. Especially for frail elderly who have difficulties with walking in general. Neighbourhoods with complex street layouts with few connecting streets often prevent direct routes and can cause disorientation for people with short-term memory problems or spatial disorientation.

+ **Solution**

When designing pedestrian routes it should be made possible to use the direct routes over short distances. With greater distances the primary direction towards destinations should be maintained and therefore certain street patterns containing for instance cul de sacs should be avoided.

+ **Relation to other principles**

02 irregular grid pattern; 09 walkable distance to facilities

+ **Other beneficiary population groups**

All pedestrians

+ **Degree of how elderly specific**

1 2 3 4 5
SHORT STREETS

+ Context of the pattern
Short streets supported by environmental features, diverse architecture and landmarks, add to the legibility and distinctiveness of a public space, which helps elderly pedestrians to navigate and orientate themselves.

Elderly tend to loose their way when it is difficult to see along each street.

+ Problem
Elderly tend to loose their way when it is difficult to see along each street. Consequently, long straight streets which lack a clear orientation points can cause elderly to get confused and disoriented.

+ Solution
When navigating through a street is helpful to see the end of a street as a orientation point. This helps to maintain concentration, which is necessary to avoid becoming disoriented or confused.

+ Relation to other principles
14 diverse architecture; 15 small blocks; 16 landmarks; 17 environmental features

+ Other beneficiary population groups
People with cognitive limitations

+ Degree of how elderly specific
1 2 3 4 5
RELATIVELY NARROW STREETS

+ Context of the pattern

Narrow streets add to the legibility of the public space due to the proximity of the buildings and environmental cues.

Wide streets are perceived as impersonal and lack environmental cues necessary for elderly to feel safe and navigate.

+ Problem

Built environments with large spaces and wide streets are felt to be cold and impersonal. Firstly, because when streets are wide the view on the street from the surrounding buildings is limited and the feeling of unsafety increases. And secondly, when streets are too wide contact between the pedestrians is limited.

+ Solution

When designing pedestrian friendly streets it is important to keep the human-scale in mind. In order to do so the ratio between the building height and street width is essential. In the case of elderly friendly neighbourhoods the streets should be relatively narrow (around 12 meters) because they help elderly to concentrate due to the closer proximity of environmental cues. Furthermore, due to the fact that in narrow streets people are experiences in a closer range they are more likely to be perceived as warm and personal. While the width of the street preferably should be a maximum of 12 meters, the exact width should be based on the expected amount of people using the street and the height of the surrounding buildings.

+ Relation to other principles

04 relatively narrow streets; 21 clear signs and symbols

+ Other beneficiary population groups

Other frail population groups such as people with cognitive limitations or children.

+ Degree of how elderly specific

1 2 3 4 5
QUIET ROUTES AND ZONES

+ Context of the pattern
Public spaces should have nodes of activity (with pavement cafes or markets, for example), complemented by quiet zones for elderly to comfortably rest and watch people go by.

A high amount of activity can cause elderly to become disoriented.

+ Problem
Older people typically experience a decline in their hearing. Hearing loss makes it difficult to distinguish a particular voice or sound from general background noise, which can cause communication problems, confusions and disorientation.

+ Solution
Although elderly prefer lively, informal open spaces they also prefer being separated from motorised traffic and being able to sit quietly and watch the activity around them. Quiet side roads should be designed to give people the opportunity to choose alternative routes away from traffic. This can be done by making some streets pedestrianised with seating and shelter. Public spaces should have nodes of activity (with pavement cafes or markets, for example), complemented by quiet zones for rest and people-watching.

+ Relation to other principles
4 Hierarchical streets; 21 Clear street zoning; 22 Green barriers and buffers; 29 informal green spaces and squares; 34 public seatings

+ Other beneficiary population groups
People with hearing impairments and all people looking to escape crowds and traffic in general.

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Kleyman, 2004)
part II. design principles

WALKABLE DISTANCE TO FACILITIES

+ Context of the pattern

The main mode of transportation for elderly is walking and their main outdoor mobility goal is shopping. Therefore to stimulate active ageing, facilities need to be within a be accessible walking distance.

When the distance is to daily facilities is to great elderly are likely to stay home which limits their amount of physical activity.

+ Problem

Older people, especially those aged 75 years and over, experience far greater difficulties in accessing local facilities than younger people due to the distance from their home. When the distance is to great elderly are likely to stay home which limits their amount of physical activity. Furthermore going out for an errand is a pretext, or occasion, for contact. Which is essential for elderly who are at risk of becoming socially frail.

+ Solution

Older people are more likely to use local facilities within walking distance of home, shop more often and make regular visits to medical facilities. Ten minutes is found to be a comfortable walking time to reach services and facilities. Frail elderly generally take around ten - twenty minutes to walk 400 meters to 500 meters and cannot walk further than ten minutes without a rest. Consequently older people should ideally live no further than 125 meters from a telephone and post box, and no further than 500 meters from essential services and facilities, including a general food store, post office, bank, general practitioner’s (GP) surgery or health centre, green space (such as village green, green street edges), public toilets, seating and a bus stop. If secondary services and facilities, including a park or other form of open space, library, dentist, optician, places of worship, and community and leisure facilities, cannot be within a 500 meter radius they should be no further than 800 meter from the home of an elderly, again with public toilets and seating.

