Keeping the Elderly Mobile

Outdoor Mobility of the Elderly: Problems and Solutions
Proceedings

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Papers and Discussions
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The Netherlands TRAIL Research School
Preface

In June 1998 a Euroconference focusing on the outdoor mobility of the elderly took place in Rolduc (NL). A mixture of presentations and discussions between researchers and people active in business companies, governmental administrations and interest groups was the main part of this conference. Some people played a special role in this Euroconference, Piet Bovy (The Netherlands TRAIL Research School), Vappu Taipale (STAKES, FI) and Wolfgang Zapf (WZB, GE) were members of the scientific board.

Frank Greco contributed greatly to the success of the conference. As chair he played a major role in the plenary sessions and he was able to monitor a final discussion, even after four days of hard work. Jan Graafmans had a major role in chairing the discussions after each session, in which a short report of the presentations and of the discussion in the working groups was the start for a plenary discussion of the statements of these groups. He managed a hard job with stimulating introductions and remarks.

We want to thank all the senior or young researchers active as speakers for their role in the realisation of the conference. The papers and the contributions in the working groups are an integral part of the success of the conference. In the practical organisation of the conference Charlotte de Kort–Holtgreve played a major role. She was the central person for all practical events during such a conference and was always prepared to solve any problems. Marion Gleixner contributed to this book by writing the reports of all discussions.

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Outdoor mobility is a necessary condition for an independent way of life and through this an important part of the quality of life. With advancing age the risk of impairments also increases. Can elderly persons nevertheless realise a level of mobility which meets their needs? Or do they accept (too) many concessions? What types of problems do they experience? Low-floor buses, accessible public transport, comfort, supportive techniques in handling private means of transport: car or bicycle, travel information, organisation of the whole journey, supporting feelings of social safety and many other means are available to ease trip making.

An exchange of the available knowledge about supply and demand for supportive techniques to improve the outdoor mobility of elderly people was the main goal of a conference which took place in Rolduc, the Netherlands, between the 10th and 14th of June 1998. In four days about 60 European experts met there to discuss the problems and available solutions in order to keep elderly people mobile.

A central place was included in the programme for the presentation of the results of four national surveys carried out as a result of the co-operation started in the European COST-A5: Ageing and Technology programme. In 1991 the first action for this COST-programme took place. The health situation and indoor mobility have traditionally been the main subjects of discussion about the situation of the elderly. In 1993 during a workshop of COST-A5 in Eindhoven the first ideas about a research project on outdoor mobility were formulated. Outdoor mobility should also be a basic condition for the autonomy and well-being of the elderly. Several people were interested in this subject. Ruoppila (Finland), Mollenkopf (Germany) and Op ‘t Veld & Tacken (Netherlands) made a start and established the working group 'Outdoor Mobility of Elderly People', which resulted in the project 'Keeping the Elderly Mobile'.

The initial group first of all made an inventory of the available data on the living situation of elderly people and their mobility behaviour in the above-mentioned countries. This information is available in national reports written by the project starters. The national information has been used as a start for the research proposal: Keeping the Elderly Mobile: Technology to meet their outdoor-mobility needs. Later Marcellini (Italy) joined the working group.

From the beginning the group, co-ordinated by Mollenkopf, intended to carry out a survey about the outdoor mobility behaviour of elderly people. We wanted to gather more information on the drives (goals) and needs for mobility and the impediments experienced in mobility by the elderly. A questionnaire was developed by the working group to acquire this information. It was considered important by the researchers to complete these data by data on actual travel behaviour. For this purpose a travel diary was developed. Considering the large scale of the study, external funds were needed. Germany, Finland and Italy succeeded in getting funding. In the Netherlands the research project could be carried out later with internal financial means of a PhD project. This explains the differences in time schedule and approach.

At the end of 1996 the presentation of the project results in the different
countries was considered. It was agreed that the ideal way was to organise an international conference and to publish the main results in a book. However, and even though the project included basic aspects of the outdoor mobility of older people, a single survey cannot cover all aspects of this complex issue. Therefore, experts from other disciplines as for example city and transport planning, engineering, and sports sciences should be invited in order to achieve a comprehensive understanding. The European programme “Training and Mobility of Researchers” offered the opportunity to organise a Euroconference and to bring together both renowned experts and young scientists in the field of outdoor mobility. One of the conditions for such a conference was that it should take place in a ‘closed environment’. This brought us to the choice of Rolduc, an old monastery built on a hill near the German border.

This book presents the content of the Euroconference, including most of the papers given. In the introduction some general remarks are made to relate the subject of the conference to the broader context. The general part presents the main national findings of the international research project ‘Keeping the Elderly Mobile’ and a first comparison for some parts of the figures. Then in four parts specific subjects will be presented. The book will be concluded by a compilation of the most important remarks in the different papers and the working group discussions and some general findings and recommendations looking back on the whole conference.

In this introduction the general presentations made as an introduction to the subject of the conference have been collated.
1.

WELCOME BY THE SCIENTIFIC DIRECTOR OF THE RESEARCH SCHOOL TRAIL.

Piet. Bovy
Scientific Director TRAIL

Welcome to this Conference on Mobility of the Elderly

I am happy to be your host here, in Kerkrade, in the centre of Europe. A multi-cultural, multi-lingual region where 90% of its borders are constituted by other countries. Not by chance, Maastricht, the now most famous European city, is the capital of this interesting region.

Clearly it was a very good idea to choose this very location for an Euro-Conference. You certainly will like the place. It offers just the right atmosphere for concentrated open exchange of ideas and opinions, and to work together on this important topic of Mobility of the Elderly.

Of course, it is an important subject. Not because you are all working on it, or because we all will become older, and belong to the elderly sooner or later. My concern with this topic is a scientific one.

As a director of a scientific school, The Netherlands Research or (Graduate) School TRAIL (for Transportation, Infrastructure and Logistics), I am since years concerned with the simplistic one-dimensional approaches in transportation planning and design. Most of our theories, of our models, and of our design guidelines only consider the average human being. Most of these consider the population of drivers, or of travellers, or of passengers, of being completely homogeneous, of being composed of standardised persons, all equal to some average, or to some percentile point. I consider this as a significant deficiency of our current theories of travel behaviour or driving behaviour.

Also look at the design of transportation facilities or public transport vehicles, they are clearly not designed for the very young of very old, or for the little or for the tall among us. Instead, a statistically average person seems to be the guiding norm traveller.

Clearly, average traveller is a phantom, he (it is mostly a he) does not exist. In this room there is not a single person equalling the dimensions, the preferences, and the abilities of this phantom average.

We are thus strongly in need to improve drastically our current myopic approaches in theory and design. We need theories and design guidelines that take sufficiently account of the full variety of personal characteristics in travelling, in driving, in walking, in cycling, etc., that take account of
differences in measures, in physical abilities, in behavioural preferences, in emotional feelings.

Your work here contributes to such a necessary extension of our current knowledge and current approaches. And that is why I was very pleased to have been invited to give an opening address at this conference.

From a scientific point of view such an extension is difficult, but very challenging! And if we succeed it is very rewarding, I am sure. What we should strive for in our efforts, is a jump from the simplistic single-valued myopic homogeneous-population approaches to a multi-user class, heterogeneous-population-based approach in our theory building and design methodology.

Dealing with heterogeneity in travel and transportation always has been a key topic on my research agenda, both my personal research agenda as well as the research agenda of my Graduate School TRAIL. That's why TRAIL enthusiastically co-operates to make this conference a success.

Let me say a few words about this Research School TRAIL.

It is the Netherlands logistics-graduate school for Ph.D. students in transportation, infrastructure planning and logistics. The school and its educational programme is multi-disciplinary: all disciplines involved in transportation are represented (economics, engineering, psychology, mathematics, etc.). Students as well as professors come for all these disciplines.

Three universities participate in the school, that is Delft University of Technology (mainly engineering disciplines), Erasmus University of Rotterdam (economics, management, law) and Groningen University (psychology). In total twelve different faculties support the school. Today, TRAIL serves about 100 Ph.D. students while about 200 faculty members are active in the school by performing research and education. Ten research streams form the core of the scientific activities. Two of these are important in the context of this conference, so I will devote a few words to these subjects.

The first research stream concerns traffic flow analysis and control.

Research work in this topic deals with flows of vehicles and persons in networks, especially on roads. Important objective is to develop traffic flow theories and models that can handle the heterogeneous composition of the population of drivers, or cyclists or pedestrians. This means explicit treatment of travellers with quick and slow reaction abilities, or with high or low desired speeds etc., thus, also considering explicitly younger and elder drivers in the flow. It is my favourite research subject from which I expect a considerable enhancement of our current understanding.

Three doctoral students of TRAIL are preparing dissertation theses in this
field.

The second TRAIL research stream relevant to this conference is Seamless Multimodal Mobility.

In this program we intend to develop all kinds of building blocks necessary to design and operate efficient and attractive demand-responsive travel and transport services. These services need to be tailor-made, taking account of the large variety in abilities, preferences, information levels, etc. within the population. Special attention is given to the transfers between the successive modes of multi-modal trips such as take place in larger transit stations.

Today, about ten doctoral students are active in this stream.

At this Conference, there is a contribution from this research group in Delft, presented by one of the Ph.D. students from the Graduate School TRAIL.

So far, a few words about some activities of TRAIL.

Organisers of the Conference, may I congratulate you with the attractive programme you have set up here. I am convinced that this conference will bring us a significant advancement of our knowledge of the mobility of the elderly.
2.

MOBILITY OF THE ELDERLY IN DUTCH AND EUROPEAN POLICY

Ad van Herk
Ministry of Transport, Public Works and Water Management of The Netherlands

I bring you greetings from the Minister of Transport of The Netherlands

I have been asked to tell you something about the way the Dutch government and in particular the minister of transport deals with the question of mobility of the elderly and what we are doing at an international level.

In this country you can become member of an organisation for the elderly when you are fifty years of age. That's rather soon, don't you agree? But apparently after a certain age you are assumed to be a special species. I do not believe that to be true. You can at an advanced age still be very active and in full possession of all your marbles. You can be unable to meet the challenges of society already at a very early age. So what is so special about old age, about being elderly? Physically you are likely to encounter some difficulties, but does that mean that you are entitled to special attention by the government, to special rates in subsidized public transport for instance?

The only thing that at this particular moment is interesting with regard to older people is that there will be more and more of them - us - I must say. Around 2020/2030 of every third Dutchman one will be over 60 years of age. We are a force to be reckoned with. People who most often have worked all their lives, have worked hard to bring our part of the world where it is now. Who are being used to enjoy life and to travel and who want to keep on doing so.

What is needed is that you are able to make use of what society has to offer: work, culture, sport, independent life, being able to visit your friends and family. But that has nothing to do with age. The same goes for younger people and they may also have problems with their mobility.

So, at the ministry of Transport we do not deal with mobility for the elderly. We make no distinction. We do not - so to speak - discriminate, neither in a negative sense nor in a positive sense. So what do we do?

We focus on stimulating people to make less use of their private car and make more use of public transport. Such public transport of course then must have the quality people may reasonably expect and demand and that is often enough not the case. That quality must be improved. One way to achieve that is to introduce competition in the market of public transport. In
The Netherlands we will change the traditional rules in public transport and create such competition by having regional authorities give out concessions for say six years to any transport company who meets the criteria and comes out with a suitable offer.

What is of course also important and so obvious that one wonders why in the past no one paid too much attention to it, is the question what quality the passenger exactly desires. That is not only the quality for those of us who are fit and well but it is especially necessary to pay attention to the needs of people who find it difficult to be mobile. People who have a mobility restraint: elderly, disabled people, pregnant mothers, fathers pushing prams or carrying heavy shopping bags, guys who have broken their leg whilst trying to ski and their like.

In The Netherlands we will make sure that concessions are given out only to those companies who make sure that their transport system is -or will be- fully accessible to all. Will be, because it is not realistic to expect that for instance trains and trams can be replaced for fully accessible equipment immediately. Such equipment often has an economic life span of thirty years. All the more reason therefore to rush things a bit.

On the assumption that fully accessible transport is identical to an increase in the quality of transport and will thus entice more and more people to make use of it, it is reasonable that the transport companies pay for their own investment and do not expect the government to pay the bill. We do not have very good experiences with the companies expecting government to pay for it all. Government is only there to give a helping hand or pay for facilities which otherwise will not be realised.

It is my hope that within the next thirty years all public transport in the Netherlands will be fully accessible. That then there will be no more need for special services for elderly and disabled people. Special services which cost a small fortune. The amount spent annually on such services in this country is approaching rapidly the amount spent in public transport subsidy; and obviously that cannot be a good thing.

As long as public transport, however, is not fully accessible, something needs to be done for those amongst us who find their mobility hampered, in particular when they want to travel outside their place of residence. It is therefore that the government has recently decided to write out a tender for a so-called mobility manager. A contract will be concluded between the government and an organisation able to organise the mobility demands of particularly disabled people - and realise the same by making use primarily of existing modes of public transport.

The transport will have to be paid by the passenger himself. Organising the trip and rendering assistance when needed in getting in and out trains or buses will be for account of the government. All this - I stress - for as long as public transport is not yet fully accessible and disabled people cannot make use of it without assistance. Once the transport services have become fully accessible this service by the government will have to be terminated.

I have used the words more than once now -fully accessible. But what do
they mean? It means that the vehicles can easily be entered and got out of. That they have e.g. low floors, but also that they have space available for people in wheelchairs, that the buttons and rails are there where you can reach them and that when you have problems with hearing that you can read the information about the next stop, or when you have poor eye sight that you can read same. And of course that the infrastructure is also accessible: the stations and bus stops, the airport and seaport terminals.

Now it is not such a good idea to let every one develop his or her own idea on what is accessible. One authority might feel that this is necessary, the other such. One blind traveller may wish the facilities to be that, whilst another finds that a bad idea.

Some standards must be developed. If only to make it possible that we travel from one area to another.

It is therefore that we have developed - together with the Netherlands Council of the Handicapped and the Netherlands Railways - a standard on accessible railway stations, which can also be used for other stations or terminals and we are about to develop a similar standard on the infrastructure along the motorways: restaurants, fuelling stations and the like.

Plans are under development to come to such standards also for trains, buses, trams, taxi's, coaches etc.

Now of course we do not only wish to travel in our own countries. After all we want also to go abroad and see new places and faces an keep on doing what we have been doing when we were still young; that is younger than 50. It is therefore essential that the facilities in other countries than our own are accessible as well. Therefore the standards I spoke of have to be developed also at an international level. For buses we have done so in the framework of COST-322 on low floor buses. We are at present working on trains in COST-335, but let me not say too much on that. I must leave something to say for my friend and colleague Danae Penn of the services of the European Commission.

What I can, however, mention, is that within the Conference of European Ministers of Transport we are endeavouring to come to an agreement with the International Road Union - the organisation of among others taxi operators - to do a study on accessible taxi's and the economical consequences of introducing such vehicles.

We are tackling also other elements, but I have by now taken up already too much of your time.

Let me finish by saying that whilst we in government are paying full attention to the problem of accessibility and mobility, it is not government which can bring about the solutions. It are in most cases the transport companies and the local and regional authorities who must do the job. The technical solutions can be found, what is needed is the commitment to bring theory into practice.
3.

KEEPING THE ELDERLY MOBILE. THE SOCIETAL BACKGROUND AND STRUCTURAL CONDITIONS OF MOBILITY

Heidrun Mollenkopf
The German Centre for Research on Ageing (DZFA) Heidelberg
Department of Social and Environmental Gerontology

1. THE STRUCTURAL CONDITIONS AND SOCIETAL BACKGROUND OF MOBILITY

Mobility (the ability to move about) and traffic (the transportation of people, goods, and news) have been the prerequisite, engine, and outcome of economic development in modern societies. Over and above that, they are essential factors in developing and maintaining more than just society at large. With today's increasing functional and spatial separation of commercial, residential, and leisure domains, every member of society finds that mobility is not only a basic human need for physical movement. It has become an ever more important aspect of ensuring the ability to lead one's everyday life, keep up social relations, and take part in every kind of activity outside one's own four walls. The changes in urban and regional structures, the division of the spheres of work, living, entertainment, and recreation, make mobility and traffic increasingly necessary to bridge the widening gap between these functional areas in order to seek out people or places subjectively significant or objectively central, to meeting daily material needs, to guaranteeing access to health care and maintaining societal participation. Mobility, whether by foot or by using private or public means of transportation, is therefore a major component in safeguarding a person's quality of life.

Mobility as movement in time and space can be manifested in many different ways and can be motivated by many, often inseparably intertwined motives. Movement in this sense has distinct features. It is performed—

- on a more or less habitual basis (daily or unusual, routine or one-time action);
- within complex or simple sequences of action;
- in a goal-directed mode or for its own sake;
- under one's own power, with natural forces, or by technical means;
- in an active or passive manner;
- at varying speeds; and
- over short or long distances.

Two central categories of motives for mobility are currently distinguishable...
Introduction

(see Flade, 1994; Schmitz, 1994):
1. Mobility as an end to reach a destination or leave a pre-existing condition. This motive makes mobility a mediator between needs and their satisfaction, with movement from A to B serving to preserve or enhance the quality of life (e.g., by meeting basic needs and satisfying the need for social interaction).
2. Mobility for its own goal of action. In this case mobility is not a mediator of need satisfaction but rather motion for its own sake and a direct way to enhance self-esteem (e.g., being able to move by oneself, enhancing one’s physical pleasure, including the thrill of overcoming fear caused by risky movement).

Mobility is thus both a need and a necessity. As a person ages, the importance of mobility still increases. Grown children leave home; retirement spells the end of occupational contact with people and frees up a great amount of time and energy; one must cope with the loss of the person considered by most people to be the chief figure—one’s life partner. All these changes are ones that demand a growing measure of mobility if the elderly person is to continue being part of society. Seeing that ageing is also accompanied by the increased risk of physical disabilities and declining sensory abilities, preserving and fostering the ability to engage in mobility is central to maintaining the quality of life experienced by elderly women and men.

Outside the home, many external circumstances further complicate the elderly person’s ability to move about. The immediate vicinity, public buildings, and the general service infrastructure are often not entirely accessible. In many cases transport facilities are not yet functional enough or are absent altogether, and the speed and complexity of traffic can be so intimidating for elderly people that they “voluntarily” restrict their action radius. Studies on mobility that are based on the collection and analysis of statistical data on how and how much various age groups participate in traffic in terms of their transportation needs, activity budgets, and patterns of use have found that mobility definitely declines as a person ages.

In addition, elderly persons’ life circumstances vary widely, depending on their generation, type of household, and income. Their households are also equipped in very dissimilar ways with technology, the type and variety of which is largely a function of the factors cited above. But the technology in a private household, the availability and use of technology outside the household, and the technological competence traditionally transmitted mainly through the work a person does are sometimes decisive in determining the ways in which he or she can participate in modern society. Mobility in particular is largely aided by technology and in many cases is not even possible without it. Elderly people with an impaired ability to walk, especially those living in rural areas and suburbs with reduced local public transport service, often depend on a car to manage daily demands. Furthermore, a variety of generally available means of transport and specific aids to mobility can enable elderly people to bridge a gap that may exist between their abilities and the demands of the environment, particularly when their strength is waning or physical impairment is an issue, and can help them extend the boundaries of their life space. The mobility of elderly drivers, for instance,
declines little as they age, whereas elderly people without access to a private car pursue fewer activities outside their homes than do younger people (Hartenstein et al., 1990).

On the other hand, the increase in motorised traffic sometimes makes it difficult for elderly people to be a part of social life outside the home. Street traffic illustrates especially well that technical developments can contain ways to expand one's scope of action as well as risks that constrict one's life space, depending on the context in which those technological resources are used. The growing ability of elderly people to travel and the increasing ownership of cars among members of age cohorts below 65 years of age is contributing to a definite increase in mobility and thereby enhancing the degree of satisfaction enjoyed in old age. But: Whether on the road as pedestrians, car drivers, users of local public transport, or bicyclists, elderly people also suffer from ever heavier and more aggressive street traffic and the danger of being injured or killed in a traffic accident.