+ Relation to other principles

05 direct routes; 10 proximity of public transport; 11 mixed use neighbourhoods; mixed use streets; 31 buildings facing the street; 35 accessible public toilets; 36 comfortable public seatings

+ Other beneficiary population groups

People with a lower possible walking distance such people who are physically impaired or children.

+ Degree of how elderly specific

1 2 3 4 5
PROXIMITY OF PUBLIC TRANSPORT

+ Context of the pattern
Public transport is important for older adult generally and essential for people with limited mobility to access facilities outside their walking or cycle distance is they don’t have access to a car.

+ Problem
People, especially older adults, living in neighbourhoods with poor infrastructure have lower level of health-related quality of life compared to people with good access to proper services. This is partially because a long distance to reach a transit stop is said to make travelling out of the neighbourhood less safe and in some cases unfeasible therefore reducing the accessibility of certain facilities.

+ Solution
Elderly express a strong preference for living in their neighbourhoods for as long as they are able and feel good public transportation makes it possible to meet people and reach their outdoor mobility goals. Therefore public transport transits should be on a walkable distance of 500 meters from the homes of elderly and near the destinations they are going to such as city centres and hospitals. In order to do so the steps to access the mode of transportation should not be to high.

Public transport is not just an alternative to driving, but can help senior to meet and connect with other people. Therefore shelters with places to sit should be provided.

+ Relation to other principles
09 walkable distance to facilities; 37 sheltering bus and tram stops

+ Other beneficiary population groups
People who are impaired or don’t have access to a car.

+ Degree of how elderly specific
1 2 3 4 5
MIXED USE NEIGHBOURHOODS

+ Context of the pattern
Mixed use neighbourhoods and streets add to the accessibility of facilities and provide elderly with opportunities to be active in a distinctive built environment.

Inhabitants of monofunctional neighbourhoods are likely to have difficulties accessing facilities.

+ Problem
With walking as their main mode of transport, elderly are often limited to their nearby surroundings for their daily activities. As a consequence, the neighbourhood environment becomes increasingly significant. When neighbourhoods are mainly residential, inhabitants have trouble accessing their support services which lowers the activities undertaken in the public space especially by elderly as shopping is their main outdoor mobility goal. Consequently, the public space is likely to be quiet and unattractive for be in. Furthermore monofunctional neighbourhoods can be perceived as monotonous which can lead to disorientation and confusion of the elderly inhabitants.

+ Solution
Older people living in mixed use neighbourhoods are generally more able to access the services and facilities they need than those living in solely residential areas. Neighbourhoods that provide a mix of uses relevant to the needs of local people will also be active places with different population groups using the public space that help older people to feel less vulnerable, providing they are not overcrowded. Furthermore, Inhabitants of mixed use neighbourhoods are generally more active because the facilities provide inhabitants with opportunities to be active. And finally, the different types of uses add to the distinctiveness of the neighbourhood.

+ Relation to other principles
09 walkable distance to facilities; 12 mixed use streets

+ Other beneficiary population groups
Everyone with a lowered action space, for instance people without access to a car.

+ Degree of how elderly specific

1 2 3 4 5
part II. design principles

(Jaspers, 2011)
MIXED USE STREETS

+ Context of the pattern
Mixed use streets add to the accessible of facilities and provide elderly with opportunities to be active in a distinctive built environment.

Elderly users of monofunctional streets are more likely to become disorientated due to the lack of distinctive features and to have trouble accessing facilities.

+ Problem
Elderly tend to perceive uniform uses and designs as ‘very boring’ and lacking in the distinctive features necessary for identifying where they are and which way they need to go. Streets that are identical to each other in terms of use with few distinguishing features can cause anyone to experience disorientation and confusion. Furthermore, when facilities are concentrated and wide spread the distance to the facilities increases which makes them inaccessible for elderly.

+ Solution
Mixed use streets not only make a neighbourhood more interesting to walk around but also more vibrant and provide the necessary interest and stimulation for people who need to maintain concentration to avoid losing the way.

+ Relation to other principles
09 walkable distance to facilities; 11 mixed use neighbourhoods; 33 buildings reflecting their use

+ Other beneficiary population groups
People with a lower possible walking distance such people who are physically impaired or children. Or people with cognitive limitations.

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles
REFLECT LOCAL STYLE

+ Context of the pattern
Familiar built environments where the changes which are being made are small scale and reflect the local style help in reducing confusion and maintaining the independence of frail elderly.

Large scale development is in an unfamiliar style is likely to cause disorientation, confusion and anxiety in older people.

+ Problem
Older people generally take longer to remember the names of people, places and objects or to learn new information than when they were younger. This is especially the case for elderly who are less aware of their environment and rely on constant reinforcement. Therefore when large changes are being made elderly could get confused.

+ Solution
When performing design interventions in the built environment the new situation should still be familiar to frail elderly to prevent confusion and anxiety. Therefore the changes should be small and incremental and reflect the existing local style.

+ Relation to other principles
01 incremental and small scale changes; 14 diverse architecture

+ Other beneficiary population groups
DIVERSE ARCHITECTURE

+ Context of the pattern
Diverse architecture leads to legible and distinctive streets and neighbourhoods which helps elderly pedestrians to navigate and orientate themselves.

A succession of architecturally similar buildings alongside a street make pedestrian routes feel long a trying.

+ Problem
When buildings and streets look the same it is hard for everyone, and elderly in particular, to orientate themselves. Leading to disorientation and confusion. Additionally a succession of architecturally similar buildings alongside a street make pedestrian routes feel long a trying. Making the perceived walking distance longer.

+ Solution
Design aspects that add to a neighbourhood’s legibility, distinctiveness and overall visual interest include the presence of a variety of architectural styles within one block. The value of exceptions in a street such as a vivid colour or silhouette feature is to entrap the eye so that it does not slide into the beyond with resulting in boredom. Important elements which add to the differentiation between buildings are the use of different materials, colours, building widths and heights resulting in a diverse skyline. Consequently the diverse architecture can add to the diversity between streets and neighbourhoods.

+ Relation to other principles
03 gently winding streets; 13 reflect local style; 15 small blocks; 16 landmarks; 33 buildings reflecting their use

+ Other beneficiary population groups
All pedestrians

+ Degree of how elderly specific

1 2 3 4 5
SMALL BLOCKS

+ Context of the pattern
Irregular grid patterns with gently winding and short streets lined with small building blocks and diverse architecture add to the visual interest of a route and reduce the perceived distance.

Big buildings and building blocks with long facades make pedestrian routes feel long and trying.

+ Problem
Large building blocks alongside a street make the perceived distance longer than the actual distance. In general the action space of elderly is smaller than that of younger persons. Partially because the walking distance acceptable for elderly is shorter than that of a younger person. Therefore if a street is designed with large building blocks, the larger perceived walking distance can cause the action space of elderly to reduce even more.

+ Solution
The principle should be small units with many doors facing the street, concentrating events towards the street. Building blocks should be of varying short lengths from around 60–100m to allow for variety.

+ Relation to other principles
02 irregular grid pattern; 03 gently winding streets; 06 short streets; 14 diverse architecture

+ Other beneficiary population groups
All pedestrians

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

LANDMARKS

+ Context of the pattern
Landmarks add to the legibility and distinctiveness of a public space, which helps elderly pedestrians to navigate and orientate themselves.

A succession of similar buildings and spaces in use and design can cause frail elderly to get disorientated

+ Problem
A succession of similar buildings and public spaces in use and design make pedestrian routes feel longer than they are and therefore trying. Additionally the lack of differentiations makes it difficult for elderly to navigate through the public space which can cause disorientation.

+ Solution
Landmarks such as distinctive buildings, particularly those of civic status, towers or statues help provide reference points and emphasise the hierarchy of a place. Furthermore, they add to the perceived attractiveness of the neighbourhood. Due to the fact that exceptions in a street such as a tower or belfry is to entrap the eye so that it does not slide into the beyond with resulting in boredom.

There are five different types of landmarks that can be distinguished:
+ Historic buildings; such as churches, and historic structures, such as memorials and monuments, are particularly important as they are more likely to be remembered due to having been in existence for a very long time.
+ Civic buildings; including town halls, hospitals, village halls and libraries are also important landmarks.
+ Distinctive structures; including high-rise buildings, bridges, spires, steeples and towers.
+ Places of interest and activity; such as parks, commons, playing fields, tennis courts, nature reserves, allotments, play areas and recreation grounds are being used as direction cues as well.
+ Unusual places, buildings or usages; places, buildings or usages that have a distinctive local identity, such as ‘the toothpaste tube houses’ and ‘the big ugly house at the end’.

+ Relation to other principles
14 diverse architecture; 17 environmental features; 33 buildings reflecting their use
+ Other beneficiary population groups
All users of the public space, especially people with cognitive difficulties
+ Degree of how elderly specific

1 2 3 4 5
part II. design principles

ENVIRONMENTAL FEATURES

+ Context of the pattern
Environmental features add to the legibility and distinctiveness of a public space, which helps elderly pedestrians to navigate and orientate themselves.

A succession of public spaces and difficult decision points in use and design can cause frail elderly to get disorientated.

+ Problem
The lack of differentiations in the public space makes it difficult for elderly to navigate which can cause disorientation.

+ Solution
Environmental cues are first recognised in terms of their function, followed by their location and then their design. People make fewer mistakes when the features are positioned at places where complex decisions are required. In order for them to work environmental features need to be long-term. Two types of environmental features can be distinguished as orientation and way finding cues:
- Aesthetic features; such as water pumps, fountains, village greens, ponds, attractive front gardens, trees, hanging baskets and flower tubs, are used to identify the direction elderly are going in and the location of their destination.
- Practical features: such as street furniture including letter boxes, public seatings and bus shelters.

+ Relation to other principles
14 diverse architecture; 16 landmarks; 21 clear signs and symbols; 26 street lights

+ Other beneficiary population groups
All pedestrians trying to find their way, especially people with cognitive limitations

+ Degree of how elderly specific

1  2  3  4  5
part II. design principles
part II. design principles

AVOID CROSSROADS

+ Context of the pattern
In a city with an irregular street pattern with hierarchical streets crossroads can be prevented, adding to the legibility of the built environment.