On the whole, then, the conditions for the mobility of ageing women and men are not highly favourable. The question of whether and how external conditions and demands of the environment can be harmonised with individual needs and resources were the topic examined in the presentations and discussions of the Euroconference on "Keeping the Elderly Mobile", held in the conference centre Rolduc, Kerkrade, from Wednesday, 10 June to Sunday, 14 June 1998. This book includes a selection of the papers presented at this conference. We are publishing these papers in the hope that the knowledge gained here about both the supporting and injurious components concerning the ability to engage in mobility in old age will feature in future research and technological developments.

2. REFERENCES

4. MOBILITY OF THE ELDERLY: NEW SOLUTIONS FOR AN OLD PROBLEM

Dick Knook
TNO Centre for Ageing Research, Leiden, The Netherlands Section of Gerontology and Geriatrics, Department of General Internal Medicine, Leiden University Medical Centre

1. MEDICAL AND SOCIO-ECONOMIC ASPECTS

The main goal of this Euroconference is an exchange of the available knowledge about supply and demand of supportive techniques to improve the outdoor mobility of elderly people. To the best of my knowledge the oldest example of a technological device to improve mobility can be found in an Egyptian papyrus known as the Edwin Smith Papyrus. In one of the titles of the descriptions of drugs in this papyrus there is a hieroglyph of an old man with a walking stick. Some 4000 years later a walking stick still seems the most commonly applied supportive technology to improve mobility.

Walking sticks compensate for a decline in bodily functions, which are often the consequence of the ageing process. Decreased personal mobility or an increase in immobility is one of the major functional declines or disabilities of old age. Other important disabilities include instability, impaired communication, impaired intellectual capacities and single or double incontinence. These major disabilities make - on account of their severity and frequency - a great socio-economic and health-care impact on the increasing elderly population in Europe.

The health and social services of various European countries are already feeling the strain of increasing numbers of older people. It is estimated that France and the Netherlands for example spend about 40% of their public health expenditures on the over-65 sector of the population, and the UK 47% (European Institute of Women’s Health, 1996). A steady growth in the over-65 age group will result in a concomitant rise in public expenditures.

2. MOBILITY IN THE OLDEST OLD

To get a clear picture of the importance of personal mobility we studied mobility in a very old age group, the 85-plus population. We also wanted to obtain insight into the possibilities of technological compensations and the use of aids, which could make an impact on the functioning of these very old people.

Our Leiden 85-plus monitoring study annually collects information about the health status and living conditions of all the inhabitants of the city of Leiden aged 85 years and over (Weverling-Rijnsburger et al., 1997).
The Leiden 85-plus elderly kept their independence for quite a long time. Half of them were living independently, 37% were living in residential homes for the elderly and 13% resided in nursing homes. There is a small subgroup of completely healthy people of 85 years and older, who for example have an immune system which shows nearly all the characteristics of people of 30 years of age. We call these healthy old persons Senior Europeans or SENIEURS (Knook, 1994).

One of the central questions in our study is: How many elderly people aged 85 and over have functional impairments in their autonomy and what are these impairments? Almost half of the elderly proved to be functionally independent in their ADL (Activities of Daily Living) activities. They were, for instance, able to perform activities like eating, washing, dressing and toileting. However, the other half of them had clear impairments in their ADL activities. The majority of the latter group also experienced problems in the IADL (Instrumental Activities of Daily Living) activities. IADL include: cooking, shopping and walking outdoors (unpublished results).

From these studies it is clear that mobility plays a central role in ADL as well as in IADL activities. Due to limitations in mobility, the elderly become dependent on their social environment and therefore need formal help from professionals or informal help from the social network.

3. AGEING, DISEASES AND MOBILITY

Until now we have focused on diseases and handicaps in the elderly. They form, however, fortunately only one aspect of the process of ageing. It is of great importance to distinguish the disease state associated with older age from the intrinsic, biological ageing process. In addition there is a third group of important factors, namely external environmental, lifestyle factors. The process of ageing as we observe it, is the result of the mutual relationship between these three groups of pathological, biological and external factors. As a consequence if we observe a decline in a certain physiological function, we do not know in most cases which portion of the decline is due to intrinsic factors, to external factors or to disease factors (Knook, 1992).

In this concept it is also obvious that the healthy subpopulation of old people, the SENIEURS, are excellent representatives of persons who show normal ageing and the small decline observed in their physiological functions is not caused by disease factors.

By analogy with this train of thought, there are also three groups of factors, which cause the mobility problems of the elderly (see figure 1): the biological ageing process; environmental, behavioural and socio-economic factors; the disease state. In looking at mobility problems, indoors and outdoors, it may be very helpful to take these factors into account.
4. TECHNOLOGY FOR INDEPENDENT LIVING

There are great individual differences among the elderly. However, differentiation into categories of older persons is necessary primarily as regards policymaking, but also for the development of technological aids. In daily practice, the situation is even more complex since there are increasing numbers of elderly people with chronic diseases as well as of handicapped people surviving to old age.

At a personal level it is obvious that most of the elderly, even those with a handicap, want to maintain an independent lifestyle for as long as possible. Elderly people expect much from improvements in medical know-how and from new technologies. For these and other reasons not mentioned here, the requirements for supportive technologies are diverse and even sometimes conflicting.

In addition, the cost of technological improvements should be manageable and preferably even reduce the costs of care by extending the period of independence. But making independent living possible requires a broad range of adaptations to and provisions in homes and an extensive improvement of the infrastructure (e.g. of public transport).

5. SOLUTIONS FOR NEEDS

In a recent report Prof. Bouma of the University of Eindhoven summarised the needs of the elderly with regard to mobility (table 1).
Table 1. Mobility: needs of the elderly

- Moving freely within the house
- ADL: walking freely
- Cycling in the neighbourhood
- Easy driving of private car
- Easy access to public transport (bus, train, plane, etc.)
- Proper integration of private and public travelling modes (also with luggage)

(Bouma, 1996)

Table 2. Possibilities for intervention

<table>
<thead>
<tr>
<th>Levels of intervention</th>
<th>Examples of intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>At community level:</td>
<td>housing, urban planning, environmental</td>
</tr>
<tr>
<td>At individual level:</td>
<td>exercise, nutritional and dietary factors,</td>
</tr>
</tbody>
</table>

Intervention is possible at two different levels (see table 2). This intervention can lead to the solutions for the needs of mobility e.g. by adaptation of private and public transportation vehicles and infrastructure as well as by system integration for door-to-door mobility (Bouma, 1996). These technological solutions will be extensively discussed during this conference.

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5.

OUTDOOR MOBILITY OF ELDERLY PEOPLE IN THE EUROPEAN CONTEXT

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Directorate-General for Transport (DG VII) European Commission

1. INTRODUCTION

Elderly people without outdoor mobility are also without the freedom to go where they want, when they want. They lose their independence. As my frail elderly neighbor puts it, "if I could no longer go by car to do my shopping, I would be a prisoner in my own home". The solution of teleshopping would be practical, of course. But it would not solve her emotional need to get out and about, to escape from being isolated within the four walls of her house.

At least one third of the population of the European Union are affected by reduced mobility, including many elderly people as well as people who are temporarily disabled/convalescing. For some of them, the best form of transport is "door-to-door", preferably driving their own car, (or taking a taxi). But many elderly people do no have the use of a car, and by the year 2020 that will mean millions of potential passengers of public transport, as well as people with pushchairs, people with heavy shopping, people with luggage.

To meet the transport needs of all these people, local and regional transport systems need to be accessible. This involves much more than just getting on and off a bus, tram or train important though that is. Transport accessibility involves; the whole travel chain: finding out what exists, when and where; walking along safe and trouble-free pavements to the bus-stop; having a seat at the bus-stop and on the bus; the existence of trained transport staff; clean metro and railway stations with lifts - which can be used by anyone with luggage, pushchairs, or wheelchairs. Accessible transport systems can make a real difference to the travel opportunities available to people with mobility handicaps. Even minor access improvements can postpone the point at which elderly people give up travelling by bus or can encourage elderly people who have given up to return to bus use. Nevertheless, there are still many elements in current transport systems that present major barriers to some older people. These elements include aspects of road design, like motorway entrances, intersection configuration, long cross walk distances relative to older pedestrian walking speeds, placement of signs relative to decision points, and the size of letters on signs.

Many older people have difficulty in using some vehicles. Kneeling and low floor buses are very helpful, but most special transport vehicles are very difficult for the older people to get on and off because they are goods vans converted to transport wheelchair users. Cramped plane, bus, or train
lavatories, narrow aisles, and overhead racks or bins may be difficult to use for older passengers. Few employees have sensitivity training for dealing with older people or training on how to help evacuate them in an emergency.

Bus, rail, and aviation terminals present special problems for many older people. Problems include signs that are difficult to read or interpret, long walks from one area to another especially in large airports, lack of places to sit or rest, and difficulty in boarding smaller planes.

Older people are less resistant to trauma caused by car crashes. Osteoporosis is prevalent, particularly among older women. Safety belts that protect younger people may injure older people. Similar problems related to fragility may exist with airbags. Slipping and falling accidents in terminals, railway stations and on urban buses represent a significant risk of injury.

2. PRIVATE CARS

2.1 Driving licenses

The European Union's driving license directive n° 911439/EEC ensured mutual recognition of national driving licenses - and thus helped pensioners retiring in another country. This was amended in June 1997 by directive n° 97/26/EC, which harmonized the information given in the form of codes on driving licenses (e.g. the requirement to wear glasses or the adaptations made to vehicles for disabled drivers). However, the individual Member States can decide on what age, if any, a driver should have to apply for a new driving license.

2.2 Research

In the 5th Framework Program for Research and Technological Development (1998-2002) there will be a project on epilepsy/diabetes/twilight vision - safe driving.

2.3 Medicines and Safety

Meanwhile, the Directorate-General for Transport is trying to get changes made to the packaging of medicines so that in future the outside of the medicine package should show really clearly what is the relative safety of driving/using a machine. We are thinking of having a red-yellow-green type of sign printed on the outside of every package to show danger-prudence-safety (as with traffic lights). The major difficulty seems to be to harmonize the methodology of accessing the danger/lack of danger. The warning messages will apply to established medicines as well as to newly developed ones.

The report for the European Commission by the AITIFIA (Alliance
Internationale de Tourisme and Federation Internationale de l'Automobile) entitled "Mobility and Older People" gave 13 recommendations for self-help by older drivers. These are:

- Choose car models with automatic gears or power-assisted steering
- Do not choose cars with tinted windows
- Consider extra mirrors to improve all-round vision.
- Keep windscreens and lamps clean
- Do not drive in situations or conditions in which you feel uncomfortable
- Try to avoid stressful situations
- Plan journeys and routes carefully
- Take frequent breaks during long journeys.
- Ask doctors about the effects of medical conditions and treatments on driving ability
- Check eyesight regularly
- Consider being unable to drive a car when choosing places to live
- Partners should keep up driving. If one has to give up the other will find starting hard.
- Consider whether taxis and buses can provide a cheaper and easier alternative to the car.

3. PUBLIC TRANSPORT

3.1 Taxis

Taxis are, certainly, a cheaper alternative to special transport services - from the point of view of municipalities who provide, and fund, special minibuses or converted vans for disabled and elderly people. Taxis are also much more comfortable, and attractive, from the point of view of the passengers. They form an important element in the mix of public transport in both urban and rural areas in most European countries. In particular, they have a potentially important role to play in providing services for people, with reduced mobility. As long ago as 1986, surveys of mobility of disabled people in the UK showed that even amongst the most severely disabled people, almost 20 per cent made some use of taxis even though at that time virtually no taxis in the UK could be considered fully accessible.
Introduction

In Sweden, where there is a long history of the provision of special services for disabled people, all municipalities provide, a special transport service, for elderly and disabled people, subsidized by the community for those who are, unable to, use the mainstream public transport system. This special transport service is carried out by taxi operators and other organizations and provides a door to door service giving the traveler the assistance needed. About 60 per cent of the taxi journeys in larger metropolitan areas are special transport service, while in urban areas up to, 90 per cent of the taxi journeys are special transport service.

These, taxi journeys are mostly carried out with ordinary sedan cars for ambulant persons and specially equipped vehicles, like vans, for wheelchair users. The experiences gained show that none of these, vehicles are suitable for all the categories of passengers within this kind of traffic. Ordinary cars are unsuitable for wheelchair users, and severely disabled ambulant persons can often use only the front seat of the cars. Specially equipped vans, on the other hand, are often difficult to use and are uncomfortable for other persons than wheelchair users. This makes it difficult of coordinate the journeys and leads to a situation where different categories of travelers are directed to different types, of vehicles. This in turn makes it difficult to utilize the full capacity of the vehicles; which leads to higher costs for the services.

It is usually reckoned that specially equipped vans cost a municipality four times as much as a system of the municipality reimbursing taxi drivers contracted to transport disabled and elderly people. It is very much a "win/win" situation to use taxis for special transport services.

What is, needed is research into the ideal vehicle and into the best way to organise its use in a special transport services system. The Directorate-General for Transport in the European Commission is funding a two-year research project by Cranfield University (UK) and Lund University (Sweden) to develop design standards for fully accessible taxis, based on sound ergonomic principles and applicable both to multipurpose vans and to purpose-built taxicabs, and to plan and evaluate the use of these vehicles in the following circumstances:

- as basic public transport service in more remote, low density rural areas where there is little conventional public transport

- as part of the provision of special demand-responsive services targeted at people with mobility-related handicaps

- as part of a general taxi fleet operating in a range of urban areas.

In all cases, the processes followed comprise:

- Selection of an appropriate area within which to evaluate the accessible taxis

- Detailed planning of the services to be provided, operational organization
Introduction

of the services

- Monitoring and evaluation of the performance of the vehicles in service

The evaluation processes, which are at the heart of the research, include:

- User attitudes towards the vehicles, including ease of use, any problems encountered, any improvements to design that should be considered

- User attitudes towards the services provided, including how easy it is to book and obtain a journey (including comparison with any pre-existing services), quality of the service offered, reliability, customer care etc.

- Operator and driver views and evaluations of the vehicles

- Quantitative data, covering passenger carryings, costs and revenues (again including comparisons made with preexisting services), vehicle reliability, special equipment reliability (lifts, ramps etc)

- Cost-benefit analysis of the services.

The research deliverables will comprise:

- Development of design guidelines for the construction of taxis that meet the requirements for access and use by all people including those with disabilities and who travel by wheelchair.

- Guidance to operators and to local authorities on the planning and financing of accessible public transport in those rural areas where conventional public transport is difficult or too expensive, to provide.

- An evaluation of the role that accessible taxis can play in special transport services: how that role can be best defined, for example in a service combining taxis with "Dial-a-Ride" minibuses, and what the cost implications are in terms of reduced costs per person carried.

- An evaluation of the impact on personal mobility of disabled people where fully accessible taxis are provided as part of the general fleet of taxis in urban areas.

It is expected - indeed, it is intended - that the results of this research will benefit older people in particular. In this way, it will help older people keep their independence when they give up driving a car.

Another use of taxis which the European Commission is very interested in is the development in the Netherlands and Sweden of "Train-taxis". The idea of the "Train-taxi" is that the train passenger has the advantage of a reliable taxi connection as a continuation of the train trip. The Dutch system is subsidized by the state for social reasons, whereas the Swedish system is totally commercial.
Introduction

The ticket for the "Train-taxi" is bought in advance at the ordinary ticket desk. It can also be bought in a travel agency. The Dutch prices are a bit lower than ordinary taxi fares. The Swedish system is a bit more expensive than ordinary fares. The arguments are that it is easier, more comfortable and is worth more to the customer than an ordinary taxi. The "Train-taxi" is also a reliable taxi, where the customer does not have to risk being derouted or forced to pay more than expected.

The system also offers an extra additional service to disabled people. There is an opportunity to get help not only from the building entrance but from the apartment door, not only to the station entrance but on to the platform. These extra services make it possible to go by train for people who otherwise would have been forced to stay at home or would have been forced to go by taxi for a very long distance. The "Train-taxi" system is comparatively cheap and enables many people to travel by train. Thus, railway companies get more passengers. So this is another "win/win" situation.

The "Train-taxi" system was publicized on pages 20-21 of the European Commission's Green Paper entitled "The Citizens' Network - Fulfilling the potential of public passenger transport in Europe".

3.2 Citizens' Network

This Green Paper has been followed by the Commission's Communication of 10 July 1998 entitled "Developing the Citizens' Network - Why good local and regional passenger transport is important, and how the European Commission is helping to bring it about".

The Communication describes the Commission's three year work program designed to support the role of local and regional passenger transport in contributing to economic development and employment, reducing congestion, using less energy, producing fewer pollutants, making less noise, reducing social exclusion and improving quality of life. Achieving these objectives means making more use of environmentally friendly forms of transport like clean and efficient public and private transport, cycling and walking. It requires an integrated approach.

The work program covers information exchange, benchmarking, establishing the right policy framework, and the use of Community financial instruments. In line with the principle of subsidiarity, the European Commission will act mainly as supporter or catalyst.

To stimulate information exchange, the European Commission is setting up ELTIS, the European Local Transport Information Service for practitioners and policy-makers to find out about transport developments across Europe.

The Commission is supporting benchmarking in local and regional passenger transport, based on self-assessment. This should help public authorities, transport operators and user groups to compare the performance of their transport system with those elsewhere. It should stimulate change where this
is needed.

To establish the right policy framework, the Commission is developing measures to help address the transport aspects of land use planning; encourage mobility management schemes; set harmonized standards for vehicle design; address the transport needs of women and of people with reduced mobility; support fairer and more efficient transport pricing; and promote applications of transport telematics. The Commission is studying how Community legislation on public services and competition is applied in passenger transport, with a view to bringing forward legislative proposals.

To ensure the effective use of the European Union's financial instruments, the Commission will examine how to address local and regional connections in the trans-European transport network guidelines. It will support demonstration projects to test the results of research, and will give a high priority to supporting sustainable local and regional transport through the structural funds.

3.3 Service Routes

One local transport development which is targeted at helping older people is the "Service Route"-system. This involves a combination of solutions to older people's problems:

- The bus is fully and easily accessible to everyone, including people using wheelchairs, walking frames or crutches
- The bus is relatively small (20 seats maximum) and therefore, capable of reaching close to dwellings in narrow streets
- The driver is especially trained in disability-awareness (and that includes driving the bus without jerks and sudden braking)
- The timetable is slower and flexible, to allow passengers plenty of time to reach their seats before the bus starts
- There is no need to reserve a place in advance, be resident in a particular area or municipality, state precisely why you wish to travel (and be forbidden a place if that reason is not a medical one). These requirements are often mandatory before being allowed to use special transport services
- The fare is identical to the ordinary local bus fare, (which means a small subsidy from the municipality)
- The bus is available for any passengers - elderly, young, with children, shopping or luggage - thus ensuring the inclusion of older people in normal life
The route is based on where older people live and where they want to travel to.

The route and - very important - the stopping places, are flexible to suit the passengers instead of the bus operation schedulers who are probably car drivers anyway!

3.4 ELTIS

Service Routes are ideal good practice case studies to be included in ELTIS, the Citizens' Network European Local Transport Information Service mentioned above.

ELTIS can be contacted at the following addresses:

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ELTIS is jointly funded by the transport research and policy directorates of DG VII of the European Commission, as part of the follow-up to the Citizens' Network Green Paper, and UITP, the International Union of Public Transport. It is being developed in partnership with POLIS, a European network of cities and regions promoting innovative transport measures, EURONET, a pan-European research institute specialized in sustainable urban planning and development, Transport and Travel Research Ltd., a transport consultancy offering advice and research to support transport planning and decision-making, and questionnaires Sans Frontieries-Romania, a foundation transferring know-how on transport and environmental management between East and West in Europe.

ELTIS is designed for everyone involved in improving mobility, transport efficiency and safety as well as reducing the environmental impacts of transport, in particular transport policy-makers and managers, transport operators and user groups. The aim of ELTIS is to support a practical transfer of knowledge and exchange of experience in the field of urban and regional transport in Europe and so help create a more sustainable living environment, one which provides greater accessibility and mobility to its inhabitants.