One of the greatest fears of frail elderly is loosing their way especially at road junctions and crossings.

+ Problem
Frail elderly are likely to get disoriented at road crossings and junctions where they had to make a decision about which way to turn. Road crossings and junctions are particularly difficult when there are a number of visually similar routes to choose from or where it is difficult to see along each street.

+ Solution
Forked, staggered and T-junctions should be used, rather than cross-roads, which keep the number of alternative routes to a minimum and provide a focal point at the end of the streets. The streets coming together at the junctions should preferably be hierarchical to make it easier for elderly which way they need to go.

+ Relation to other principles
02 irregular grid pattern; 04 hierarchical streets; 21 clear signs and symbols

+ Other beneficiary population groups
People with cognitive limitations

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Kunz, 2008)
SIGNAL-CONTROLLED CROSSINGS

+ Context of the pattern
Street crossings should preferably be signal-controlled combined with dropped curbs and an traffic island making it safe for elderly to cross a busy road. However, in the case of quiet secondary roads an traffic island and dropped curbs are sufficient.

Concerns about traffic safety and inadequate pedestrian infrastructure limit elderly in walking and other activities.

+ Problem
Crossing a wide or busy road can be a difficult task for anybody but for people with slow reactions, reduced cognitive abilities or mobility problems it can be dangerous and stressful even at controlled crossings. A problem with some signal-controlled crossings is that older people often have difficulty hearing higher frequency sounds. Another problem is that it takes older people longer to react than younger adults once they have realised that it is safe to cross and it takes them longer to cross the road.

+ Solution
Traffic signals with pedestrian controls are found essential to feel safe at street crossings. Wherever possible, but particularly on busier and wider roads, ground level signal-controlled pedestrian crossings should be provided. Audible signals should be at a fairly low pitch so that people with hearing impairments can hear them and there should also always be a visual signal. Furthermore, they should provide enough time for elderly to cross.

+ Relation to other principles
20 traffic islands; 40 curbs

+ Other beneficiary population groups
Everyone trying to cross a busy road and in particular people with slow reactions, reduced cognitive abilities or mobility problems and children.

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Gleichmann 2011)
part II. design principles

TRAFFIC ISLANDS

+ Context of the pattern
Street crossings should preferably be signal-controlled combined with dropped curbs and an traffic island making it safe for elderly to cross a busy road. However, in the case of quiet secondary roads an traffic island and dropped curbs are sufficient.

Concerns about traffic safety and inadequate pedestrian infrastructure limit elderly in walking and other activities.

+ Problem
Crossing a wide or busy road can be a difficult task for anybody but for people with slow reactions, reduced cognitive abilities or mobility problems it can be dangerous and stressful. Mainly because they don’t have enough time to cross the road in one go without feeling unsafe due to upcoming traffic.

+ Solution
Non-controlled traffic islands are a good alternative for secondary quiet roads instead of signal controlled crossings. They enable elderly to cross the road in two stages and to pause for a rest or a break in the middle.

+ Relation to other principles
19 signal controlled crossings; 40 curbes

+ Other beneficiary population groups
Everyone trying to cross a busy road and in particular people with limited mobility.

+ Degree of how elderly specific

1 2 3 4 5
CLEAR SIGNS AND SYMBOLS

+ Context of the pattern
Legible environments provide a diversity of architecture and public spaces supported by clear signs and symbols to prevent elderly from loosing their way.

It is extremely debilitating for elderly how are likely to loose their way to be unable to follow directions in an illegible environment.

+ Problem
For elderly who are more likely to loose their way it is extremely debilitating if they are unable to seek help or to follow directions in an illegible environment. Especially elderly with cognitive impairments struggle to interpret the information supplied by signs and will sometimes follow the instructions regardless of where they actually want to go or what they want to do. Clusters of signs, signs with to much information, signs with abbreviations, small letters, low contrast or stylised graphics are difficult for elderly to understand and read.

+ Solution
The best signs for older people are plain and simple and provide explicit, essential information only. They should have large, non-stylised contrasting letters and symbols should be realistic and unambiguous. Additionally should be made with non-glare lighting and non-reflective coverings. Signs giving directions should preferably be on posts and single pointers and positioned at important way finding decision points, such as road junctions and crossings. Signs identifying the location of a place or building are most effective when perpendicular to the wall as they can be seen from a distance but as too many on one street would be confusing. Therefore sign should be restricted to essential shops, services and facilities. And finally signs positioned flush on a wall, such as those identifying the name of a place or building, should be in a clear contrasting colour to that of the wall.

+ Relation to other principles
17 environmental features; 18 avoid cross roads; 26 street lights; 27 devoid of clutter

+ Other beneficiary population groups
People unfamiliar with their surroundings and people with cognitive problems

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(by the author)
CLEAR STREET ZONING

+ Context of the pattern
Streets are clearly zoned together with green barriers, assigned parking spaces and wide sidewalks help elderly pedestrians feel safe from traffic.

One of the major safety concerns for elderly is that they are afraid of being knocked over.

+ Problem
Bicycles on footways are a common safety concern for older people. The main cause for concern is that elderly are afraid of being knocked over.

+ Solution
It should be clear for all users of the public space where their zone is. Clear zoning helps pedestrians feel safe from bicyclists and cars. Therefore pedestrians should be separated from traffic by trees, on-road parking or bicycle lanes.

+ Relation to other principles
23 green barriers and buffers; 24 assigned parking spaces; 25 wide sidewalks

+ Other beneficiary population groups
Children and cyclists

+ Degree of how elderly specific
1 2 3 4 5
GREEN BARRIERS AND BUFFERS

+ Context of the pattern
By providing a clear street zoning and adding green barriers and buffers between the sidewalks and the main road elderly pedestrians feel safe and protected against traffic. Elderly describe busy arterials as unpleasant and unsafe and therefore tend to avoid them.

+ Problem
Traffic safety is one of the major concerns of elderly pedestrians. Busy roads are especially daunting because sudden, loud noises often startle older people causing confusion and disorientation, especially for those with dementia. In addition, continuous noise, such as the drone of heavy traffic, affects their ability to hear. Therefore elderly tend to avoid busy roads, however the facilities they want and need to reach are often located near or on busy arterials.

+ Solution
Acoustic barriers and buffers, such as fencing, trees and shrubs, help to shield pedestrians from traffic and to reduce street and background noises. Furthermore, a line of trees and a grass verge between the footway and road also helps to delineate the footway from the road and discourages or prevents drivers from parking their vehicles on the footway. Apart from the safety related issues the presence of vegetation or greenery is perceived as being attractive for walking along. As wet leaves can be slippery under foot it is better to use evergreens or trees with small leaves that disperse in the wind.

+ Relation to other principles
22 clear street zoning

+ Other beneficiary population groups
Children

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

Live in AsiaNZ, 2006
ASSIGNED PARKING SPACES

+ Context of the pattern
Streets are clearly zoned together with green barriers, assigned parking spaces and wide sidewalks help elderly pedestrians feel safe from traffic.

Cars parking on sidewalks make it difficult for elderly to walk.

+ Problem
When there are no designated and not wide enough parking spaces cars are likely park partially on the footways. As a result leaving little to no room for pedestrians and especially people in wheelchairs.

+ Solution
Large enough parking spaces should be provided in every neighbourhood. Parking spaces should be assigned to prevent elderly from being bothered by cars and therefore feel unsafe. On-street parking can also provide an extra barrier between pedestrians and traffic and helps to slow the traffic down. A line of parked cars is not, of course, as attractive as grass and trees but parking spaces can be interspersed with some trees or planting.

+ Relation to other principles
22 clear street zoning

+ Other beneficiary population groups
People in wheelchairs, parents with baby carriages and people with shopping carts

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Callow, 2011)
part II. design principles

WIDE SIDEWALKS

+ Context of the pattern
Walking demands space for all pedestrians to move comfortably and safely without being disturbed.

Narrow sidewalks limits how freely a pedestrian can move and can cause a fear of being jostled or disturbed by other pedestrians or nearby traffic.

+ Problem
Tolerance and demands for space varies between population groups and per person. In the case of older people it is generally harder for them to cope with crowded places because they are sometimes unable to anticipate which way an oncoming pedestrian may go. Causing them to be afraid of being jostled or knocked over. Furthermore, elderly are often afraid or feel unpleasant when they are confronted with busy traffic.

+ Solution
For older people to be able to cope with crowded places they need enough space on the footway to walk along unimpeded without being jostled. Footways need to be flat and at least two meters wide to allow people with dementia, mobility problems and wheelchair users to safely pass oncoming pedestrians. A wide footway also gives people a chance to walk a little further away from the motorised traffic moving alongside on the road. The width of the footways need to be increased when the amount of people using the sidewalks increase.

+ Relation to other principles
22 clear street zoning; 38 smooth street pavement, 39 small and smooth grates and drains; 40 curbs

+ Other beneficiary population groups
Children, parents with baby carriages, people in wheelchairs or with shopping carts

+ Degree of how elderly specific

1 2 3 4 5
part II. design principles

(Parker, 2011)
STREET LIGHTS

+ Context of the pattern
Street lights make the public space feel safer at night and can work as environmental features during the day, however cluttering of the street should be avoided.

Darkness is perceived as being unsafe and a reason for elderly to not go out.

+ Problem
Darkness is often perceived by elderly as a barrier for physical activity and going outside mainly because they associate it with crime and unsafety. Therefore, streets can be very unfriendly places for older people with barriers such as poor lighting.

+ Solution
Every neighbourhood should have well lit spaces for walking. However, it is important to prevent any type of reflection where possible and the posts should be located at the edge of the sidewalk to prevent it from becoming an physical barrier.

+ Relation to other principles
27 devoid of clutter; 21 clear signs and symbols; 17 environmental features

+ Other beneficiary population groups
All users of the public space at night

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles
(by the author,)
DEVOID OF CLUTTER

+ Context of the pattern
Street lights make the public space feel safer at night and can work as environmental features together with signs and symbols as way finding cues during the day, however cluttering of the street should be avoided.

It is difficult for elderly to negotiate around street clutter such as poles and bicycles.