It is a guide to current transport measures, schemes and practices implemented in cities and regions across Europe and provides facts on and
illustrations of local transport activities in Europe. It incorporates an ever-growing database of transport case studies, concepts and documentation. It is also an interactive-web-site which provides a platform to participate in the debate on the latest European transport policies and tools in "ELTIS Forum". It became partly operational in the summer of 1998, and will be fully operational in November 1998.

3.5 COST 322

A typical good "transport measure, scheme and practices implemented in cities and regions across Europe" is the low floor urban bus system. This evolved from the COST 322 action (COST is an acronym for "European Cooperation in the Field of Scientific and Technical Research") which started out as an examination of the safety of wheelchair users in low floor buses, but was later extended into design standards for such buses and their bus stops. It has revolutionized the manufacture of buses, the demand for buses, and the design and siting of bus routes and bus stops.

3.6 Coaches

The Commission intends to include in the 5th Framework Program for R & D -under the heading of the priority subject of accessible transport - a project for a completely new design concept of coaches, aimed especially at helping older people travel easily, comfortably and cheaply in quality coaches.

3.7 Railways

The great success of the COST 322 research led to the launch of the COST 335 action on accessible railways. As with the COST 322 research, this will lead to an EC standards directive - on accessible railways - and this objective is also mentioned in the Commission's White Paper on a Strategy for Revitalizing the Community's Railways. COST 335 covers economic aspects, pre-travel information, access to and within stations, rolling stock design, staff availability and training fare structures, ticketing arrangements and group travel. The Final Report will be published in October 1999 and the Commission will bring forward the directive soon afterwards.

Secondary objectives of COST 335 include the raising of awareness among train operators of the actual and potential size of the market for rail travel among disabled and elderly people, and giving them a clear indication of the wide range of issues involved in realizing that market potential. As with the COST 322 action, there are clearly going to be increased opportunities for new products and new jobs as a direct result of COST 335.

Information about both COST actions can be found on the Internet: http://www.cordis.lu/cost4transport/home.html
There is massive participation in the COST 335 Action: all EU Member States (except Portugal), the Czech Republic, Hungary, Norway, Slovenia, Switzerland; UIC, UITP and UNIFE (Union of European Railway Industries); the European Commission; the European Disability Forum, represented by TTFA (the International Foundation for Travel and Tourism for All) and Mobility International; and, possibly, Japan. Thirty-four of the delegates participating in COST 335 work in railway undertakings. The other delegates belong to national authorities, regional authorities, transport research institutes, railway industry, and advisory committees on transport for disabled people.

The COST 335 Management Committee has set up four Working Groups to bring together current knowledge, to identify gaps in that knowledge, and then to build up information on best practice, and guidance for the future - including the development of standards. The four Working Groups are (1) Stations, (2) Rolling Stock, (3) Information & Staff Training, and (4) Economic & Marketing Issues.

The first COST 335 seminar was held in Brussels on 30-31 October 1997 in order to let everyone involved in railway undertakings, railway industry, and in the disability movement know what the Action is doing and to invite seminar participants to work with the Management Committee, not only in identifying technical and operational improvements but also in raising awareness generally about the need for accessible trains and stations. Railway undertakings were represented at this seminar. 23 countries were represented, including the United States and Japan - but not Italy. There will be another COST 335 seminar at the end of the Action (October 1999).

3.8 Passenger information

Part of the COST 335 Action builds on a pilot project (called NEWT) on information services for passengers with disabilities, conducted by the University of Northumbria at Newcastle, and part-funded by the Directorate-general of Transport of the European Commission. Many of the findings and recommendations of the NEWT survey are especially relevant to older people. For example:

- Elderly users decrease as age increases, except for buses and ordinary taxis
- Elderly disabled public transport users tend to rely on the bus and metro and ordinary taxi for their transport need
- Telephone, leaflets and printed information and drivers/inspectors are the most commonly used sources of transport information
- Impairment and age affect the source of information used
- A large number of elderly respondents (almost 1/2) already own teletext television sets, and 26% of respondents said that they would buy one if it
had up to date transport information.

- The key problems experienced by users appear to differ little according to transport mode, these being height of steps, height of kerbs for transport modes using roads.

- Metro users state more varied problems, although height of steps is still of prime importance. Lack of metro information is rated in the top 3 concerns of 4 categories of user.

- The most transport information sought by users in general is toilet information followed by timetable information, then physical access.

- Transport information could be improved by making the information easier to understand, using bigger print and making the information more up to date.

- The very elderly require documentation that is easier to understand.

- The very elderly tend to rely more on the telephone and staff, than printed information.

- Sight, hearing and communication impaired users of public transport rely on a variety of information sources, particularly staff.

The University of Northumbria (Special Needs Research Unit), which conducted the survey, made the following recommendations:

- It is recommended that a transport information training program is set up to enable operators of passenger transport services to develop their transport information systems to take account of the needs of elderly and disabled people.

- There should be an audit of current transport information documentation, to assess whether it is easily understood, optimum size of print etc., and amendments made where necessary.

- Problems experienced by users, such as steps being too high, lack of wheelchair access, and delays should be addressed as soon as possible.

- More information should be made available to passengers regarding toilets, physical access and timetables.

- As the key methods of information provision are via leaflets, telephone, and drivers/inspectors, it is recommended that the associated members of staff are given disability awareness training, together with instruction in the use of equipment designed for people with disabilities, such as induction loops for the hearing impaired, and ramps for wheelchair user.

- Printed information and leaflets should be distributed more widely in the
community, to ensure adequate coverage.

- The possibility of real time information reaching as many passengers as possible should be investigated further, bearing in mind the findings of this survey. It is suggested that teletext should be investigated further as a suitable medium for future transport information.

3.9 Maritime research

The latest transport research project aimed specifically at helping disabled and elderly people is the HANDIAMI project: "Investigation into the employment of disabled people in the maritime industry; new shore based jobs and emergency situations". Despite the title, this will concentrate on how to evacuate disabled and elderly passengers from ferries and cruise ships during emergencies. The consortium is led by the Southampton Institute (UK), with VTT Manufacturing Technology (Finland), INRETS (France), Marine Safety Rotterdam (NL), Scandlines (DK), Cork Regional Technical College (Ireland), and the Aristotle University of Thessaloniki (Greece). The project started on 1 December 1997 and is estimated to end on 31 May 1999.

4. CONCLUSION

To summarize, the European Union's policy on transport for people with reduced mobility is set out in its Action Program on the accessibility of transport to persons with reduced mobility. So far, the Commission has adopted type-approval directives on buses and coaches and on cable-cars. It is preparing standards directives on accessible railways, accessible aircraft and accessible airports. It is funding research on the emergency evacuation of elderly and disabled passengers from ships and ferries. It has funded four pilot projects on information services for passengers with disabilities.

Finally, the European Commission adopted on 5 November 1997 its Working Paper on the 5th Framework Program for research and technological development for 1998-2002. Priorities include the accessibility, security and comfort of transport and also "design-for-all" products, systems and service. The crosssector benefits of accessible transport will be a key subject. This links in with COST A5 because it concerns how to finance improved quality of life for older people.

Older people value outdoor mobility very highly. In the European Commission we are working to make transport accessible, with legislation, Research & Development, EU funding, the Citizens’ Network development, etc. - but we would like your expert help and advice too.
General Part.
Keeping the Elderly Mobile; Outdoor-Mobility.
Results of a survey in four European countries
6.

A COMPARATIVE INVESTIGATION INTO THE MOBILITY OF ELDERLY PEOPLE: THE PROJECT "KEEPING THE ELDERLY MOBILE – TECHNOLOGY TO MEET THEIR OUTDOOR MOBILITY NEEDS"

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1. BACKGROUND

In this chapter we present some findings of the international comparative research project "Keeping the Elderly Mobile – Technology to Meet Their Outdoor Mobility Needs" which was developed within the framework of the European COST A5 programme "Aging and Technology". The aim of this programme which ran from 1991 to 1996 was to bring research on ageing and technology more closely together in order to make future developments more productive (Graafmans/Taipale 1994; COST is an abbreviation for "European Co-operation in the Field of Scientific and Technical Research"). This aim was aspired to by different working groups and research projects dealing with specific topics, for instance "Indoor Mobility", TED (Technology, Ethics and Dementia), PLANEC (Planning of the Care of the Elderly in European Countries), and also by a postgraduate course on GERONTECHNOLOGY (Rietsema 1998).

The project depicted here focused on the elderly people's outdoor mobility because the mobility outside the home is a fundamental prerequisite as well for the maintenance of an autonomous lifestyle as for the involvement in social relationships and everyday activities. It is therefore one of the most important requirements for preserving the quality of life of older men and women. Thus far, empirical research on mobility has been confined largely to observable traffic behaviour of various age groups—number of routes, distance travelled, choice of transport, and purposes of trips—or to problems and strategies of adjustment that elderly drivers have. It was not known,
however, whether the reduced mobility behaviour of elderly people resulted from external circumstances or from health problems; to what extent, if any, there is a great desire for mobility outside the home; and what specific causes may frustrate that desire.

The objective of the project “Keeping the Elderly Mobile—Technology to Meet Their Outdoor Mobility Needs” was therefore to expand the body of knowledge about the deeper mobility needs of elderly men and women and about the factors which complicate their needs to move or prevent these people from satisfying their desires for mobility outside the home. The project investigated the present situation of elderly people in regard to their ability to actively participate in social life in European countries with different cultural and structural backgrounds: in Italy, in Finland, and in Germany. Some elements of the study were also conducted in the Netherlands. Co-operating institutes were the Italian National Research Centre on Aging (INRCA), Italy, the University of Jyväskylä, Finland, the Social Science Research Centre Berlin (WZB), Germany, and the Delft University of Technology, the Netherlands.

2. METHODOLOGY AND EMPIRICAL BASIS

The first phase of the investigation was conducted in autumn 1995 in selected urban regions supplied with good public transport facilities and in outskirts with unfavourable transport conditions. Subject of research was the age group of 55 years old and older men and women. 600 persons both in Finland (Jyväskylä) and Italy (Ancona) and 800 in Germany (400 in Chemnitz, East Germany and 400 in Mannheim, West Germany) were interviewed by standardised questionnaires, and subsequent to the interviews the respondents were asked to keep a diary in which they recorded the circumstances of their trips for three days (in Ancona for one day).

In the second phase, which took place in autumn 1996, the collected data was supplemented by qualitative case studies in order to gather further information about social and technological factors that typically facilitate or frustrate the satisfaction of mobility needs. In addition to this empirical data collection, an international workshop of experts was held in Ancona in 1995 and in Berlin in 1996 so that technological and organisational aspects of the study could be discussed along with its social science dimension (for further details see Mollenkopf and Marcellini, 1997; Mollenkopf, Marcellini, and Ruoppila, 1998).
The objective of the research project was to identify specific ways to facilitate the mobility of elderly people in order to help them participate in society and thereby maintain the quality of life in old age. The comparison between various regions of Europe makes it possible to throw light on the way in which the mobility of elderly people is affected by different infrastructures, the possession of private means of transportation, and various cultural traditions.

In the following we give an overview on some of these differences. In the subsequent chapters, then, specific national findings will be presented.

3. COMPARISON OF THE SAMPLES: THE CONTEXT AND COMPONENTS OF MOBILITY

The respondents were recruited from the Municipality Registration Offices of the involved cities, and identified in a random way, stratified by gender, age (55-74 and 75+), and living area, that is the town centres, heterogeneous suburbs and less populated or rural areas in the periphery.

Like in all countries, most of the interviewed older people in Ancona, Jyväskylä, Chemnitz and Mannheim live in two-person households, and they are mainly married or live together with a partner. However, in Jyväskylä the share of single living persons is much higher (43%) than in both German regions (36%/37%). In Ancona, only 15% of the elderly are living alone. These figures are of course average values. They escalate enormously with growing age especially with women due to their longer life expectancy.

A similar situation can be stated in regard of the number of children. In the Italian sample, the well known importance of the family in Italy is obvious:
here only 10% have no children compared to 15% in the Finnish and 16% (Ma) respectively 18% (Ch) in the German samples. Due to the strong family ties, most of the Italian respondents have children living nearby whereas a good deal of the German and even more of the Finnish respondents' children live further away. Consequently, the share of persons who can reach their children by foot is highest in Ancona and lowest in Jyväskylä.

As people age, there is an increased probability of declining health and mobility - and this is probably the most important factor affecting the ability to move outside of the home.

The proportion of people who feel impaired in their mobility is surprisingly high: On an average, only one third of the respondents aged 55 and older reported to have no problems at all with their physical mobility. These subjective statements range from a quarter in the East German region to a good 40% in the Italian group. Of course, these proportions shift, depending on which age group is concerned. In the younger age groups, between one third of the Italian and two thirds of the Finnish respondents report on temporary or constant impairments, whereas with advancing age this share rises to 75% or even 80%. Correspondingly, the main reasons for difficulties and limitations, which the elderly in all research regions report most frequently, is their own health.

**Fig. 2:** Impairment of Mobility (by age)

Age 55-64

<table>
<thead>
<tr>
<th>Region</th>
<th>No problems</th>
<th>Temporarily impaired</th>
<th>Constantly impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>East-Germany</td>
<td>36</td>
<td>31</td>
<td>33</td>
</tr>
<tr>
<td>West-Germany</td>
<td>52</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>Finland</td>
<td>45</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Italy</td>
<td>68</td>
<td>22</td>
<td>10</td>
</tr>
</tbody>
</table>
Differences in both mobility and activities are firstly contingent on age and health conditions. As might be expected, the very old and those who are limited in their mobility by health impairments are less active outside of their homes. Second, the childless men and women who do not have children are less often active outside of their homes than those with children (mainly in Chemnitz and Ancona). And thirdly, the mobility patterns of drivers license holders and car owners compared to persons without a car differ clearly. Owning a car, and even more, driving the car oneself, results in the same way as physical mobility in a clearly higher multiplicity of trips. At the same time, persons owning and driving a car themselves show a significantly higher satisfaction as well with their possibilities for getting where they would like to go (figure 3) as with their possibilities for participating in activities (figure 4) - even if they are physically impaired.
With this, an important aspect of technology comes to the fore: Particularly in countries whose transport systems are strongly determined by private passenger car traffic, the ownership or the possibility of using an automobile is frequently the prerequisite for coping with everyday necessities and maintaining outdoor activities and relationships. However, we see in all European countries great differences in the level of provision of the elderly and the population as a whole (StBA, 1994; Mollenkopf, Marcellini and Ruoppila, 1997: 11).

As for the investigated regions, the ownership of a car in the household is highest in Ancona (68%). However, the Italian households are also most frequently including young people. In Finland, on the other hand, barely half the elderly dispose of a car. As for Germany, the availability of private cars is generally lower in the New Länder than in the Old Länder. Correspondingly, in the West German sample, more than one-half (56%) of the 55 years and older respondents have a car in their household. In the East German region, this applies only to two fifth (39%; for more details see Mollenkopf, Marcellini and Ruoppila, 1997).
Figure 4

Satisfaction with Possibilities for Participating in Activities

EAST-GERMANY (Chemnitz)

<table>
<thead>
<tr>
<th>Age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-64</td>
<td>7.1</td>
</tr>
<tr>
<td>65-74</td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td></td>
</tr>
</tbody>
</table>

WES T-GERMANY (Mannheim)

<table>
<thead>
<tr>
<th>Age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-64</td>
<td>7.5</td>
</tr>
<tr>
<td>65-74</td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impairment of mobility</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No constantly</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Children</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>with children</td>
<td></td>
</tr>
<tr>
<td>no children</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Availability of a car</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>driving himself</td>
<td></td>
</tr>
<tr>
<td>no car</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current mobility capacity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>excellent/good</td>
<td></td>
</tr>
<tr>
<td>poor/very poor</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Change in the extent of outdoor activities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>more</td>
<td></td>
</tr>
<tr>
<td>less</td>
<td></td>
</tr>
</tbody>
</table>

Mean on satisfaction scale: 0 (very unsatisfied) to 10 (very satisfied)

Data base: Outdoor Mobility Survey 1995

Satisfaction with Possibilities for Participating in Activities

ITALY (Ancona)

<table>
<thead>
<tr>
<th>Age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-64</td>
<td>7.9</td>
</tr>
<tr>
<td>65-74</td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Impairment of mobility</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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</tbody>
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<tr>
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<td></td>
</tr>
<tr>
<td>less</td>
<td></td>
</tr>
</tbody>
</table>

Mean on satisfaction scale: Italy: 0 (very unsatisfied) to 10 (very satisfied)

Data base: Outdoor Mobility Survey 1995

FINLAND (Jyväskylä)

<table>
<thead>
<tr>
<th>Age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-64</td>
<td>8.7</td>
</tr>
<tr>
<td>65-74</td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impairment of mobility</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
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<tbody>
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<td>more</td>
<td></td>
</tr>
<tr>
<td>less</td>
<td></td>
</tr>
</tbody>
</table>

Mean on satisfaction scale: Finland: 1 to 9

Data base: Outdoor Mobility Survey 1995
How frequently the owners of a car use this transport mode depends on their individual preferences and habits, on the equipment of the immediate surroundings with shops and services, and on the availability of convenient public transport systems. In this regard there are obviously remarkable differences between the investigated regions (figure 6).
4. CONCLUSIONS

One of the key contributions of the study is its empirical documentation that the opportunity and ability to be mobile and active even in old age has a major impact on a person's quality of life. The low level of satisfaction of people whose mobility is hampered by limitations on their physical ability to move about or by lack of private or public transport clearly shows that the decline of outdoor mobility in old age is not an entirely voluntary retreat from the world. On the contrary, it means that elderly people are more or less being compelled to cope with health impairments and adverse external circumstances. The low level of satisfaction of elderly people who engage little in recreation is another indication that many of them would gladly do more if they had the opportunity.

When physical strength wanes with increasing age and a person's action radius shrinks, environmental features take on ever-greater significance. Environmental factors such as residential situation and traffic conditions can prevent or encourage an elderly person's activities, depending on the nature of them. Ultimately, functional disabilities that might develop have far less impact under favourable conditions than under conditions that restrict the living space of elderly people and fail to meet their needs.
5. REFERENCES

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OUTDOOR MOBILITY SURVEY: FINDINGS FROM ITALY

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Fabio Leonardi  
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Liana Spazzafumo  
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1. INTRODUCTION

In Italy demographic ageing (people with 65 and over) has been high in the last ten years: the ageing rate (percentage ratio between people with 65 and over years and people with 0-14 years) has risen from 68.1% in 1971 to 80.4% in 1981) to 109.1% in 1995 according to Eurostat elaborations. This increase is particularly evident for women, where the value reaches 132%. It is estimated that in 2020 the weight of the over 70-year-olds will be 22.7. Besides, the strong negative tendency of the population growth forecasts a further acceleration of the ageing phenomenon. In fact in Italy the mean fertility rate is currently equal to 1.22 children per woman and is the lowest value in Europe.

The outdoor mobility Italian survey was carried out in the city of Ancona, on a random sample of 600 persons stratified by sex, age and living area. Ancona is a middle-sized town on the Adriatic coast (slightly south of Venice) with about 100,000 inhabitants and with a high level of ageing. The percentage of people of 55 years and over on the total population is 35% and the percentage of elderly 65 years and over on the total population is 22%. This last value is higher than the national average (14.8%).

2. SOME CHARACTERISTICS OF THE SAMPLE

Family structure of Italian respondents is shown in table 1. In Italy the family is very important and within it there is a great solidarity between generations (Mengani and Gagliardi, 1993). Due to this strong tie, most of the respondents have children living nearby (Figure 1).
Regarding house ownership, it is interesting to note that, the large majority of elderly people, 74%, own the house they live in. As rents are very high and most pensions are low, it is important for the elderly to own their house. For Italians house ownership is a symbol of security, it is an important value for the family and therefore very diffused, with a percentage of about 79% of elderly families (60 and over of the head of the family) who have the ownership (ISTAT, 1993).

The level of education of the majority of elderly is rather low, and that of women is lower within every age group, even though the situation is a little better for the younger generations, as for the whole Country (ISTAT, 1991).

3. OUTDOOR ENVIRONMENT AND MOBILITY

Participating in outdoor activities means, in modern societies, having to deal with living spaces and traffic environment, which are rarely suited to the needs of the elderly.