+ Problem
Elderly are afraid of falling down and find it difficult to negotiate busy streets. If streets are filled with clutter such as poles with signs and bicycles their fear of falling increases. Additionally due to cognitive limitations some elderly find it difficult to read a multitude of signs and symbols and other way finding cues.

+ Solution
Preferably the amount of signs and symbols should be limited and if possible fixed to existing elements such as walls and street lighting. And facilities such as bicycle racks should leave at least 2 meters of footways free for elderly to walk on.

+ Relation to other principles
17 environmental features; 26 street lights; 21 clear signs and symbols

+ Other beneficiary population groups
Children
part II. design principles
LIVELY GREEN SPACES AND SQUARES

+ Context of the pattern
Elderly friendly neighbourhoods should provide a variety of facilities with buildings facing the public space making it possible for elderly to meet and interact with people provided that there are also quiet routes and zones where they can sit comfortably.

Quiet green spaces and squares make it difficult for elderly to meet people, putting them at risk of becoming socially frail.

+ Problem
Elderly are likely to be or become socially frail due to the fact that they often have too few people they can turn to in difficult times. Therefore social interaction is essential. However, when public spaces are quiet and there are little or no facilities in the neighbourhoods it is difficult for elderly with a limited action space to meet people.

+ Solution
Urban squares and green spaces should be informal, have plenty of activity in and around them, delineated footpaths and a variety of features, such as seating, trees and other soft landscaping. This provides people with places to meet and talk to people and provided the necessary stimulation for those who need to maintain concentration.

+ Relation to other principles
11 mixed use neighbourhoods; 29 informal green spaces and squares; 31 buildings facing the street; 36 comfortable public seatings

+ Other beneficiary population groups
All users of the public space

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Gemmell, 2011)
INFORMAL GREEN SPACES AND SQUARES

+ Context of the pattern
Age-friendly neighbourhoods should offer informal public spaces where older people are able to relax, meet and interact comfortably by providing quiet zones combined with lively spaces and public seatings.

Elderly are more likely to avoid formal public spaces as they find them intimidating and therefore uncomfortable.

+ Problem
Elderly find that formal places can sometimes feel intimidating and forbidding due to their size and type of design. This is partly due because elderly with cognitive impairments find it difficult to understand what is expected of them.

+ Solution
The ‘more human’, welcoming nature of informal and natural open spaces provides a more psychologically comfortable environment for people who are aware of losing the ability to always understand what is expected of them in a particular environment. Essential is the design of informal public space is being aware of the human scale and providing comfortable small scale zones with places to sit and rest away from large amounts of people and traffic. Making use of soft landscaping such as trees and hedges.

+ Relation to other principles
08 quiet routes and zones; 28 lively green spaces and squares; 36 comfortable public seatings

+ Other beneficiary population groups
Children and people with cognitive limitations

+ Degree of how elderly specific
1 2 3 4 5


MAINTENANCE

+ Context of the pattern
In order for elderly to safely walk through the public space, smooth and well maintained pavement is essential.

Difficult terrain has been found to restrict out-of-home activities in older people.

+ Problem
Fear of falling is probably the most important factor in predicting activity avoidance among older adults. That is why maintenance of pavements, including repairing broken paving slabs and cutting back overgrown hedges is a cause for concern for older people.

+ Solution
It is essential for the owners of the public space, such as municipalities, to maintain the public space and therefore upholding and improving its attractively and safety. From an urban designer point of view materials, trees and plants should be chosen which need a manageable amount of maintenance.

Relation to other principles
38 smooth street pavement

Other beneficiary population groups
All users of the public space and in particular people with mobility problems due to physical impairments.

Degree of how elderly specific
1 2 3 4 5
part II. design principles

(Johns, 2011)
part II. design principles

BUILDINGS FACING THE STREET

+ Context of the pattern
Buildings should be facing the street to provide safe, accessible and familiar public spaces for elderly and other pedestrians. And adding life to the public space.

Buildings turning their backs towards the streets make the public space feel unsafe and make the buildings themselves more difficult to access.

+ Problem
The pleasantness of a place is partly depending on protection from danger an physical harm, primarily from insecurity due to fear of criminality. When there is a lack of people walking in or watching over the public space the instinctive unsafety rises. Additionally when buildings don’t face the street their entrances are hard to find which negatively affects the accessibility.

+ Solution
Buildings facing the street help to make people walking along the street feel safer because it is reassuring to feel that the street can be seen by the occupants of the buildings, adding to the natural surveillance of public areas. The edges of the street blocks should be lined with buildings facing the street, not only because this a more familiar environment for older people but is also helps to identify what the buildings are for and provide a clear distinction between public and private space. Additionally it provides inside the buildings with the ability to see what is going on in the public space which can be an element of invitation

+ Relation to other principles
07 relatively narrow streets; 09 walkable distance to facilities; 28 lively green spaces and squares; 32 visible and obvious entrances; 33 buildings reflecting their use

+ Other beneficiary population groups
All users of the public space

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles
(by the author)
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VISIBLE AND OBVIOUS ENTRANCES

+ Context of the pattern
In order to be accessible buildings and their entrances need to face the street and be clearly visible.

Due to possible cognitive limitations it is difficult for frail elderly to find entrances to buildings if they are not directly visible.