In fact one of the most important goals of our research was to investigate the outdoor environment and impairments related to it.

The prevalence of health injuries and chronic illnesses increases with advancing years: these impairments affect sensory perception and flexibility...
and therefore can make outdoor mobility extremely difficult in complex traffic conditions. Moreover, spatial barriers and insufficient or non-appropriate transport facilities can be causes of immobility in the elderly (Penn, 1994). Now we examine data concerning risks, safety and improvements of outdoor environment and transportation system.

Satisfaction with the living area, measured using the Likert scale (0-10) shows a good mean level of satisfaction (7.51.), without significant differences among age groups. People who live in the suburbs are less satisfied than those who live in the centre and in areas surrounding the city (countryside) (p. lower than point zero five - p< .05)

The satisfaction with the living area is not due to the services of living areas, as the multiple regression analysis shows.

The variables that explain most variance of satisfaction with the living area are two: the number of years that people have been living there, the feeling of insecurity. The mean of number of years is significantly lower in the suburbs than in the other areas (p.lower than point zero zero one - p<.001) (Figure 2).

This result can be explained hypothesising that the recent ways of building causes less comfortable living conditions for the elderly or that the elderly are less satisfied with their new environment because they feel it as being less friendly.

As regards feeling of insecurity, people who feel insecure when they are alone in their living area are 21.5%.

The main cause of insecurity is the presence of dangerous streets and crossings: the high percentage of people who complain about this aspect shows the high relevance of traffic problems for the elderly.

The other causes can be linked to delinquency problems.

As we have already seen, the traffic situation is nowadays an important aspect of outdoor environments also involving some aspects related to the living area.

The results show that the most problematic aspects are related to the behaviour of other means of transport such as cars, mopeds and bicycles, which create an insecure environment, especially for those on foot.

Other problems are linked to structural traffic conditions unfavourable for
pedestrians (inadequate traffic lights, sidewalks, etc.). Finally, elderly people complain about a general difficulty to move in city traffic.

The main risk for the elderly in outdoor environment is the occurrence of accidents.

The high degree of mobility perceived by the elderly seems to exist in an insecure environment where the number of accidents is relevant. In fact, about 18% of the respondents (N=107) had accidents in the last five years.

With regard to the type of accidents, the more frequent accidents are those that occur as pedestrians (47.7%) and as car drivers (38.3%).

If we analyse the age of those who have had an accident, we find an age-effect in the two main types of accidents (Table2).

Table 2 Accidents in the last five years by age only those who had accidents replied - %

<table>
<thead>
<tr>
<th>AGE</th>
<th>as pedestrian</th>
<th>in car as driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 - 64</td>
<td>9.8</td>
<td>34.1</td>
</tr>
<tr>
<td>65 - 74</td>
<td>11.8</td>
<td>24.4</td>
</tr>
<tr>
<td>75 - 79</td>
<td>31.3</td>
<td>24.4</td>
</tr>
<tr>
<td>80 +</td>
<td>47.1</td>
<td>17.1</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: I.N.R.C.A. Outdoor Mobility Survey

This age-effect is due to the type of transport used by different age groups: in fact the higher the age, the more people move on foot and less by car.

Many accidents have no consequences and therefore they must not be considered a big problem for elderly people. Nevertheless a relevant percentage of accidents cause consequences concerning health and feeling of security with high costs for society and a worse quality of life (Table3).

Table 3 Consequences of accidents

<table>
<thead>
<tr>
<th>No consequences</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consequences on health</td>
<td>51</td>
<td>47.7</td>
</tr>
<tr>
<td>Financial consequences</td>
<td>38</td>
<td>35.5</td>
</tr>
<tr>
<td>I feel more insecure</td>
<td>4</td>
<td>3.7</td>
</tr>
<tr>
<td>I drive less</td>
<td>34</td>
<td>31.8</td>
</tr>
<tr>
<td>I don't drive anymore</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>I'm no longer able to leave my home</td>
<td>2</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Multiple answers
Source: I.N.R.C.A. Outdoor Mobility Survey

4. CAPACITY OF OUTDOOR MOBILITY

After having analysed the outdoor environment, it's interesting to know the capacity of outdoor mobility of the respondents.

The self-rated capacity of mobility was found to be at a medium-high level; in fact, about 77% of the interviewed consider their mobility to be from sufficient to very good. This dimension varies in different age groups showing an age-effect (Figure 3).
Even if the capacity of mobility seems good, 41.3% of elderly diminished outdoor activities in the last years and only 14.7% increased it. Furthermore 35.3% of respondents would perform more outdoor activities.

As expected, walking is the most used way, while the car is the most used means of transport, followed by the bus. These data must be related to the fact that Ancona is a middle-sized town and that the elderly often use important services within their area.

Overall these data are a significant indicator of how the elderly in our sample behave regarding means of transport. In fact the second way, and the first means of transport, is the car. This shows that an important prerequisite to outdoor mobility is, in fact, owning a car.

In our sample 67% of respondents had at least one car in the family even if it must be remembered that the families were also made up of young people.

This data is very high, above all if we consider that in German and Finnish samples only about 47% of the respondents owned cars.

It can be seen that car ownership varies depending on the kind of family: those who live alone most often do not own cars, also because most of these people are very old and also female, and therefore have had more cultural and economic obstacles in taking a driving licence and owning a car (Table 4)

<table>
<thead>
<tr>
<th>Table 4 - Car ownership in different family groups (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>YES</strong></td>
</tr>
<tr>
<td>Live alone</td>
</tr>
<tr>
<td>Live with partner</td>
</tr>
<tr>
<td>Live with others</td>
</tr>
</tbody>
</table>

Source: I.N.R.C.A Outdoor Mobility Survey

As regards the habit of using the car we can note that a good percentage in every age group prefers to use this means of transport and don’t want to substitute it with public transport even when offered free bus tickets.

This result - the importance of the car for the elderly - is in agreement with the findings of previous European researches in this field (Madre and Bussière, 1995; Traenkle, Gelau and Metker, 1993).

About 1/3 of respondents says they don’t use public transport. The frequency of non-use increases with age.
If we examine the reasons of this behaviour in the older groups which are more at risk and have lesser mobility we see two contradictory aspects: no need to use public transport and the inconvenience of taking a bus. In our society the need is linked to the supply; probably the percentage of old-old who say that they don’t need public transport do so because the difficulties in the use can sometimes cause a perception of not needing to use it (Marcellini, Pavan and Ulisse, 1989).

**5. CONCLUSIONS**

The outdoor environment is not homogeneous because different areas have different characteristics and the level of satisfaction varies significantly. Two aspects appear to be very problematic: the feeling of insecurity and chaotic traffic. The level of mobility is good, even if the risks of accidents are very high. This aspect can be considered a big problem of outdoor environment because it can lead to a worsening in health conditions and in the capacity of mobility (Evans, 1988).

A closer look at transport facilities and the living area from the perspective of an elderly person shows that much has still to be done to prevent elderly from feeling insecure and uncomfortable in an outdoor environment, in walking, in using public transport or in driving a car (Mollenkopf and Marcellini, 1997).

The suggestions gave by respondents about improvements of the outdoor environment are probably the more important needs expressed by the elderly (Figure 4).
They concern the possibility of feeling safe and comfortable outdoors (road courtesy, benches to sit on, road safety, etc.), especially for persons with problems (more people to help frail persons, designing buses according to the needs of the elderly, transport services for disabled). Furthermore better economic resources suggested by the elderly aren't always sufficient to be able to move in outdoor environments. In conclusion many requirements must be addressed to the public administration which should provide services and facilities for frail and elderly people.

6. REFERENCES

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8.

THE OBJECTIVES AND ENCOUNTERED PROBLEMS IN OUTDOOR MOBILITY OF ELDERLY PEOPLE: FINNISH FINDINGS

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Timo Suutama
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1 INTRODUCTION

Mobility is one of the most important requirements for physical and instrumental activities of daily life, for preserving social integration and quality of life, and for physical activities like walking or jogging, cycling, and enjoying the nature and related recreation activities. It is the decisive link between the individual and his or her social, built and "natural" environment and thus one of the most important factors for preserving personal autonomy. Along with aging, active participation in social life and taking care of the necessary physical and instrumental activities of daily life are increasingly jeopardized through the possible loss of sensory functions like vision and hearing, through the rising prevalence of chronic illnesses causing mobility and especially outdoor mobility difficulties or through the lack of social or economic resources. Besides these kinds of difficulties at the individual level, there may also be hindrances related to the living environment or to the means of transport the person is using to fulfill his or her needs of outdoor mobility. The individual, the environment and the system and means of transport interact together making the outdoor trips easier or more difficult. In this respect the concept of outdoor mobility is related to community planning, its transport policy and transport system, and also to the living environment and socio-economic status of the person. Personal factors, such as functional impairments and disabilities as well as fears, also have effects on the way an individual is evaluating his or her possibilities to be mobile outdoors and keep his or her personal autonomy. (Brown 1992, Era 1987, Kohli 1996, Lawton 1990, Schroll et al. 1997, Teichmann 1996, Ukkonen et al. 1998).

While mobility is always tied with the time and place, it is also closely connected with the individual's resources such as health, functioning capacity, owning a vehicle, and so forth. On the other hand, it is connected with the possibilities the environment dictates: for example, the road network, distances to desired destinations, the services of public transport system
Objectives and Problems in Outdoor Mobility: Finnish Findings

(costs, timetables etc.) (Kaiser, 1997, Tacken 1993, 1997).
With the changes in the age structure of the populations in the western European countries, especially the rapid growth in the numbers of very old (85+) people, the social policy, health and economic aspects of this change gain emphasis (Walker and Maltby 1997). This stresses the preventive, rehabilitative, and technical measures to keep elderly people capable for outdoor mobility. Prevention is understood in this context not only as a medical concept but also as a social and cultural construct. Also different technical aids and vehicles are needed for preserving outdoor mobility. In this respect urgent needs for technical development must be emphasized. Elderly people need technical equipment ergonomically adapted for them (Balschbach 1997, Hekstra & Veenbaas 1997, Marciani 1997, Pauzie 1997, Stålhl 1991,1997, Varaida 1997). Especially in the Nordic countries, where the yearly climatic changes like snow and ice with short time of day-light in winter hinder outdoor mobility, special measures are needed to overcome these obstacles. The aim of this study was to find out what kind of difficulties Finnish persons 55 years and over do have in their outdoor mobility.

2. Material and methods

Jyväskylä, the main city in Central Finland, has about 75,000 inhabitants, and serves practically as a centre for more than 100,000 people living in the area. Jyväskylä has long traditions as a centre of Finnish language and culture. The town is known especially as an educational centre having a university (about 11,000 students), a polytechnics (about 4,500 students), and many other educational institutes. The industry consists of paper machinery (VALMET), other machine factories, paper industry, and increasingly high-tech enterprises like NOKIA. Geographically, Jyväskylä is situated between lakes and water-routes, which was the motive to establish the town at its present location in the first place. Jyväskylä is an important crossroad link for both the North-South bound and East-West bound traffic and transport. As for local traffic, people living in the neighbouring municipalities commute to Jyväskylä almost on a daily basis.
Disproportionate stratified samples regarding age (55-74 and 75+ years), sex, and living area (centre, intermediate, outskirts) were drawn from the population register of Jyväskylä, reflecting the situation on August 1, 1995. In the sample older cohorts and men were given "over-representation" to get enough subjects for each subcategory for statistical analyses. In total 618 subjects in Jyväskylä were interviewed at their homes using a standardized questionnaire; the sample did not include persons living in institutions or similar settings. The stratification variables accounted for 12 subcategories of elderly people, each subcategory consisting of about 50 persons. Of all the persons contacted 66% participated in the study.

The questionnaire included questions concerning physical functioning (self-evaluations of sensory functioning, health, outdoor and indoor mobility, PADL and IADL and satisfaction with mobility possibilities), social contacts and networks, transport facilities and difficulties experienced while making trips. Similarly, the questions concerned the persons’ socio-economic background (education, income, housing environment, car ownership). The interviewees were also asked to fill in an outdoor mobility diary over three days. The outdoor mobility diary gives information on the number of trips, means of
transport, company, destination, duration, activities and circumstances of trips, pleasant or unpleasant.

3. Results

There were about 5% of subjects who had visual problems which permanently prevented them going out, and 3% who sometimes had similar problems. Hearing problems preventing outdoor mobility were less frequent than visual problems, constantly preventing about 2% and sometimes preventing about 2%. With age these difficulties increased but very slowly. The differences between the sexes were small in terms of the sensory problems preventing outdoor mobility: women had slightly more frequently visual problems while hearing difficulties were slightly more frequent among men.

The subjects were generally satisfied with their possibilities to move outdoors as a pedestrian, cyclist or car-driver (Table 1). Generally men were more satisfied than women in this respect, and with age the satisfaction rate decreased while its variance increased.

Table 1. Satisfaction with outdoor mobility possibilities (means and sd's)

<table>
<thead>
<tr>
<th></th>
<th>55-74</th>
<th></th>
<th>75+</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>sd</td>
<td>m</td>
<td>sd</td>
</tr>
<tr>
<td>Women</td>
<td>7,9</td>
<td>1,6</td>
<td>7,4</td>
<td>1,8</td>
</tr>
<tr>
<td>Men</td>
<td>8,0</td>
<td>1,1</td>
<td>7,6</td>
<td>1,7</td>
</tr>
</tbody>
</table>

The self-ratings of health showed satisfaction, although this had the lowest mean of all satisfaction scales. When these self-ratings were analysed in relation to the subjects' illnesses or traumas causing outdoor mobility difficulties (Table 2), the most satisfied were those having no such illnesses or traumas, and the most dissatisfied those having illnesses or traumas which permanently weakened their mobility capacity.

Table 2. Effects of illnesses and traumas on mobility capacity and satisfaction with health (means and sd's)

<table>
<thead>
<tr>
<th>Effects of illnesses and traumas</th>
<th>All (n=601)</th>
<th>Men (n=306)</th>
<th>Women (n=295)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>sd</td>
<td>m</td>
</tr>
<tr>
<td>No effects</td>
<td>8,0</td>
<td>1,0</td>
<td>7,8</td>
</tr>
<tr>
<td>Weakened temporarily</td>
<td>7,4</td>
<td>1,3</td>
<td>7,5</td>
</tr>
<tr>
<td>Weakened permanently</td>
<td>6,0</td>
<td>2,1</td>
<td>5,9</td>
</tr>
</tbody>
</table>

$X^2(2) = 146,96; p<0,001$

The number of persons suffering from illnesses or traumas which had weakened their mobility capacity increased rapidly with the ageing process (Table 3). The oldest persons had more difficulties than the younger ones. Women had more difficulties in this respect than men did.
Table 3. Effects of illnesses and traumas on self-rated mobility capacity by age and sex (%)

<table>
<thead>
<tr>
<th>Effects of illnesses and traumas</th>
<th>All (n=616)</th>
<th>Men (n=309)</th>
<th>Women (n=307)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-64 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No effects</td>
<td>45</td>
<td>47</td>
<td>42</td>
</tr>
<tr>
<td>Weakened temporarily</td>
<td>25</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>Weakened permanently</td>
<td>30</td>
<td>27</td>
<td>33</td>
</tr>
<tr>
<td>65-74 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No effects</td>
<td>32</td>
<td>38</td>
<td>28</td>
</tr>
<tr>
<td>Weakened temporarily</td>
<td>22</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Weakened permanently</td>
<td>46</td>
<td>42</td>
<td>48</td>
</tr>
<tr>
<td>75-79 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No effects</td>
<td>28</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Weakened temporarily</td>
<td>20</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>Weakened permanently</td>
<td>52</td>
<td>51</td>
<td>53</td>
</tr>
<tr>
<td>80+ years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No effects</td>
<td>22</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>Weakened temporarily</td>
<td>14</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Weakened permanently</td>
<td>65</td>
<td>58</td>
<td>71</td>
</tr>
</tbody>
</table>

The difficulties in performing various PADL and IADL activities are shown in Table 4 by age. In the younger age groups especially carrying heavy bags, walking 2 km and heavy housework caused difficulties. In the older age groups the same activities produced even more difficulties. Women experienced difficulties more often than men.

Table 4. Age in relation to incompetence to perform some physical and instrumental activities of daily life (%)

<table>
<thead>
<tr>
<th>Activity</th>
<th>55-64 yrs</th>
<th>65-74 yrs</th>
<th>75-79 yrs</th>
<th>80+ yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moving in the house/apartment</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bending down</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Climbing stairs</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Going outdoors</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Shopping</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Carrying heavy bags</td>
<td>4</td>
<td>14</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>Walking 2 km</td>
<td>4</td>
<td>10</td>
<td>15</td>
<td>34</td>
</tr>
<tr>
<td>Light housework</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Heavy housework</td>
<td>7</td>
<td>13</td>
<td>29</td>
<td>51</td>
</tr>
</tbody>
</table>

The different indicators of the mobility capacity correlated quite highly (0.45 - 0.68) showing their close associations. The patterns of correlations were very similar in both age groups (Table 5).
Table 5. Correlations between self-rated mobility capacity and PADL and IADL among 55-74 and 75+ years old persons

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(75+ years)</td>
<td>0.57</td>
<td>0.42</td>
<td>0.46</td>
<td>0.61</td>
<td>0.36</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td>2. Climbing stairs</td>
<td>0.48</td>
<td>0.49</td>
<td>0.54</td>
<td>0.66</td>
<td>0.39</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>3. Going outdoors</td>
<td>0.34</td>
<td>0.45</td>
<td>0.67</td>
<td>0.52</td>
<td>0.49</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>4. Shopping</td>
<td>0.37</td>
<td>0.47</td>
<td>0.65</td>
<td>0.60</td>
<td>0.49</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>5. Walking at least 2 km</td>
<td>0.49</td>
<td>0.68</td>
<td>0.49</td>
<td>0.65</td>
<td>0.41</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>6. Doing light housework</td>
<td>0.27</td>
<td>0.38</td>
<td>0.36</td>
<td>0.48</td>
<td>0.38</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>7. Doing heavy housework</td>
<td>0.43</td>
<td>0.49</td>
<td>0.34</td>
<td>0.46</td>
<td>0.53</td>
<td>0.44</td>
<td></td>
</tr>
</tbody>
</table>

Table 6 summarizes information on different services available in different parts of Jyväskylä. Most of the services were equally easy or difficult to reach regardless of the part of city where a person was living. There were, however, services which were located in the city centre, such as medical care, Senior centre, swimming pool and social welfare office.

Table 6. Services available according to living area (%)

<table>
<thead>
<tr>
<th>Services</th>
<th>Centre (n=208-209)</th>
<th>Intermediate (n=200-203)</th>
<th>Outskirts (n=201-203)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grocery store</td>
<td>99</td>
<td>90</td>
<td>89</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>93</td>
<td>57</td>
<td>50</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hair dresser</td>
<td>97</td>
<td>85</td>
<td>89</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Foot care, physiotherapy</td>
<td>80</td>
<td>52</td>
<td>61</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Doctor, Health centre</td>
<td>91</td>
<td>45</td>
<td>65</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Senior centre</td>
<td>63</td>
<td>47</td>
<td>27</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Day nursing care</td>
<td>40</td>
<td>25</td>
<td>30</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>68</td>
<td>13</td>
<td>8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bank</td>
<td>90</td>
<td>60</td>
<td>72</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Post office</td>
<td>76</td>
<td>87</td>
<td>88</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Social welfare office</td>
<td>53</td>
<td>25</td>
<td>34</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cultural facilities</td>
<td>81</td>
<td>72</td>
<td>84</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Park</td>
<td>99</td>
<td>95</td>
<td>98</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bus stop near</td>
<td>94</td>
<td>97</td>
<td>97</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Church</td>
<td>94</td>
<td>86</td>
<td>88</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Bar, café</td>
<td>85</td>
<td>78</td>
<td>91</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

p-values are based on X^2 test, C = Centre, I = Intermediate, O = Outskirts

Table 7 shows which were the services people felt were important but had difficulties in reaching. These were pharmacy, medical services, bank, swimming pool, and post office.
Objectives and Problems in Outdoor Mobility: Finnish Findings

Table 7. Important services not available and available in living area (%)

<table>
<thead>
<tr>
<th>Services</th>
<th>Not available in living area, would be important</th>
<th>Available in living area, is important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grocery store</td>
<td>6</td>
<td>88</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Hair dresser</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>Foot care, physiotherapy</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>Doctor, health centre</td>
<td>19</td>
<td>61</td>
</tr>
<tr>
<td>Senior centre</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Day nursing care</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Bank</td>
<td>16</td>
<td>66</td>
</tr>
<tr>
<td>Post office</td>
<td>12</td>
<td>78</td>
</tr>
<tr>
<td>Social welfare office</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Cultural facilities</td>
<td>7</td>
<td>47</td>
</tr>
<tr>
<td>Park</td>
<td>1</td>
<td>83</td>
</tr>
<tr>
<td>Nearest bus stop</td>
<td>2</td>
<td>68</td>
</tr>
<tr>
<td>Church</td>
<td>2</td>
<td>47</td>
</tr>
<tr>
<td>Bar, café</td>
<td>3</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 8 presents the persons who the subjects had contact with. 55-74-years old men and women met their siblings, other relatives, good friends and colleagues more often than did the persons 75 and older. The older subjects, on the other hand, had contact with a priest more often than the younger ones.