+ Problem
Elderly with cognitive limitations find it difficult to determine the use of different buildings if their identity is ambiguous. When the entrances are not obvious and visible it is likely that frail elderly will find it difficult to find them which makes the building less accessible.

+ Solution
Buildings and their entrances should be facing the street and should be made further visible with clear signs and symbols and use of contrasting materials to point out the main entrance.

+ Relation to other principles
31 buildings facing the street; 33 buildings reflecting their use

+ Other beneficiary population groups

+ Degree of how elderly specific

1 2 3 4 5
part II. design principles
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BUILDINGS REFLECTING THEIR USE

+ Context of the pattern
Accessible neighbourhoods should provide a mix of different uses and by buildings reflecting their use towards the street the legibility and distinctiveness of the public space improves as well.

If the identity of buildings are ambiguous it can be cause for confusion for frail elderly.

+ Problem
Elderly with cognitive limitations find it difficult to determine the use of different buildings if their identity is ambiguous. Especially people with dementia struggle to understand what places and buildings are for and may enter private property by mistake.

+ Solution
With the use of clear signs and the use of an open facades for public and more closed facades for private buildings the use of the building should be reflected.

+ Relation to other principles
12 mixed use streets; 16 landmarks; 31 buildings facing the street; 32 visible and obvious entrances

+ Other beneficiary population groups

+ Degree of how elderly specific
1 2 3 4 5
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GENTLE UNAVOIDABLE CHANGES IN LEVEL

+ Context of the pattern
Changes in level should be avoided, however when they are unavoidable level changes should be gentle and therefore safe and accessible for elderly.

Any level change can create barriers for people who are frail, have an unsteady gait or a visual impairment.

+ Problem
Fear of falling is probably the most important reason older adults to be inactive. Any level change can create barriers for people who are frail, have an unsteady gait or a visual impairment. Elderly who find it difficult to lift their feet and people with visual impairments who have trouble to see steps, find ramps easier to use. However, both steps and ramps can be a challenge for people with mobility problems.

+ Solution
Accessible streets avoid changes in level wherever possible. However, where they are unavoidable, for older people both steps and a ramp should be provided. In the case of great height differences a ramp is essential for people with walking frames, pushchairs, wheelchairs and shopping trolleys. Ramps should have level landings at the top and bottom and a maximum gradient of five percent. Steps should have clearly marked short straight runs with a minimum of three and a maximum of twelve steps per run. Risers should be of uniform height (minimum 10 centimetres and maximum 15 centimetres high) and threads should be no shallower than 30 centimetres deep.
Both ramps and steps should be clearly marked and well lit with guards and plain, nonslip, nonreflective surfaces. Rounded handrails should always be provided on both sides in a smooth material that does not conduct heat or cold.

+ Relation to other principles
26 street lights; 38 smooth pavement, 39 small grates and drains; 40 curbes

+ Other beneficiary population groups
People with baby carriages, wheelchairs, walking frames, pushchairs and shopping trolleys.

+ Degree of how elderly specific

1 2 3 4 5
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ACCESSIBLE PUBLIC TOILETS

+ Context of the pattern
Public toilets are important factors in making a place or street comfortable. (Burton and Mitchell, 2006)

The lack of public toilets prevents some older people from going out as often as they would like.

+ Problem
Older people tend to need to visit the toilet more often than when they were younger. The lack of public toilets prevents some older people from going out as often as they would like. An additional problem is that elderly with cognitive problems struggle to understand modern designs that are unfamiliar to them while other elderly fear that they will not be able to understand or cope with the new technology.

+ Solution
Public toilets are important factors in making a place or street comfortable, welcoming and easy to use for people of all ages and capabilities. Public toilets should be designed in a familiar way and be located on ground level situated in view of passers-by and neighbouring buildings. The doors should have no more than two kg pressure to open and levers that are easier to manipulate for people with weak or stiff hands than knobs.

+ Relation to other principles
09 walkable distance to facilities

+ Other beneficiary population groups
Small children and people with continence problems

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles

(DeBold, 2009)
COMFORTABLE PUBLIC SEATINGS

+ Context of the pattern
Public seatings for resting are facilitators of physical activity and are important factors in making a place or street comfortable, welcoming and easy to use for people of all ages and capabilities.

When the public space lacks places to rest it is a reason for elderly not to go outside.

+ Problem
Many older people cannot walk for longer than 10 minutes without resting and often the public space is lacking places to rest. When the public space lacks places to rest it can be a reason for elderly not to go outside. Furthermore, elderly people find many modern designs unrecognizable as seatings or uncomfortable.

+ Solution
In order to facilitate physical activity, seating should be every 100 m to 125 m. In order for the seatings to be used successfully they should provide a good view of surrounding activities. Suitable places are spots along main paths of gardens and on squares with views on trafficked pedestrian routes. Where possible, for example in open spaces, positioning some seating at right-angles to each other allows people with poor hearing or eyesight to see and chat to their companions.

Elderly prefer to use seats with both back and arm rests. The back rest gives comfortable support and the arm rests provide something to hold onto when sitting down and to push down on when standing up. Furthermore higher seats help elderly to stand up more easily.