Table 8. Social contacts among men and women in two age groups (%)

<table>
<thead>
<tr>
<th>People</th>
<th>55-74 yrs (n=157-158)</th>
<th>75+ yrs (n=149-151)</th>
<th>p</th>
<th>55-74 yrs (n=157)</th>
<th>75+ yrs (n=148-149)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td>11</td>
<td>-</td>
<td></td>
<td>14</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td>3</td>
<td>-</td>
<td></td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Daughter(s)</td>
<td>77</td>
<td>70</td>
<td></td>
<td>67</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Son(s)</td>
<td>66</td>
<td>69</td>
<td></td>
<td>64</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Daughter(s)/son(s)-in law</td>
<td>73</td>
<td>81</td>
<td>&lt;0.001</td>
<td>71</td>
<td>68</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sister(s), brother(s)</td>
<td>73</td>
<td>48</td>
<td>&lt;0.001</td>
<td>83</td>
<td>54</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Grandchildren</td>
<td>73</td>
<td>76</td>
<td></td>
<td>72</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Other relatives</td>
<td>61</td>
<td>40</td>
<td>&lt;0.001</td>
<td>69</td>
<td>53</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Good friends</td>
<td>84</td>
<td>69</td>
<td>&lt;0.01</td>
<td>91</td>
<td>71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neighbour(s)</td>
<td>60</td>
<td>58</td>
<td></td>
<td>59</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Fellow worker(s)</td>
<td>44</td>
<td>29</td>
<td>&lt;0.01</td>
<td>38</td>
<td>15</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Priest</td>
<td>15</td>
<td>23</td>
<td></td>
<td>20</td>
<td>38</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Other</td>
<td>12</td>
<td>8</td>
<td></td>
<td>8</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

p-values are based on X² test.

In terms of activities people were interested in, there were many clear sex differences. Women had more cultural, study, religious and voluntary work kind of interests than men, whereas men enjoyed more often jogging and hiking, active and passive sport, fishing, hunting, and picking berries and gathering mushrooms (Table 9). Although interest-based activities slowly decrease with the ageing process, they decrease much more rapidly among those who have mobility hindrances; most of them, anyway, would like to continue their activities if they only could visit these locations more easily.
Keeping the Elderly Mobile; Outdoor Mobility. a survey in four European countries

Table 9. Activities among men and women in different age groups (%)

<table>
<thead>
<tr>
<th>Activities</th>
<th>Men</th>
<th></th>
<th>Women</th>
<th></th>
<th>p</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55-74 yrs</td>
<td>75+ yrs</td>
<td>55-74 yrs</td>
<td>75+ yrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(n=157-158)</td>
<td>(n=149-150)</td>
<td>p (n=156-157)</td>
<td>(n=148-149)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting friends</td>
<td>87</td>
<td>79</td>
<td>92</td>
<td>82</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Going to café, restaurant</td>
<td>42</td>
<td>24</td>
<td>&lt;0.001</td>
<td>48</td>
<td>20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Playing games</td>
<td>18</td>
<td>10</td>
<td>13</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Making short trips,journeys</td>
<td>80</td>
<td>55</td>
<td>&lt;0.001</td>
<td>81</td>
<td>58</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gardening</td>
<td>63</td>
<td>42</td>
<td>&lt;0.001</td>
<td>50</td>
<td>24</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Swimming,dancing,gymn.</td>
<td>57</td>
<td>36</td>
<td>&lt;0.001</td>
<td>59</td>
<td>28</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Jogging, hiking</td>
<td>68</td>
<td>36</td>
<td>&lt;0.001</td>
<td>51</td>
<td>11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Walking</td>
<td>93</td>
<td>84</td>
<td>91</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actively pursuing sports</td>
<td>12</td>
<td>3</td>
<td>&lt;0.01</td>
<td>5</td>
<td>-</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Watching sports events</td>
<td>38</td>
<td>15</td>
<td>&lt;0.001</td>
<td>19</td>
<td>5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Theatre, movies, concerts</td>
<td>56</td>
<td>33</td>
<td>&lt;0.001</td>
<td>78</td>
<td>3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Library</td>
<td>61</td>
<td>36</td>
<td>&lt;0.001</td>
<td>75</td>
<td>33</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Studying</td>
<td>25</td>
<td>10</td>
<td>&lt;0.001</td>
<td>38</td>
<td>9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Religious events</td>
<td>40</td>
<td>41</td>
<td>56</td>
<td>59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Club and organizational activities</td>
<td>48</td>
<td>44</td>
<td>38</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities for retired people</td>
<td>18</td>
<td>35</td>
<td>&lt;0.001</td>
<td>28</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Fishing and hunting</td>
<td>58</td>
<td>31</td>
<td>&lt;0.001</td>
<td>20</td>
<td>7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Picking berries and mushrooms</td>
<td>79</td>
<td>38</td>
<td>&lt;0.001</td>
<td>69</td>
<td>20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Other activity</td>
<td>27</td>
<td>23</td>
<td>26</td>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p-values are based on X² test.

What kind of difficulties did the subjects experience when they were moving outdoors and what kind of factors were related to these difficulties? The difficulties and hindrances experienced were analysed in relation to use of services, to social contacts and interactions and interest-based activities. 17% of subjects experienced difficulties in moving at least to one place of services. The most important causes of difficulties were health problems, long distances, and difficulties in using the public transport system. In visiting the three most important services - a grocery shop, post office or bank - about one tenth had experienced difficulties. Nearly 30% had difficulties when visiting friends or close relatives, older people more often than the younger. The main reason for difficulties in keeping up social contacts among the older age group may be the loss of age mates like sisters and brothers, other relatives, good friends, and fellow workers. As for visits to friends or relatives, women experienced more difficulties than men. The most common reasons for having difficulties in meeting people were long distances, health reasons and high costs. The most often mentioned causes of difficulties to continue interest-based activities were health problems, distances, lack of time and high costs.

When moving outdoors, a majority of the younger age group felt very secure or secure, only 6% felt themselves somewhat or very insecure. The older group did not differ greatly from the younger one, the share of feeling insecure being 10% (Table 10).
Objectives and Problems in Outdoor Mobility: Finnish Findings

Table 10. Feelings of security among men and women in two age groups (%)

<table>
<thead>
<tr>
<th></th>
<th>55-74</th>
<th></th>
<th>75+</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>very secure</td>
<td>54</td>
<td>80</td>
<td>54</td>
<td>69</td>
</tr>
<tr>
<td>somewhat secure</td>
<td>38</td>
<td>17</td>
<td>33</td>
<td>26</td>
</tr>
<tr>
<td>somewhat insecure</td>
<td>8</td>
<td>3</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>very insecure</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Most common reasons for feeling insecure were being afraid of mugging during dark hours or day-time and being afraid of burglary (Table 11).

Table 11. Reasons for feelings of insecurity by sex (possible to mention more than one reason) (Only those persons having mentioned at least one reason)

<table>
<thead>
<tr>
<th>Reason of insecurity</th>
<th>All</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Afraid of being mugged when dark</td>
<td>62 (46)</td>
<td>44 (11)</td>
<td>72 (35)</td>
</tr>
<tr>
<td>Afraid of being mugged during daytime</td>
<td>18 (13)</td>
<td>12 (3)</td>
<td>20 (10)</td>
</tr>
<tr>
<td>Afraid of burglary</td>
<td>18 (13)</td>
<td>12 (3)</td>
<td>20 (10)</td>
</tr>
<tr>
<td>Dangerous crossing</td>
<td>5 (4)</td>
<td>8 (2)</td>
<td>8 (2)</td>
</tr>
<tr>
<td>Lonely areas</td>
<td>3 (2)</td>
<td>-</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Presence of undesirable people</td>
<td>37 (27)</td>
<td>44 (11)</td>
<td>33 (16)</td>
</tr>
<tr>
<td>Negative events in the past</td>
<td>35 (26)</td>
<td>28 (7)</td>
<td>39 (19)</td>
</tr>
<tr>
<td>High dense shrubbery</td>
<td>3 (2)</td>
<td>4 (1)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Other reason</td>
<td>12 (9)</td>
<td>8 (2)</td>
<td>14 (7)</td>
</tr>
</tbody>
</table>

As pedestrians, the subjects most often avoided crossing the street without a pedestrian crossing; walking a road without a sidewalk; walking at bad roads; and busy traffic. Women avoided different situations more than men and older subjects did so more than the younger ones (Table 12). Situations which people avoid as cyclists are shown in Table 13. Women avoided the difficult situations more often than men did, and older subjects did so more often than the younger ones. Men over 75 years and women of 55-74 years avoided such situations as often. Altogether 12% of the subjects were active cyclists, cycling throughout the year, also in icy and snowy winter weather. This transport mode seemed to be chosen in order to keep fit and to preserve health. As car drivers (Table 14) the subjects most often avoided driving at dusk or at night and driving bad roads. Younger women avoided driving unknown routes more than did younger men, older men avoided driving at rush hour, driving long distances, unknown routes and motorways more than did younger men.
Table 12. Avoiding different situations in traffic as a pedestrian by age and sex (%)

<table>
<thead>
<tr>
<th>Situation</th>
<th>55-74 yrs Men (n=156)</th>
<th>55-74 yrs Women (n=157)</th>
<th>75+ yrs Men (n=148)</th>
<th>75+ yrs Women (n=143-144)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing the road at dusk or at night</td>
<td>25</td>
<td>32</td>
<td>51</td>
<td>75</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Walking at bad roads</td>
<td>35</td>
<td>48</td>
<td>56</td>
<td>72</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Walking in the city centre at rush hours</td>
<td>19</td>
<td>33</td>
<td>&lt;0.01</td>
<td>49</td>
<td>67</td>
</tr>
<tr>
<td>Crossing the street without pedestrian crossing</td>
<td>44</td>
<td>54</td>
<td>60</td>
<td>63</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Walking a road without a sidewalk</td>
<td>49</td>
<td>52</td>
<td>61</td>
<td>65</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Walking in unfamiliar places</td>
<td>23</td>
<td>34</td>
<td>51</td>
<td>71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Busy traffic</td>
<td>31</td>
<td>42</td>
<td>56</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

p-values are based on X² test.

Table 13. Avoiding different situations in traffic as a cyclist by age and sex (%)

<table>
<thead>
<tr>
<th>Situation</th>
<th>55-74 yrs Men (n=92)</th>
<th>55-74 yrs Women (n=79)</th>
<th>75+ yrs Men (n=40)</th>
<th>75+ yrs Women (n=7)</th>
<th>YM-YW</th>
<th>YM-OM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riding at dusk or at night</td>
<td>67</td>
<td>75</td>
<td>78</td>
<td>86</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Riding on bad roads</td>
<td>52</td>
<td>61</td>
<td>63</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult junctions</td>
<td>28</td>
<td>47</td>
<td>53</td>
<td>86</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Riding at rush hours</td>
<td>42</td>
<td>63</td>
<td>60</td>
<td>86</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Riding busy roads</td>
<td>40</td>
<td>63</td>
<td>50</td>
<td>86</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Riding long distances</td>
<td>53</td>
<td>52</td>
<td>65</td>
<td>100</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Riding unknown routes</td>
<td>15</td>
<td>41</td>
<td>45</td>
<td>100</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

p-values are based on X² test.
YM = 55-74 yrs men, YW = 55-74 yrs women, OM = 75+ yrs men

Table 14. Avoiding different situations in traffic as a car driver by age and sex (%)

<table>
<thead>
<tr>
<th>Situation</th>
<th>55-74 yrs Men (n=119)</th>
<th>55-74 yrs Women (n=42)</th>
<th>75+ yrs Men (n=57)</th>
<th>75+ yrs Women (n=6)</th>
<th>YM-YN</th>
<th>YM-OM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving at dusk or at night</td>
<td>54</td>
<td>71</td>
<td>65</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving on bad roads</td>
<td>45</td>
<td>60</td>
<td>49</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult junctions</td>
<td>13</td>
<td>19</td>
<td>19</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving at rush hours</td>
<td>36</td>
<td>48</td>
<td>60</td>
<td>83</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Driving busy roads</td>
<td>16</td>
<td>31</td>
<td>21</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving long distances</td>
<td>25</td>
<td>38</td>
<td>51</td>
<td>67</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Driving unknown routes</td>
<td>24</td>
<td>52</td>
<td>44</td>
<td>83</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Driving motorways</td>
<td>5</td>
<td>14</td>
<td>18</td>
<td>17</td>
<td>&lt;0.01</td>
<td></td>
</tr>
</tbody>
</table>

p-values are based on X² test.
YM = 55-74 yrs men, YW = 55-74 yrs women, OM = 75+ yrs men

In Figure 1 (Appendix 1) can be seen that especially wide sidewalks, quiet zones with little traffic, pedestrian areas, convenient parking possibilities and peaceful shops were the most important factors making a trip pleasant. All these refer to environmental factors. Things that made a trip difficult or unpleasant were mainly based on weakened health and bad weather (Figure 2, Appendix 2).
4. Discussion

The findings concerning the self-ratings on sensory functioning, health, mobility capacity in general, and mobility capacity required in some specific activities of daily life, show similar kinds of age and sex differences which are generally found in the studied age groups (Gillman et al. 1986; Heikkinen et al. 1997; Jylhä et al. 1992; Kaplan et al. 1993; Laukkanen et al. 1993; Sakari-Rantala et al. 1995; Schroll et al. 1997). Problems and difficulties tend to increase by age, although people are at the same time adjusting to their weakened health (Idler 1993; Jylhä 1994). The differences between women and men in the above mentioned self-ratings are from practical point of view negligible; only women 80 or older have clearly more difficulties than men (Holland and Rabbit 1992; Rabbit and Abson 1991). Problems with the physical activities of daily life increase during the ageing process. This is especially true with the activities which are the most straining ones, anyhow, like carrying heavy bags and doing heavy household works (Avlund et al. 1993; Avlund et al. 1996). Mobility capacity is strongly related to the performance of physical and instrumental activities of daily life. Mobility capacity correlates highly with the satisfaction with health, as well. Women over 80 years and having illnesses and traumas which are weakening their outdoor mobility were most dissatisfied with their mobility possibilities. These persons were not voluntarily decreasing their outdoor mobility; on the contrary, they would go out if they could get help, or if they had technical means to overcome their difficulties. The self-ratings seem to reflect the ageing process in industrialized West-European countries (Heikkinen et al. 1983; Waters et al. 1989).

When people report their difficulties and hindrances in getting services, there are differences showing the importance of the location of different services in relation to the location of houses and apartments where people are living. The older people with lowered mobility capacity have more difficulties also due to the fact that they have less opportunities to use own cars. This is especially true for the elderly women (Ukkonen, Ruoppila, Suutama in this publication). These women belong to the age cohorts who do not typically have a driving licence. In this respect the younger cohorts of women are in a greatly different position owning a car and being used to drive it. It can be said that elderly people living in Jyväskylä appear to have very high feelings of security when they are moving outdoors. They also have many interest-based activities. The importance of these security feelings for participating in different interest-based activities is a question to be analysed in the comparative part of this study. Interest-based activities and the social interactions related to them are important factors for the quality of life. When these activities decrease, this is usually not a decision of one's own free will but a necessity, because of the great difficulties to participate in these activities. In order to sustain elderly persons' physical, psychological and social functioning it is necessary also to promote their outdoor mobility possibilities so that they can get to the localities where they can continue their interest-based activities (Hirvensalo et al. 1998; Suutama and Ruoppila 1998). How much their reported feelings of security actually reflect the degree of real threats, in terms of registered crime rates, for instance, is still an open question. Analyses based on local crime statistics should provide us with some answers, however, despite the problems involved. The amount and quality of interest-based activities of people in Jyväskylä may reflect a
culturally formed “way of life”, the roots of which are not easily explained (Heikkinen et al. 1993). One explanation may be the very homogeneous nature of the Finnish culture.

We have analysed differences between the sexes, but it should be noted that they may well be connected with possible cohort differences, as well, which can be seen most clearly in the percentage of elderly female drivers. This will increase rapidly during the next two decades, rendering sex differences in car driving patterns negligible in this respect. Altogether, the research findings show that it is possible to influence on many of the factors affecting outdoor mobility. The services and localities for interest based activities can be more equally distributed within a city, technical aids can be used and it is also possible to develop more accessible public transport systems. To guarantee safe and secure outdoor mobility possibilities to all user groups of different transport modes - as pedestrians, cyclists, and car drivers or as passengers using public transport - is a very important goal with regard to ecological, social, economical and individual viewpoints. This, however, is not an easy goal to achieve.

Acknowledgements: The Academy of Finland, the Ministry of Transport and Communication, City of Jyväskylä and the Department of Psychology, University of Jyväskylä have financially and by other means supported this study.
References


Keeping the Elderly Mobile: Outdoor Mobility, a survey in four European countries


Objectives and Problems in Outdoor Mobility: Finnish Findings


Keeping the Elderly Mobile; Outdoor Mobility. a survey in four European countries

Appendix I.

Figure 1. Things making the trip pleasant. (Multiple choices possible, altogether 2140 choices).
Appendix 2.

<table>
<thead>
<tr>
<th>Problem Description</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems because of weakened health</td>
<td>120</td>
</tr>
<tr>
<td>Long, exhausting way or exhausting gradient</td>
<td>29</td>
</tr>
<tr>
<td>Inconvenience due to weather situation</td>
<td>25</td>
</tr>
<tr>
<td>Other reasons</td>
<td>11</td>
</tr>
<tr>
<td>Heavy loads to carry</td>
<td>6</td>
</tr>
<tr>
<td>No seats for resting</td>
<td>5</td>
</tr>
<tr>
<td>Lack of parking place</td>
<td>5</td>
</tr>
<tr>
<td>Problems in getting in/out of car</td>
<td>5</td>
</tr>
<tr>
<td>Dark roads and places</td>
<td>4</td>
</tr>
<tr>
<td>Too many people in shops and streets</td>
<td>4</td>
</tr>
<tr>
<td>Bad or uneven or too narrow sidewalk</td>
<td>3</td>
</tr>
<tr>
<td>Hectic traffic</td>
<td>3</td>
</tr>
<tr>
<td>Wide or highly frequented streets</td>
<td>2</td>
</tr>
<tr>
<td>Unfavourable transport communication</td>
<td>2</td>
</tr>
<tr>
<td>No separate bicycle path</td>
<td>2</td>
</tr>
<tr>
<td>Problems with road construction works</td>
<td>2</td>
</tr>
<tr>
<td>Problems in getting in/out of bus or train</td>
<td>1</td>
</tr>
<tr>
<td>Bus starts and brakes too abruptly</td>
<td>1</td>
</tr>
<tr>
<td>Reckless or inconsiderate traffic participants</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 2. Things making the trip unpleasant or difficult. (Multiple choices possible, altogether 231)
9.

THE MOBILITY OF ELDERLY PEOPLE IN GERMANY: BASIC MOBILITY NEEDS AND THE MAIN REASONS PREVENTING THEIR SATISFACTION

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The German Centre for Research on Aging (DZFA) Heidelberg
Department of Social and Environmental Gerontology

1. BACKGROUND

As in most industrialised nations, transport policy and planning in Germany, too, has been shaped since the 1950s primarily by growing motorization. This orientation has led to massive projects for building new roads, upgrading old ones, and reducing the Federal German railroad network. In 1996 passenger cars accounted for 82% (745 person-kilometres) of all passenger transport in Germany. Of the 48.5 million officially licensed motor vehicles in early 1997, 41 million were passenger cars (including station wagons) - that are 85% of all vehicles (StBA 1997).

2. THE AVAILABILITY OF PASSENGER CARS IN EASTERN AND WESTERN GERMANY

Since the regime shift in East Germany, traffic volume has expanded enormously in the new Laender as well. The west-east gap has almost been levelled off in regard to passenger cars, in particular among the younger age groups. However, the provision of the elderly, above all those living alone, with private cars looks still very different. For two-person households in which both partners were already 55 years old or more are the figures of western Germany still clearly higher (79%) than those are for eastern Germany (66%). Out of all those over 55 who lived alone only 25% in western Germany and 5% in eastern Germany had a car in 1995, the year in which the mobility study was conducted (according to the German socio-economic panel SOEP 95).

The well-known difference between both East and West and young and old is also perceptible in our study. One reason for these differences is that the one-person households are predominately made up of older women, who still do not have driving licences.
The Mobility of Elderly People in Germany

Figure 1: Availability of passenger cars

<table>
<thead>
<tr>
<th></th>
<th>Chemnitz</th>
<th></th>
<th>Mannheim</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single member households</td>
<td>Households of 2 or more persons</td>
<td>Single member households</td>
<td>Households of 2 or more persons</td>
</tr>
<tr>
<td>Men</td>
<td>Women</td>
<td>N</td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>----------------</td>
<td>----------</td>
<td>----------------</td>
<td>----------</td>
<td>----------------</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>103</td>
<td>253</td>
<td>41</td>
</tr>
</tbody>
</table>

N(Chemnitz) = 400; N(Mannheim) = 404
Database: Outdoor Mobility Survey 1995

The low level of provision with private cars results in a clearly more limited mobility radius of elderly people. We found that persons who did not have a car in their households or who did not themselves drive made only one trip per day, whereas those who owned a car made an average of 1.4 trips, and those who themselves drive averaged 1.5 trips a day (one trip, by our definition, includes going or driving to a destination and the way back home).

However, most of the elderly people in the German research regions cover the distances of their trips without any technical support: they walk (51% on foot). Less than one third (29%) of the trips recorded in the diaries were gone by car, and the share of trips the public transport was at least partly used for was about 16%. Driving a bicycle was even minor.
Figure 2: Average number of trips per day

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>Trips per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-59</td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td></td>
</tr>
<tr>
<td>65-69</td>
<td></td>
</tr>
<tr>
<td>70-74</td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
</tr>
<tr>
<td>CAR IN HOUSEHOLD</td>
<td></td>
</tr>
<tr>
<td>Car available</td>
<td></td>
</tr>
<tr>
<td>No Car</td>
<td></td>
</tr>
<tr>
<td>Car driver</td>
<td></td>
</tr>
<tr>
<td>Non car driver</td>
<td></td>
</tr>
<tr>
<td>Multimember households</td>
<td></td>
</tr>
<tr>
<td>Single member household</td>
<td></td>
</tr>
<tr>
<td>Child(ren)</td>
<td></td>
</tr>
<tr>
<td>No child</td>
<td></td>
</tr>
<tr>
<td>IMPAIRMENT OF MOBILITY</td>
<td></td>
</tr>
<tr>
<td>No problems</td>
<td></td>
</tr>
<tr>
<td>Temporarily impaired</td>
<td></td>
</tr>
<tr>
<td>Constantly impaired</td>
<td></td>
</tr>
</tbody>
</table>

Light bars not significant; N = 803
Database: Outdoor Mobility Diary 1995

As strength gradually wanes, however, when it becomes harder to see or hear, or when it becomes a problem to move and react, the effect of adverse natural environmental conditions, physical obstacles in the vicinity of the home, and difficult traffic conditions is much greater on the elderly person than on young people, who often do not even notice such adversities or can compensate for them without much trouble. The average number of trips per day recorded by the elderly men and women decreases constantly by increasing age and declining mobility.

How elderly men and women manage as they go about their daily affairs depends not only on their state of health and the means of transport available to them, but also on habits of many years.

Jakob C. (aged 81 years, Mannheim), for example, is 81 years old and is accustomed to doing everything by bicycle. He likes to ride, saying: "And it is so healthy! To the market, around the vicinity, to the cemetery, I do it all by bike. Shopping, too. Everything with the bike." Riding a bicycle is no problem to him so far. The only difficult thing is taking it down to the cellar. And he avoids main streets. "I don't ride there; it's really dangerous because the cars go incredibly fast."

Josef I. (83, Mannheim) is an avid user of local public transport: "That is the most convenient way for me. And the shortest," he said. Not being able to
leave the house "would be terrible! I like being at home, but I would also like to be able to go out whenever I want to."

Compared to them, the ability of Luise D. (71, Chemnitz) to move about is greatly inhibited by asthma and severe arthritis. She is barely able to get to the nearby bakery. She relies on help for large shopping runs and heavy housework. To get to her doctor, she must cross a large intersection and take the streetcar, so medical appointments there are very difficult for her.

The example of Gerti G. (78, Mannheim) shows how important a car can be in such cases. Her walking is severely hampered, too, but she is mobile nonetheless. She is happy "because I can still drive better than walk." She has been driving for 40 years and uses the car to go shopping and visit friends who live elsewhere. Stores for daily needs would be near enough for her to walk from where she lives, "but then carrying things back is hard, so I just take the car." Because she has been living alone since the death of her husband, this chance for getting out is quite important to her. "Actually, very important in order—simply in order to keep from getting lonely."

It is no wonder that elderly drivers, with their possibilities for getting wherever they want, are considerably more satisfied than elderly people who do not drive. Encountering other people, the chance to see something new now and then, physical outdoor exercise, just being able to leave the house—all these things are a great need among elderly men and women.

**Figure 3: The satisfaction**\(^1\) of elderly people with their possibilities to get where they want to\(^2\)

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Chemnitz* (7.3)</th>
<th>Mannheim (7.8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car drivers</td>
<td>Non-drivers</td>
<td>Car drivers</td>
</tr>
<tr>
<td>55-64</td>
<td>8.0</td>
<td>8.2</td>
</tr>
<tr>
<td>65-74</td>
<td>7.4*</td>
<td>(7.7)*</td>
</tr>
<tr>
<td>75-79</td>
<td>7.4</td>
<td>(8.0)</td>
</tr>
<tr>
<td>80 or older</td>
<td>6.4</td>
<td>(8.5)</td>
</tr>
<tr>
<td>Ability to move about</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No impairment</td>
<td>7.9</td>
<td>7.6</td>
</tr>
<tr>
<td>Temporarily impaired</td>
<td>7.6</td>
<td>8.3</td>
</tr>
<tr>
<td>Chronic impairment</td>
<td>6.8</td>
<td>8.4</td>
</tr>
<tr>
<td>Availability of a car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With motor vehicle</td>
<td>7.7*</td>
<td>8.1</td>
</tr>
<tr>
<td>No motor vehicle</td>
<td>7.0</td>
<td>-</td>
</tr>
</tbody>
</table>

1. Means on satisfaction scale: 0 (very unsatisfied) to 10 (very satisfied)
2. Question: "How satisfied are you, all in all, with your possibilities to get where you want to—whether as a pedestrian, a cyclist or a driver?"

(): Cases: 29<n<40; (()): Cases: n<30

* Differences between the region in eastern Germany and the region in western Germany are significant \((p<0.01)\)

bold: Significant differences \((p<0.01)\)

\((\text{of all respondents } = 7,6); N(\text{Chemnitz})=400; N(\text{Mannheim})=404\)

Database: Outdoor Mobility Survey 1995
3. THE SUBJECTIVE MEANING OF MOBILITY

Main aspect of mobility:

- Mobility as movement per se, as a basic human need
- Mobility as movement in and observation of nature
- Moving around as a social need for integration and participation
- The possibility to move about as an expression of freedom and autonomy
- Mobility as a source of stimulation and diversion
- Mobility as a reflective expression of the life force one still has

Exemplary answers:

- "A person has to move! I want to move and feel good when I do"
- "I have to get out, have to know what is going on in nature"
- "Still being able to take part in social life"
- "Meeting someone or having someone to talk to"
- "Not being locked in"
- "Being able to go out any time I want"
- "Sometimes seeing something other than the four walls you live in"
- "Proof that I'm still a human being like anyone elsewhere elderly people were asked what it means to them to be able to move about outside their homes, some of them spontaneously responded at a very abstract level: "Joy". At a more concrete level, their answers can be broken down into six main aspects. Accordingly, the idea of no longer being able to move about outdoors one day is regarded as terrible. Echoing many other respondents, Ludwig D. (56, Mannheim) stated: "I can't find words for it. It is inhumane."

4. DIFFICULTIES WITH IMPORTANT ASPECTS OF MOBILITY

More than half (54%) of the people who were 55 years old or more reported hardships in at least one area that is important for leading their lives—making their way to friends and relatives, institutions that provide services, and recreational facilities. One fourth of the elderly people in the German study reported having problems with one aspect of mobility or another. As expected, very old respondents experience hardships more frequently than people of younger age groups do. However, it depends more on their health situation than on their age: almost one third of the respondents who were 80 years old or more were still able to reach important destinations with no problem. Declining health and physical mobility is the most important factor effecting mobility outside of the home.
Among the specific material and organisational conditions that complicate the mobility of elderly people are a lack of bicycle paths, excessively short green lights at crosswalks, an insufficient number of crosswalks, bus and streetcar entrances that are too high, and too few seats to rest on during a trip. Every fifth elderly person has difficulty with the jolting stops and starts of buses and trains, overly long waits, incomprehensible schedules and routes, and footpaths that are too narrow.

Furthermore, elderly people in Germany have great problems with the hectic pace of traffic and the undisciplined, inconsiderate behaviour of many drivers and bicyclists. The rapid increase in the density of traffic in former East Germany since the opening of East-West border in late 1989, elderly people in cities have felt very unsettled, particularly in eastern Germany. In western Germany, too, however, only few elderly people feel undisturbed by the denser, more aggressive traffic. Although most elderly people say they have become accustomed to these conditions and have adapted their own

---

**Figure 4: Assent to statements about the traffic situation**

<table>
<thead>
<tr>
<th>Perception</th>
<th>Chemnitz</th>
<th>Mannheim</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are not enough lanes for bicycles.</td>
<td>72</td>
<td>42</td>
</tr>
<tr>
<td>Children and youths should be forbidden to ride their bicycles on the sidewalk.</td>
<td>70</td>
<td>43</td>
</tr>
<tr>
<td>Too few people offer their seats in the bus for a person who needs to sit down.</td>
<td>56</td>
<td>54</td>
</tr>
<tr>
<td>Many cars and motorcycles are going too fast when they approach the pedestrian crossing, and so you never know whether they will brake or not.</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>Many cars and motorcycles drive too near the sidewalks.</td>
<td>37</td>
<td>42</td>
</tr>
<tr>
<td>It happens very often that when I have to get halfway across the road, the traffic light has already turned red.</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Traffic is sometimes so busy that you don't dare to go down the street.</td>
<td>38</td>
<td>23</td>
</tr>
<tr>
<td>Cars and motorcycles drive too fast so you can see them only in the last minute.</td>
<td>37</td>
<td>30</td>
</tr>
<tr>
<td>As an elderly person you feel disadvantaged in today's traffic.</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>There are not enough pedestrian crossings and traffic lights with a button for pedestrians to push.</td>
<td>35</td>
<td>17</td>
</tr>
<tr>
<td>Nowadays I often feel helpless in traffic.</td>
<td>31</td>
<td>22</td>
</tr>
<tr>
<td>I have difficulties in getting in and out of the bus because of the high steps.</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>There are not enough seats or shelters at the bus stops.</td>
<td>17</td>
<td>28</td>
</tr>
<tr>
<td>The sidewalks are often so narrow so you have to step into the street to make way for other pedestrians.</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>Buses run to seldom at certain times of the day.</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td>The timetables and route maps are difficult to read and understand.</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>The busses start to quickly and jerkily.</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>The automatic closing and opening of bus-doors is poorly installed, so that you can easily get caught in the door.</td>
<td>10</td>
<td>19</td>
</tr>
</tbody>
</table>

1 After Wittenberg 1986
Percentages
Persons aged 55 and older; N(Chemnitz)=400; N(Mannheim)=404
Database: Outdoor Mobility Survey 1995
behaviour as pedestrians, bicyclists, or drivers, nearly one fourth of the elderly urbanite in western Germany, and as many as one third in eastern Germany, feel helpless or disadvantaged in traffic. In addition, more than half of the elderly people in eastern and western Germany complain that too few people in buses and trains offer their seats and that drivers and motorcyclists approach crosswalks at excessive speed. Every third elderly person finds that people drive too fast in general.

5. CONCLUSIONS

Despite a growing awareness of the problem posed by motorised traffic, the total density and volume of traffic has continued to grow in recent years, and the number of passenger cars will continue to rise in the coming years, not least due to the growing number of car owners, especially women, among people below 65 years of age. The elderly persons' options for mobility may thereby increase, but the greater traffic density that results may immediately reduce them again.

Therefore, it is necessary to improve social behaviour as well as the technical, physical, and organisational conditions of mobility. Because particularly elderly persons who do not drive feel hemmed in, whereas drivers are satisfied with their scope for mobility even with increasing age and health impairments, priority should go to bettering the situation for pedestrians and the users of public transport, that is, to calming traffic and enhancing traffic safety and to facilitating socially and environmentally compatible mobility.

6. REFERENCES

ELDERLY AND OUTDOOR MOBILITY IN A DUTCH NEW TOWN: ZOETERMEER-MEERZICHT

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1. GENERAL BACKGROUND OF THE SITUATION OF THE ELDERLY

1.1 Mobility of the elderly in the Netherlands

Driving licences are valid for a period of 10 years. Each 10 year one has to renew his licence. After the age of 70 a medical examination is needed and a new period of validity will be fixed. 76% of the males older than 60 has a driving license and 34% of the females.

The other condition for mobility concerns the ownership of a car. Again the males are with 65% owners of a car much more able to use this than women with a share of 16% owning a car. This division between both will be distorted by the common vision that a car for the household belongs primarily to the male part of it. In the age group of 65+ has 56% car. A bicycle is at least owned by 75% of the 65+ people.

The use of different transport modes is a relevant aspect of their mobility. Table 1 shows how in the 1994 National Travel Survey people of 65+ make their trips. With trip is meant a movement with one activity as purpose. This means that going by bicycle and then by bus to a shop is one shopping trip, but going by bicycle to a shop and back home are two trips. These figures shows that women make much more trips as cyclist, car passenger, walking and with public transport than males do. They make less car trips.
Table 1: The average number of trips a day made by 65+ with several traffic modes by gender

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>0.58</td>
<td>0.99</td>
<td>0.12</td>
<td>0.21</td>
</tr>
<tr>
<td>car passenger</td>
<td>0.18</td>
<td>0.20</td>
<td>0.36</td>
<td>0.53</td>
</tr>
<tr>
<td>public transport</td>
<td>0.15</td>
<td>0.12</td>
<td>0.21</td>
<td>0.19</td>
</tr>
<tr>
<td>Bicycle</td>
<td>0.55</td>
<td>0.64</td>
<td>0.28</td>
<td>0.50</td>
</tr>
<tr>
<td>Walking</td>
<td>0.67</td>
<td>0.55</td>
<td>0.72</td>
<td>0.62</td>
</tr>
<tr>
<td>Other</td>
<td>0.04</td>
<td>0.04</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2.17</strong></td>
<td><strong>2.55</strong></td>
<td><strong>1.76</strong></td>
<td><strong>2.08</strong></td>
</tr>
</tbody>
</table>


Travelling is not without risks. In 1994 died 289 persons of 65+ and older by traffic accidents and 1630 got injured and admitted to a hospital. These elderly are most vulnerable as cyclist. 30% of fatal accidents concerned people riding a bicycle and 25% was driving a car.

1.2 Mobility by elderly people: problems and impairments

The data of Dutch NTS make also clear that the higher the age of people the lower the number of trips made. 40% of people of 75 and older make no trips on the interview day, for the age group of 45 - 54 is this 15%. Females are making relatively fewer trips than males. Main car users are making more trips. A relation between these findings seems to be evident. Males are the main car users: they have more often a drivers licence. Single persons are travelling less than married people are.

These very general figures about the travel behaviour of elderly people give a first impression of the type of mobility and of the immobility of an other part of this age group. In the next part a survey in a specific location will be described. This survey and the related trip diary give much more in detail the drives and needs around mobility of the elderly and this project offered an opportunity to gather more information about the problems they meet in their mobility.
2. MOBILITY OF ELDERLY PEOPLE IN A DUTCH NEW TOWN: ZOETERMEER-MEERZICHT

2.1 Description of the research area

2.1.1 Local characteristics of the residential area.

Meerzicht is planned and built in the sixties and first seventies. The oldest part has been realised in high rise buildings. Later most houses have been built as low rise in rows. The estate is situated in the Western part of Zoetermeer, a new town built mostly for people coming from The Hague or with work relations to The Hague. The Southern border of the estate is the highway and railway: Utrecht-The Hague, the northern border is a local main road and the regional railway. The main connecting road to the highway borders the eastern part. The Western part is situated along a large park area, which is connected with the regional park structure.

The main road system is based on a central 4-lane road, to which nearly all neighbourhoods are linked with cul de sacs. This road is also the route for the bus lines, most with a low frequency of once an hour. The regional railway is crossing the area with in the centre a railway station. The frequency is about 3 trains an hour during the day, more during peak hour. A high-density cycle path and footpath system with free crossings of the main roads is part of the infrastructure.

The shopping centre is located in the middle of the area next to the railway station. About 50 shops are part of this centre, including 2 supermarkets. A medical centre and social cultural facilities are also located here. An additional small supermarket is located in the southwestern part.
Near the shopping centre is a service apartment building for elderly. All central services, institutions and shops are within a walking distance of about 150 meters. Small low rise housing for the elderly has been built in the southwestern part of the area.

2.1.2 the elderly in the sample
The realised sample consists of 50% males and 50% females. In the whole area this distribution is 41 and 59%. This means that we have an underrepresentation of women. For the explanation of the behaviour it is an advantage to have equal groups for gender and it makes the data more comparable with the stratified samples in other cities. The main differences with the other samples concerns the choice for only a suburban area (Meerzicht) as research area and the choice for the age group of 65 and older. This restriction resulted in a sample of about the same size for only one area. For this sample the conclusions of the other samples can be compared.

In the sample is 37% older than 75 and in the population this share is 38%. 34% has 8 years education (mostly two years kindergarten and 6 years of basic school). 28% has two more years of additional education.

In the marital status the differences between the sample and the population of Meerzicht are small, even if the sample is divided in gender groups. A large share of women has been widowed. In the age group of 70 - 74 27% of the women are widows and 16% of the males. In the age group of 75 - 79 these shares are respectively: 70% and 13%.

43% Has an income of more than 1140,- ECU per month and 20% has less than 820,- ECU. These amounts concern the basic income for, respectively, 2 and 1 person households.

As far as we can check the composition of the sample, the main characteristics are not totally different from the whole population of this area. The largest difference concerns the lower participation of women in the sample, but this is no problem for the explanation of the mobility behaviour. Generalisation is not the aim of this survey.

2.2 Experience with several aspects of life in Meerzicht

2.2.1 the neighbourhood.
We have asked people to mention what is relevant for their mobility in the neighbourhood. Besides, we have asked them to indicate the level of hindrance of the problems.

The elderly experience most nuisance from the fear for an attack or robbery and for threatening persons in the area. 'Free running dogs' is mentioned rather often as relevant, but people can handle it. The same holds for heavy traffic. It is relevant, but no problem.