+ Relation to other principles
08 quiet routes and zones; 09 walkable distance to facilities; 28 lively green spaces and squares; 29 informal green spaces and squares; 37 sheltering bus and tram stops

+ Other beneficiary population groups
Everyone who is looking for a place to rest, particularly people with walking difficulties, pregnant women and parents watching their children play. The design principle for the bench are however very elderly specific.

+ Degree of how elderly specific

1 2 3 4 5
part II. design principles

(Magliery, 2007)
SHELTERING BUS AND TRAM STOPS

+ Context of the pattern
Bus stops and the shelter provided is an important factor in making a place or street comfortable and easy to use for people making use of public transport.

+ Problem
Public transport is important for older adult generally and essential for people with limited mobility to access facilities outside their walking or cycle distance if they don’t have access to a car. When waiting on a bus or tram the lack of shelter can make elderly feel uncomfortable due to the weather. On the other hand the stop should not be completely closed because if sight lines to the roads are being blocked people tend to feel unsafe.

+ Solution
Elderly prefer enclosed shelters with transparent walls or large clear windows, which protect them from the wind and rain while enabling them to see buses coming. The transparency also makes them feel safer as they can see who is in the shelter when they arrive and they can be seen by passers-by while they are waiting. The seats in the bus stop should be comfortable with a backrest and preferably arm rests and as a result be recognizable as seatings.

+ Relation to other principles
10 proximity of public transport; 36 comfortable public seatings

+ Other beneficiary population groups
People with walking difficulties and parents with children

+ Degree of how elderly specific
1 2 3 4 5
SMOOTH STREET PAVEMENT

+ Context of the pattern
Smooth pavement adds to the safety and accessibility of pedestrian routes.

Uneven or dislodges pavement causes a fear of falling which is one of the most important factors in predicting activity avoidance among older adults.

+ Problem
Pedestrian traffic is sensitive to surface and pavement conditions. Cobblestones, sand, loose gravel, and uneven ground surface are in most cases unsuitable, especially for those who have walking difficulties. Frail elderly for instance with dementia often walk with a slow, unsteady shuffling gait so that they are at higher risk to trip or stumble. Furthermore, people with diminished visual acuity often mistake sharp colour contrasts or paving patterns for steps or holes. Trying to negotiate busy patterns can cause people to stumble or become disoriented. And shiny or reflective surfaces are seen as wet and slippery.

+ Solution
The safest paving for older people to walk on is plain, smooth, level, nonslip and nonreflective. The edges of larger slabs are easier to see by people with visual impairments that small-block paving so that if they are uneven there is a better chance of noticing and negotiating them. Tarmac is the safest paving material for older people to walk on, if not the most attractive, followed by large paving slabs providing they are flat and smooth. However, the structure of the soil is of importance for the choice of pavement. For instance sand is more likely than clay to settle and cause level changes. Although paving patterns should be avoided on footways a distinctive change in paving colour or material can be useful for discouraging people from stepping onto hazardous areas such as bicycle lanes.

+ Relation to other principles
25 wide sidewalks; 30 maintenance; 34 gentle unavoidable changes in level; 39 small and smooth grates and drains; 40 curbs

+ Other beneficiary population groups
Particularly people with walking difficulties

+ Degree of how elderly specific

1 2 3 4 5
part II. design principles

(Shatt, 2006)
SMALL AND SMOOTH GRATES AND DRAINS

+ Context of the pattern
Small and smooth grates and drains adds to the safety and accessibility of pedestrian routes.

Uneven or large grates causes a fear of falling which is one of the most important factors in predicting activity avoidance among older adults.

+ Problem
People with dementia often walk with a slow, unsteady shuffling gait so that coarse textured paving materials, such as grates and drains, are particularly difficult for them to walk along. Knowing that fear of falling is one of the most important factor in predicting activity avoidance among older adults, attention should be paid to grates and drains.

+ Solution
Grates and drains should be levelled with the paving with openings smaller than walking stick or shoe heel size.

+ Relation to other principles
25 wide sidewalks; 38 smooth street pavement; 40 curbes

+ Other beneficiary population groups
Particularly people with walking difficulties

+ Degree of how elderly specific
1 2 3 4 5
part II. design principles
part II. design principles

CURBS

+ Context of the pattern
In order to feel safe when crossing a street elderly prefer signal controlled crossings with traffic islands which have dropped curbs and small grates and drains in the pavement to prevent them from tripping.

Uneven curbs cause a fear of falling which is one of the most important factors in predicting activity avoidance among older adults.

+ Problem
Older people often trip going up or down steps and curbs as they cannot clearly see the edge. The tactile paving used at dropped kerbs for people with visual impairments is generally consider to be a trip hazard and uncomfortable to walk on, especially when badly maintained

+ Solution
At street crossings curbs should be dropped. They should be clearly marked with an contrasting colour and additional changes in level with in the dropped curb should be avoided.

+ Relation to other principles
19 signal-controlled crossings; 39 small and smooth grates and drains

+ Other beneficiary population groups
People who are physically impaired, parents with baby carriages and people with shopping carts.

+ Degree of how elderly specific

1 2 3 4 5
part II. design principles 

(by the author)
Literature


Figures


SiD 2008. James Street South. flickr.com: Flickr for Yahoo!