Obstacles on the footpath and too high kerbs are seldom a problem for the elderly. Several neighbourhoods have a footbridge to cross the main road. Some parts of the area have a pedestrian crossing and these create some nuisance.

The general impression is that the physical accessibility of the environment is
good. No item is dominating in the negative experience of the elderly. With 8% are the free running dogs most mentioned, but feelings of insecurity have with 7% quite the same weight. 12% of the sample stays sometimes at home because of the problems they experience and 8% solves these by going with others. Most elderly know the problems, but they are no reason to stay at home.

One way to measure the satisfaction of people with the living environment is to ask people what preference they have if they have to move. 63% of the respondents prefers to live in the same area or in the same city. Relatives and friends are hardly a reason to move and the same low share wants to move to more attractive surroundings. These elderly are quite happy with the present situation. However, 23% would consider moving and this is a relevant share.

We have asked them what are the most important conditions for the residential environment they want to live in: A good and clean residential area, with a pleasant character, and good shopping and services available, is for most elderly very important. Less important is for the elderly that the neighbourhood offers entertainment: 'where the action is' or cultural facilities. Green areas are more important for recreation than 'entertainment'. Good medical care nearby belongs to the conditions for a good environment. A little bit surprising is that living near friends and relatives does not score very high. The satisfaction with the neighbourhood is quite high.

### Table 2: Relevance of some items for walking in the neighbourhood and the level of hindrance (in percentages)

<table>
<thead>
<tr>
<th>Neighbourhood</th>
<th>not relevant</th>
<th>level of hindrance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rough footpath</td>
<td>51</td>
<td>16 14 17</td>
</tr>
<tr>
<td>Obstacles on footpath</td>
<td>75</td>
<td>7 5 11</td>
</tr>
<tr>
<td>Bad pedestrian crossings</td>
<td>58</td>
<td>15 10 15</td>
</tr>
<tr>
<td>Too high kerbs</td>
<td>75</td>
<td>2 5 17</td>
</tr>
<tr>
<td>Lack of space for pedestrians</td>
<td>66</td>
<td>11 7 15</td>
</tr>
<tr>
<td>Only access via stairs</td>
<td>68</td>
<td>11 7 15</td>
</tr>
<tr>
<td>Too heavy traffic</td>
<td>60</td>
<td>8 6 24</td>
</tr>
<tr>
<td>Dangerous crossovers</td>
<td>51</td>
<td>15 15 17</td>
</tr>
<tr>
<td>Free dogs</td>
<td>51</td>
<td>13 7 26</td>
</tr>
<tr>
<td>Threatening persons</td>
<td>53</td>
<td>12 12 21</td>
</tr>
<tr>
<td>Fear for attack or robbery</td>
<td>49</td>
<td>18 15 16</td>
</tr>
<tr>
<td>Bad traffic lights</td>
<td>67</td>
<td>8 6 17</td>
</tr>
<tr>
<td>Air pollution or noise</td>
<td>57</td>
<td>13 13 15</td>
</tr>
<tr>
<td>Unsafe feeling</td>
<td>65</td>
<td>9 10 14</td>
</tr>
</tbody>
</table>


#### 2.2.2 shops and services

These facilities are considered as available if they are accessible within 15 minutes. For 90% and more most of the facilities are available. Swimming
pool and church are for more than 80% of the respondents available. Only the cultural facilities and home care facilities are less available. Unavailability is crucial, if these facilities are important for them. The features, which are less available, are also the features, which are less important for the elderly in this area. The swimming pool is only for 22% important and cultural facilities for 28%. A little bit surprising is also that only 33% of this generation of elderly mention a church as an important feature for the residential area.

Some facilities give any problem in accessibility, but this concerns maximum 3% of the respondents. Only the railway stations create any problem in access for 4%.

Food shop and the park are the most common destinations for the daily trip. Some facilities as a hairdresser or the church are important for a smaller group, only a large share of this group visits them weekly. For this group of elderly the visits to a pharmacy and to a doctor are less frequent than expected. 55% visits only yearly a doctor and 15% monthly. A pharmacy is more often the destination of a visit: 46% monthly and 36% only yearly.

For public transportation these figures show the greater importance of the railway system than the bus. The railway system has a local line with 11 stations within Zoetermeer.

Only 20 persons have mentioned any problem in the access of one of the facilities. Most often they mention the health condition (13x) and the long distance (11x) as the most important obstacle. The public transport is mentioned 6x: bad connections or difficulties in using the system.

### 2.2.3 the dwelling

The housing of the people in the sample was: 3% in a detached house, 43% in row houses and 52% in multi-storey housing. Almost all respondents (91%) live independently in a (rented) dwelling. Only 9% live in special housing for the elderly.

The high costs of the dwelling are mentioned most (58%) as a problem, which is felt by 36% as more or less troublesome. 25% has some problems with the heating system and 7% has serious problems with it. 15% finds his dwelling too large.

If they had to change the residential situation for health reasons, what alternative would be the first option? The privacy seems to be so important for people that only 5% of these respondents will change to a situation, which implies living with other people in the same house. Not surprising is that most elderly prefer to adapt their own house. A second choice is to move to an adapted dwelling or to a senior apartment.

### 2.2.4 leisure activities

Leisure is an important part of the activities of elderly, especially for the group of 65 and older.

The elderly seem to be most active in home: meeting friends, getting visitors and reading or several indoor activities. But, they walk also around near home or in the town.

More about the importance says the relation between people active with a specific activity and the share of people who mention the same activity as
important. Striking is, that some activities only have a few people who practise them, but for them these activities are very important. It concerns: fishing and active sport: the real amateurs. Some social activities as visiting friends and host friends belong to the most important activities. Cycling and active sport are activities which people want to do, but they are not able to do these. The physical condition is the most mentioned explanation. Other activities with any relation with physical condition are mentioned: bowling, dancing or short outings. Visiting theatre, concert etc. belongs perhaps more to the activities, which everybody wants to do more, but they do not get such a high priority. People mention bad health as the main reason not to go and the high costs as a second reason.

2.3 Mobility behaviour

Health is an important precondition for mobility. Mobility itself consists of two main aspects. The personal mobility is one aspect, which stresses most the independent choice people can make in their mobility. Public transport is the other way to organise mobility, but this mode offers less discretion to people.

2.3.1 health situation as condition for mobility

The own estimate of the physical mobility shows that one third has any problem. They feel their situation as fair or worse. They have more vision problems than hearing problems. More than half of the respondents has any problems with vision, but only a small part seriously. 55% says that they have no consequences for their activities, 20% mentions some problems. If people have serious problems with vision, more than 70% of them mentions consequences for their behaviour. Hearing problems are somewhat less constraining. With serious hearing problems 54% mention consequences for going out or for some activities.

Health problems people have most with heavy domestic work: windows cleaning, with carrying heavy bags and with walking longer distances. These problems are so serious that these elderly cannot do these activities. Problems with light domestic work would be an indication for problems with living independently. With this indication people are mostly staying in a home for caring or nursing.

2.3.2 personal transportation

Another important condition for mobility is the use of transport means. Are you using daily or weekly a specific transport means or did you so before?

Table 3: The actual or former use of personal transport modes

<table>
<thead>
<tr>
<th>use of mode</th>
<th>yes</th>
<th>no longer</th>
<th>never done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>61</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Moped, bike</td>
<td>3</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>Bicycle</td>
<td>59</td>
<td>34</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 3 shows that the car and the bicycle are the most important individual transport mode for this generation of elderly. Both are competing in actual use. 32% has used a moped (or a bike) before, but only a few of them are still users. For the bicycle the situation is different. 34% stopped using the bicycle, but 59% is still using this.

Interesting are the answer on several statements done by the group of people for whom the car or the bicycle was the most important mode. The car is for the users a preferred mode. A small part of them would prefer to use a different mode, but they do not see alternatives. This holds much more in the evening or on days off. For cyclists this choice is a little bit more differentiated. They like using the bicycle, but not everybody sees this also as a pleasant mode. They have a more positive attitude to the use of a bicycle. Maybe that this is stimulated by the attention that the bicycle gets as good for the environment. In the evening or during days-off most see alternatives for the bicycle.

The common idea is that elderly find a way to handle the mobility problems.

2.3.3 public transportation

We have asked them how often they use public transport and if they make any difference in daytime or evening and if the season makes any difference. Not all respondents use public transport. 20% say that they can’t judge about this transport mode.

Table 4: Frequency of public transport use and differentiation in time or season

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>mostly</th>
<th>now and then</th>
<th>never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>7</td>
<td>31</td>
<td>60</td>
</tr>
<tr>
<td>Tram</td>
<td>4</td>
<td>29</td>
<td>65</td>
</tr>
<tr>
<td>Train</td>
<td>27</td>
<td>43</td>
<td>29</td>
</tr>
<tr>
<td>airplane</td>
<td>1</td>
<td>38</td>
<td>60</td>
</tr>
<tr>
<td>Taxi</td>
<td>3</td>
<td>27</td>
<td>68</td>
</tr>
<tr>
<td>Special Elderly</td>
<td>transp.</td>
<td>11</td>
<td>78</td>
</tr>
</tbody>
</table>


These elderly are no frequent public transport users. The high density of this local system can explain the higher use of the train. Special systems as ‘elderly bus’ and ‘OV-tax’ are not frequently used. Except for the train, more than 60% of these respondents never use the public transport. The people using sometimes or often public transport has been asked what reasons they have for this use. Bus and train are the most relevant modes in Zoetermeer.

- 58 persons use the bus. 60% agrees that the stops are good located and easy to access; 45% find the bus meets their needs; 45% has no alternatives; 36% no need to look for a parking place and 24% the bus is not expensive.
- 104 persons use the train. 43% agrees that the stops are good located and easy to access. The difference with the bus is clear. The train is less flexible and the distance to the station can be far in some parts of the
Keeping the Elderly Mobile; Outdoor Mobility. a survey in four European countries

area. The same tendency of a lower appreciation can be seen in the 35% of this group that agrees with the statement that the train meets my needs or that there are no alternatives. 45% no need to look for a parking place: near each station many parking places are available. 24% the train is not expensive.

2.3.4 More understanding of mobility problems of the elderly.
Main goal of this project was the better understanding of the mobility of the elderly and the hindrances they meet in realising their wanted travel behaviour. In the mobility of the elderly we can distinguish different aspects:
1. personal situation
2. social situation
3. physical environment
4. functional environment.
Each of these fields was part of the questionnaire. Now we can summarise the findings from the survey in this paragraph.

Personal situation
Health is apparently an important factor in determining the travel behaviour. About one third mentions any problem with physical mobility. Physical condition, vision and hearing problems influence the possibilities people have to be mobile. People have mentioned several aspects of the physical condition: condition, climbing stairs, long distances. Some elderly mention problems with going outdoors, shopping or climbing stairs. In the analysis we see a relation between the ease with which they can do several activities and their own experience of the physical mobility. One third of the sample no longer uses their bicycle and one fifth has stopped with car driving. Both transport means are important condition for mobility.
At the same time we get the impression that these physical impairments also reduce the desired mobility. People have fewer needs to travel if their physical condition deteriorates.
Another characteristic of the personal situation is the financial condition. Sometimes people mention this as a reason to be less mobile. A clear relation can be seen with the costs of a car. People no longer own a car for financial reasons and this has a direct influence on their mobility behaviour. In a different way these costs play a role in travelling of long distances. Especially rather expensive activities, which are no necessary part of living conditions: cultural activities or leisure activities, get a lower priority for this reason.

Social situation
In several ways the social context is relevant for the mobility of the elderly. They get more problems to solve with higher age, if they want to maintain their social contacts. The long distance, the bad health conditions or the feelings of lacking public safety make it more difficult to maintain the existing social relations.
For many trips the company of others is a relevant condition. 48% of all trips has been made with at least one other person. This can be for social reasons: to be not alone, but also for safety reasons: it gives a feeling of safety in rather bad physical health conditions and it gives a feeling of
security against threatening persons or situations. The social environment is important in solving many mobility problems. The elderly can evidently cope with many mobility problems, but often contribute other people, belonging to the social context, to the solution: by accompanying, by driving, etc.

**Physical and urban environment**
Most elderly people have a small action space. The neighbourhood is a relevant part of the context. Remarkable are the feelings of public safety. Several respondents have made remarks about their fear for unwanted person and for robbery. It seems to be most a problem of subjective public safety.

The physical structure of the neighbourhood is less mentioned. Crossings and crossovers, some footpaths and the busy traffic have been mentioned as problems, but they can cope with these problems. Some people stay at home for these reasons, but most of them go in company or have found other solutions to go out.

Part of this system is the transport system. In the reactions of people this system does not play a dominating role. They experience some problems with the accessibility of the railway stations and the distance to these stations. The distance to bus stops is shorter. Public transport plays a minor role in the mobility of the elderly. Car, bicycle and walking are much more used modes.

For these modes is not the infrastructure the main problem, but sometimes people experience some problems with the system. Driving a car in busy traffic, at dusk or in the evening, with bad weather or for long distances create a higher threshold. The same holds for cycling. The road conditions and the weather are more dominant. People try to avoid these conditions. Financial reasons or health and for the bicycle a negative experience of an accident are reasons to stop with using these transport modes.

**Functional environment**
In the regulated planning structure of the Netherlands all facilities are realised on a distance, which can be covered by most people. Shops are concentrated in one big shopping centre in the middle of the area. At one eccentric located site a small supermarket has been realised. Health care has been concentrated near the shopping centre, even as some churches, social-cultural facilities. The accessibility of these services is most good; some dedicated houses for elderly people are located a little bit too far away. Most facilities needed for daily living are good accessible. Some other services are located in other parts of the city, but public transport and dedicated types of transport make these services accessible.
3. INTERRELATION BETWEEN MOBILITY AND SEVERAL ASPECTS OF THE LIVING SITUATION.

Table 5: Factor analysis of satisfaction scores

<table>
<thead>
<tr>
<th>SATISFACTION WITH</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOBILITY</td>
<td>.76643</td>
<td>-.06918</td>
<td>.17326</td>
</tr>
<tr>
<td>ECONOMIC SIT.</td>
<td>.74512</td>
<td>.07829</td>
<td>-.16198</td>
</tr>
<tr>
<td>HEALTH</td>
<td>.70894</td>
<td>-.00632</td>
<td>-.06101</td>
</tr>
<tr>
<td>WHOLE LIFE</td>
<td>.67803</td>
<td>.04548</td>
<td>-.44571</td>
</tr>
<tr>
<td>LEISURE ACT.</td>
<td>.61003</td>
<td>-.13585</td>
<td>.05285</td>
</tr>
<tr>
<td>PUBLIC TRANSPORT</td>
<td>.52873</td>
<td>-.35149</td>
<td>.12521</td>
</tr>
<tr>
<td>TECHNOLOGY</td>
<td>.51188</td>
<td>-.28779</td>
<td>-.03223</td>
</tr>
<tr>
<td>DWELLING</td>
<td>.26412</td>
<td>.69035</td>
<td>.14107</td>
</tr>
<tr>
<td>NEIGHBOURHOOD</td>
<td>.24640</td>
<td>.66662</td>
<td>.19558</td>
</tr>
<tr>
<td>SERVICES</td>
<td>.39015</td>
<td>.12000</td>
<td>.72863</td>
</tr>
<tr>
<td>SOCIAL CONTACTS</td>
<td>.10057</td>
<td>.52523</td>
<td>-.53992</td>
</tr>
</tbody>
</table>

This factor analysis shows us three principal components, which explain a part of the variance. The explanation is not so high. The three factors fit very well in the findings of an analysis of the data of the Dutch National Travel Survey (Tacken, 1997).

The first factor concerns a mix of 4 aspects of life, which together form the quality of life. Mobility, made possible by a good financial base and a good health, contributes to the satisfaction of the total life situation.

The second factor concerns the residential quality: the dwelling and the neighbourhood.

The last factor seems to represent the satisfaction with the social environment. This concerns the social contacts and the satisfaction with the services, shops and facilities, which also can be seen as part of social life in a neighbourhood.

4. CONCLUSIONS

- the built environment of a residential area of the sixties has some basic conditions to prevent extreme situations in the common Dutch planning structure
- private transport is most used and most liked and offers within financial borders the best conditions. The availability of a car and a driving license are important conditions. In the Dutch situation is the bicycle a good alternative during the day and with good weather
- public transport offers reasonable conditions for mobility, especially if completed by flexible transport. The distance and the accessibility of the train stops are sometimes problematic. The bus stop is better accessible, but the frequency is too low.
- good health enables an active lifestyle and this is a necessary condition for the desired mobility
- a good social context makes coping behaviour easier. The partner is the first to offer help, but also other people in the social circle can be supportive
- not directly based on the findings of the survey but supported by the findings in other projects: new technology creates new opportunities to solve problems: mobile communication against public unsafety, traveller information, dynamic traffic information and fast working communication
creates opportunities for demand responsive transport, supportive technology enhances the use of several transport modes, etc.

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in: Egeter, B. and N. Kalfs, Sprong in het duister, lange termijnontwikkelingen in het vervoersplanologisch onderzoek.CVS 1997 Amsterdam

Centraal Bureau voor de Statistiek
Part 1
Health conditions and physical mobility
Several lines of evidence in the published literature indicate that postural disequilibrium is one of the main determinants of functional disability in the elderly population. In particular, a number of studies have shown that disequilibrium causes serious functional consequences like falls, reduction of mobility, disability, and mortality. Despite the general increase in disequilibrium in the elderly population as a whole, a small proportion of the elderly enjoys good postural stability. A commonly accepted model of the effect of the age on postural control considers postural instability an exclusive function of age resulting from degeneration of the musculoskeletal, neuromuscular, and sensory system. This model explains heterogeneity in postural stability by differences in lifestyle and genetic traits.

A second model explains the loss of postural control in the elderly by an increased probability of developing specific diseases, which lead to accelerated degeneration in neural and/or musculoskeletal system, while the effect of the age is very small. In this model, individual differences in postural control derive from the different probability with which a given disease develops. Evidence exists consistent with both of these views.

In a study on socio-economic conditions of the elderly (the Dicomano study, Florence, 778 subjects total population of 65+ people, 535 interviewed), we have found a significant correlation between some physical performances (balance R/L foot, score 1-10 sec. range; walking three meters on a 25 cm width path, score time, n. of steps and errors) and some indicators of lifestyle, as going regularly out or endorsing outdoors activities. The prevalence of disability in discrete activities paralleled the score obtained in the balance test: ability to perform some items is lost with a minor deficit of equilibrium, while another item can still be performed at very low level of balance control. The relationship is almost parabolic, with B-ADLs located in the lower part of the spectrum, indicating that balance deficit is a strong predictor of functional loss in this range of abilities.

Traditionally, postural responses to disequilibrium have been thought to result from activation of reflex pathways by information from sensory receptors. This view fits better with changes in limb and head position in
response to external perturbations but it doesn’t take in account of the extreme complexity of postural control.

Postural control requires the ability to detect, encode and predict any passive or active change in posture, select the most reliable sensory cues from the environment, and eventually select and finely adapt the motor response, within the frame of biomechanical and physical constraints. In this model sensory inputs not only detect a stimulus and trigger but also develop an internal representation of the position of the centre of mass and the characteristics of the environment.

The medical and the social impact of disequilibrium has led to a great deal of research on postural instability and to development of several clinical and laboratory methods, but for the present knowledge, no one system tool can evaluate all aspects of balance control. So different approaches to the clinical assessment are used, including functional approach, system approach, and quantitative posturography.

The first is the functional approach that is based on reliable and valid performance-oriented clinical measures (i.e. Tinetti scale, Berg scale, FICSIT balance assessment). This type of approach has the advantage of a low cost and to be easy to use in different environments. It also can identify subjects with disequilibrium and predict the overall falling risk. It’s used to evaluate treatment outcome and help us in allocating resources.

However performance oriented measures just provide an overall estimate of balance. They do not detect conditions in which the compensatory postural strategies allow good functional capacity. Therefore they provide only little information to identify the cause of the deficit; they are so of little utility for planning individually tailored therapeutic programs.

This all has led to the development of a different approach to the study of postural control: (system approach) in which the postural response is broken down into its functional components (motor and sensory). System approach is normally used in clinic. It is a sort of a conceptual framework for the clinical evaluation. Since several body subsystems and environmental factor influence the goal of maintaining upright balance a detailed investigation of each subsystem is necessary to understand which subsystem primarily contributes to disequilibrium.

During clinical examination of a patient with disequilibrium we investigate the correct functioning of the different systems involved in balance and we evaluate somato-sensory inputs, joint mobility, muscle force, cognition, muscle energising, motor co-ordination and vestibular inputs. In turn the correct functioning of all these subsystems depends on metabolic omeostasis and on cardiovascular efficiency.

However, although widely used the reliability of measurements and validity of most test procedures have not been adequately demonstrated. There is a little knowledge about interactions between body subsystems, but most of all, in the presence of comorbidity; it’s difficult to determine which subsystem primarily contributes to disequilibrium.

Quantitative posturography is a method to obtain measures by force platforms. These measures compliment functional approach to evaluate severity of disequilibrium. Through this measures we analyse body motion and we can evaluate the balance control of the subject. It also compliments system approach to understand impairments underlying functional limitations in balance control. By this method we can modifyate afferent information
and/or of the support surface to evaluate the influence of some motor and sensory components.

But force platforms provide only global measures and it is not possible to determine relationships between posture and strategies to obtain the equilibrium maintenance. These measures cannot adequately explain which body system or underlying mechanism account for disequilibrium.

Therefore to overcome these limits we devised a posturographic protocol which utilises a quiet standing paradigm to quantify the severity and nature of patient's disequilibrium by force platforms and a three-dimensional motion analysis system. In this way we can monitor changes in postural sway motion, postural alignment, body position and motor co-ordination. The protocol utilises postural tasks having different levels of difficulty.

The rationale of our protocol is that the quiet standing is a voluntary task instruction dependent (we say to the patient to keep still) therefore the apparent goal of the patient is that of minimising the centre of mass motion, or body sway over the base of support. This goal can be achieved by different strategies.

In facts within the biomechanical and physiological constraints of human body five are the possible strategies the patients can use:

- to vary the base of support (larger or narrower)
- to vary the height of the centre of gravity (lower or higher)
- to vary joint moments
- by giving different weight to afferent inputs
- to vary the motor co-ordination.

While standing we trade off between stability and safety, normal subjects use strategy which can get a reasonable level of safety with minimal energy consumption by using appropriate postural strategies. The strategies are constrained by and/or specific for environmental condition (this is an adaptation i.e. when we are walking on a slippery surface we must minimise the hip motion otherwise we fall) and for functional impairment (this is a compensation i.e. hemiplegic patients tend to compensate the weakness of the affected side by using for support the lower limb of the not affected side).

On the base of different levels of functioning we differentiate subjects in three different groups:

NORMAL: subjects with normal control of body motion and that use normal strategies

COMPENSATED: subjects with normal control of body motion that use different postural strategies

ABNORMAL: subjects with abnormal body motion that use abnormal strategies

We have concluded the phases of content validity, of factibility of the study, and the study of reliability and concurrent validity. Now we are evaluating patients with single pathological conditions in order to evaluate the threshold of severity. The next study will be to evaluate the sensitivity to the changes in response to rehabilitation.

We can so conclude that our knowledge about adaptatory and compensatory strategies very little. However we believe that improving our knowledge in this field is fundamental both for designing individually tailored rehabilitative
Postural control

programs and for environmental settings.

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12.

REMOTE MONITORING SYSTEM TO MEASURE PHYSICAL MOBILITY AND TRANSFER OF ELDERLY PEOPLE

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1. INTRODUCTION

The increasing number of elderly people has made it necessary to focus on their dependency in activities of daily living and behavioural disturbances. A progressive loss in autonomy results from the aging process or chronic disorders. Dependency means the recourse to a human or technological aid to perform the activities of daily living. To assess the degree of dependency or the different disorders that affect the elderly people and for significant aspects their quality of life, various types of measures exist depending on the user's needs (care, research, planning, management, resource needs, allocation...). They rely on scales, grids or models and are based on observer's answers. Due to human observations, sometimes to the older person own opinions and more often to the elderly caregiver's answers, these measures may be subjective according to how the disorder is lived by the caregiver or by the older person himself. They may have a risk for lack of empirical data to study nature (Matteson et al. 1996) and the changes with time of the disorders (Wagner et al. 1995). The duration of the disturbance is often ignored as the disorder is difficult to follow. An episode of behavioural disorder may occur only once a week but lasts for several hours at a time (O'Leary et al. 1993).

We suggest a remote monitoring system capable of functioning 24 hours a day, 7 days a week to help professionals and researchers automatically and objectively to quantify the physical functional mobility and transfer capability of the elderly people. The system does not need the elderly people to be equipped with an electronic device, respects their intimacy, does not need their active participation to function and does not disturb their daily life. The system is part of a multidisciplinary project developed to help the elderly...
Remote monitoring system

people's professional or informal caregivers to reduce their burden in the caring task.

2. METHOD

2.1 Multisensor System

The flat of an elderly person in a long term unit is reproduced in a laboratory room. It is composed of a bedroom with a bed and a bathroom. A remote monitoring system has been installed in this room (Chan et al., 1996; Chan et al. 1995; Chan et al. 1995). The system is composed of a set of sensors and a communication network connecting the sensors to a computer located outside the flat.

The different types of sensors are used: passive and active infrared (IR) sensors (Turck 1988), pressure sensors. For a total floor surface about 20 sq.m including a bedroom with a bed and a bathroom, nine passive IR sensors are judiciously secured to the ceiling covering eight non-lapping adjacent zones for the bedroom and only one zone for the bathroom as shown in figure 1.

![Figure 1: The experimental room instrumented with several sensors.](image)

The IR sensors used exhibit a short reaction time and information keeping of 0.5s. This duration is sufficient to the purpose of the measures. The older person does not move so fast. His getting in the bedroom or his going out of is detected by an active IR sensor including a transmitter and a receiver built in near the door. The bed received a pressure sensor made of a synthetic foam with an internal resistance varying according to the pressure exerted on. The analogue information is then transformed into numerical data.
bed occupied or not). Any movement of the elderly person and his interaction with his physical environment is detected by the set of sensors and directly sent to the computer through the communication network. An industrial type bus (RS485 link) is used from the input modules that dialogue on the bus up to 38400bits/s (Figure 2).

![Diagram of communication network](image)

Figure 2: The communication network.

The link to the computer is achieved through a serial port. The C++ and window compatible software gives the results of the mobility and transfer of the elderly person.

### 2.2 Mobility and Transfer

The experiments selected focus on the mobility and transfer capability of elderly people. So the volunteer participant simulates an older person living on his own in his flat. The C++ software written with window's utilities permits to have daily detailed reports on the participant:

- how many times did he get in his flat;
- how many times did he go out of his flat;
- how long did he stay in his flat each time;
- the date of his getting in and going out of his flat;
- for the day, how many times did he go to bed, use the bathroom, go back his bed, the same questions can have answers for the night;
- how long did he stay at bed;
- the date of his going to bed and his getting up;
- the date of his going in and getting out of the bathroom;
- for the day or the night, every moving can be recorded. The data gathered are processed giving results on the manner the older person spends his time.

Depending on the study, the following daily living activities in his housing can be summarized:

- how many kilometers did the elderly person do in the day;
- how many kilometers did the elderly person do in the night;
- how many times did he get up in the night or in the day;
- how many times did he use the bathroom in the night or in the day;

Some abnormal events can be collected:

- falls, the system considers a fall as an abnormal immobility;
Remote monitoring system

- when did he fall, when did the staff help him;
- running away, when did he go away, did the staff find him, at what time.

In the laboratory room, the system functions normally. Data gathered and processed on a participant to the study gives results on his way of living. Due to experimental site and volunteer participants, all experiment time has been shortened. We have simulated the occupation of the laboratory room by several scenarios of 15 minutes. Each scenario includes several getting in and going out of the room and the bathroom, moving in the bedroom and the bathroom, going to bed, getting up and some falls. Some pieces of software have been written in C++ language to process data and the results can be displayed on a screen. Each supervision period of 15 minutes gives the numbers of going in and getting out of the room, and the bathroom, getting up from the bed, the number of kilometers performed in different ways (straight line, pacing, circular or random moving in the room involving several zones covered by the IR sensors). For 30 displacements of about 10 m, the error is evaluated to be 10% of the exact value, it greatly depends on the number of IR sensors secured to the ceiling. Some results are shown on the figure 3.

![Figure 3: Comparison between the real/measured distances.](image)

3. CONCLUSION

The feasibility of a remote monitoring system has been evaluated in measuring the physical functional mobility and transfer capability of the elderly people. We are preparing to equip a long term unit for dependent elderly people to evaluate the prototype on site. We have planned to focus on:
- the reliability and sensitivity of the data acquisition part of the system;
- the use of other sensors and bus for gathering data and sending them to the computer;
- the reliability and sensitivity of the sensors;
- the needs of the staff in a long term unit for dependent elderly people.
4. ACKNOWLEDGEMENTS

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13. FFB-MOT - DEVELOPMENT OF A QUESTIONNAIRE TO MEASURE HEALTH-RELATED FITNESS COMPONENTS IN MIDDLE AGED AND OLDER ADULTS

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1. INTRODUCTION

The promotion of health-related physical activity has gained importance as a preventive public health measure (US Department of Health and Human Services, 1996; Blair et al., 1996) and as a way to maintain work ability (Shephard, 1996), functional capabilities and outdoor mobility (Philipps and Haskell, 1995). The specific role of health-related fitness and physical activity as "salutogenic resources" were pointed by Woll (1996).

Increasing scientific evidence indicates that in addition to promoting aerobic exercise and fitness for cardiovascular and metabolic health (Wannamethee et al., 1995), the enhancement of motor and musculoskeletal fitness maintains functional capability and may prevent falls (Providenee et al., 1995). It reduces also the risk of osteoporotic fractures among the elderly and decreases the burden of back-related disability among the working age population (Heinonen et al., 1996).

Based on the known relationships between physical activity, fitness and health, a new fitness concept - health-related fitness (HRF) - has been introduced. The components of HRF are cardiorespiratory, motor and musculoskeletal fitness; body composition and metabolism. According to this conceptual model (Bouchard and Shephard, 1994) several fitness components are associated with various health outcomes and with physical activity patterns.
To evaluate and monitor the fitness level of the general population, field measures of HRF that are reliable, safe, economic, and easy to administer need to be developed (Skinner and Oja, 1994). Most importantly, the validity of the tests should be established by demonstrating significant and meaningful relationships with health and physical activity. This is necessary to determine the contribution of a particular fitness component to important health outcomes, as well as to interpret the HRF scores in terms of adequacy of fitness with regard to health (Oja and Tuxworth, 1995).

Several field test batteries of HRF have been developed during the last years. On the one hand attempts have been made to develop assessment methods of health related fitness that are applicable to large populations, and several field test batteries for adults and elderly people have been introduced, e.g. Fitness Canada (Shephard, 1991), Eurofit for adults (Oja and Tuxworth, 1995), AAHPERD functional fitness assessments (Shaulis et al., 1994). Together with the UKK-Institute in Tampere/Finland, our institute has also developed a field-based health-related fitness test battery for adults (Sunii et al. 1998).

Guralnic and coworkers (1995) showed that among nondisabled older persons, objective performance measures of balance, walking speed, and ability to rise from a chair were highly predictive of subsequent disability. The reliability of all fitness parameters and the criterion-related validity of the cardiorespiratory endurance test of the American Alliance for Health, Physical Education, Recreation, and Dance functional fitness assessment battery in elderly women have been reported (Bravo et al., 1994).

But not only field fitness tests are used in the area of health-related fitness measurement. From the gerontological point of view, the “functional status” of elderly people plays an important role for successful ageing. To assess functional status of the elderly, so called “Activities of daily Living (ADL)-Questionnaires” are used (Dencker and Gottfries, 1995; Sonn, 1996). At the moment there exist more than 25 different scales to measure activities of daily living (ADL).

2. CONSTRUCTING THE FFB-MOT SCALE

2.1 Aim and target groups of the FFB-Mot

Our aim is to develop one questionnaire to measure the functional status as well as health-related fitness. The questionnaire includes the following components of HRF: Cardiorespiratory fitness, musculoskeletal (strength and flexibility) fitness and motor fitness components. The questionnaire aims to provide objective methods for population based fitness surveys and scientific research. It also provides a practical tool for health care and sport services to promote health enhancing physical activity (HEPA) on individual level. Objective of the questionnaire is the approximate registration of the functional status of motor activity in normal population of middle aged and older adults (clinical and non-clinical groups). A single use provides the assessment of the functional status of motor activity. The basis for the assessment is age and sex specific comparative values. Carrying out test repetitions, an analysis of the changes of the functional motor activity status...
can be measured.
The selection of items for the FFB-Mot was first based on literature review of available ADL- and fitness-questionnaires. In different pre-studies an extended item pool of some hundred items was proofed. In various steps (statistical evaluation and expert rating), the number of items were reduced. The actual version of the FFB-Mot questionnaire consists of 28 items. Only 20 items were used for the scale construction. An example for a FFB-Mot item: "Are you able to carry 2 heavy suitcases several floors upstairs" (five-point Likert-scale "I don't have any problems" - "I can't manage this activity"). The range of the sumscore is 20-100 points.
Every dimension/subscale of health-related fitness (cardiorespiratory fitness, strength, flexibility, motor control) is measured with 5 items. The questionnaire can be used for interview and self-completion. It is a formal test with a high degree of standardisation. Due to this the objectivity of the test is more than sufficient.

2.2 Reliability

2.2.1 Internal consistency
Table 1 shows the results for the Cronbach-Alpha with the 458 adults (229 men and 229 women; age 33-63 years) of the Bad Schönborn study. The results demonstrate a good internal consistency for the whole scale. Within men the results are a little better than within women.

<table>
<thead>
<tr>
<th>Tab.: 1. Internal consistency (Cronbach Alpha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total scale: women .79 men .85</td>
</tr>
<tr>
<td>Subscales: women .79 - .85 men .80 - .88</td>
</tr>
</tbody>
</table>

In other pilot-studies with adult population (age 30-70 years), the range of Cronbach alpha was between .82 and .91. In sum the internal consistency of the total scale and the subscales is acceptable.

2.2.2 Test-retest
The Test-Retest-Reliability was proofed in a pilot study with 150 adults (men and women; age 30-70).
The 2-week test-retest correlation for the total scale for men is .97 and .96 for women.

<table>
<thead>
<tr>
<th>Table 2: Test-Retest-Reliability after two weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total scale: women .96 men .97</td>
</tr>
<tr>
<td>Subscales: women .83 - .93 men .90 - .96</td>
</tr>
</tbody>
</table>

The correlation for the four subscales vary between .83 and .96. While the picture presented by these data must be considered as preliminary, it does, we believe, tend to support the reliability of the scale.
3. VALIDITY

3.1 Factor Structure of the FFB-Mot Scale

The content validity was confirmed by expert rating. The validity of construction was proofed by factor analysis with the data of the Bad Schönborn study (see 3.2.2). Theoretical we differentiated the four dimensions of health-related fitness (cardiorespiratory fitness, motor fitness, musculoskeletal fitness (flexibility and strength)). The eigenvalues of the factor analysis show the structure of four factors very good (Bös et al, 1998). In sum the classification of the items of the four dimensions is confirmed by the factor analysis and by expert rating.

3.2 Criterion validity

3.2.1 Hypotheses

As a first step towards establishing the health-related content validity of the questionnaire, we studied the associations of HRF measured by FFB-mot with self-assessed health (Perceived Health, Back Function and Symptoms) in a cross-sectional design with a sample of adults in middle age. As a second step towards the "mobility/physical activity " content validity of the questionnaire, we studied the association between leisure time exercise patterns and the scale(s) in the same study. Based on the literature review concerning the relations between fitness and health (Skinner and Oja, 1994) we expressed the following working hypotheses.

a) Fitness and Health

Total Scale
- There is a positive association between fitness and perceived health
- There is a negative association between fitness and symptoms.
- There is a negative association between fitness and back-pain.
Subscales
- Especially cardiorespiratory fitness has a positive association with perceived health and negative association with symptoms
- Musculoskeletal fitness - especially strength - has a negative association with back pain

b) Fitness and Physical Activity

Total Scale
- The level of general physical activity, as determined by frequency, intensity and duration of exercise has a positive association with fitness.
Subscales
- Cardiorespiratory fitness has a strongly positive association with the general physical activity level

3.2.2 Subjects and Representativeness of the Sample

The study sample was selected from residents of the city of Bad Schönborn,
Germany, who had previously attended preventive health examinations provided by the municipality and the Institute of Sports Research Frankfurt/Main. A random sample of 458 subjects (229 men and 229 women) was investigated. An analysis by telephone interview was used to compare the participants with the non-participants. The analysis showed that there were no significant differences in important variables (e.g., health status, social status, and physical activity level) between participants and non-participants.

The age range of the sample is between 33 (minimum) and 63 (maximum) years. The average subject is 46 years old.

3.2.3 Results

Age and sex

General aspects of fitness testing can be confirmed by the FFB-Mot: Fitness is depending on age and sex. Figure 1 shows that health-related fitness decreases with age.

Furthermore, men have higher fitness scores than women, excepted for the flexibility subscale. In this dimension women got better results than men did. Because of the sex-specific differences, the results of the FFB-Mot should be analysed differently for men and women.

Health

Perceived health. As hypothesised the level of fitness has a positive association with perceived health in men and women. The level of cardiorespiratory fitness and strength has the strongest association with perceived health.
### Table 3. Men: Correlations of the FFB-Mot with measures of health (n = 229)

<table>
<thead>
<tr>
<th>FFB-Mot</th>
<th>Perceived Health</th>
<th>Symptoms</th>
<th>Back Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiorespiratory Fitness</td>
<td>r .46</td>
<td>- .43</td>
<td>- .41</td>
</tr>
<tr>
<td>Motor Fitness</td>
<td>r .30</td>
<td>- .32</td>
<td>- .33</td>
</tr>
<tr>
<td>Musculoskeletal Fitness/Mobility</td>
<td>r .42</td>
<td>- .34</td>
<td>- .44</td>
</tr>
<tr>
<td>Musculoskeletal Fitness/Strength</td>
<td>r .50</td>
<td>- .52</td>
<td>- .61</td>
</tr>
<tr>
<td>Total Fitness Score</td>
<td>r .50</td>
<td>- .48</td>
<td>- .53</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

### Table 4. Women: Correlations of the FFB-Mot with measures of health (n = 229)

<table>
<thead>
<tr>
<th>FFB-Mot</th>
<th>Perceived Health</th>
<th>Symptoms</th>
<th>Back Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiorespiratory Fitness</td>
<td>r .34</td>
<td>- .36</td>
<td>- .35</td>
</tr>
<tr>
<td>Motor Fitness</td>
<td>r .33</td>
<td>- .34</td>
<td>- .51</td>
</tr>
<tr>
<td>Musculoskeletal Fitness/Mobility</td>
<td>r .29</td>
<td>- .27</td>
<td>- .41</td>
</tr>
<tr>
<td>Musculoskeletal Fitness/Strength</td>
<td>r .33</td>
<td>- .36</td>
<td>- .56</td>
</tr>
<tr>
<td>Musculoskeletal Fitness/Strength</td>
<td>r .33</td>
<td>- .36</td>
<td>- .56</td>
</tr>
<tr>
<td>Total Fitness Score</td>
<td>r .41</td>
<td>- .42</td>
<td>- .57</td>
</tr>
<tr>
<td>Total Fitness Score</td>
<td>r .41</td>
<td>- .42</td>
<td>- .57</td>
</tr>
</tbody>
</table>

** All correlations are significant at the 0.01 level (2-tailed).

**Symptoms.** Our hypothesis was that the fitness score has a negative association with symptoms. Total fitness score as well as the different dimensions of fitness are negatively related to symptoms. Our findings of the association between fitness level and symptoms are different in men and women. Among men the association between total fitness level and symptoms is higher (- .48) than in women (- .42). As hypothesised the highest association in women exist between cardiorespiratory fitness and symptoms. In men, strength has the strongest association.

**Back-Pain.** Back-Pain was related to all measured fitness dimensions in both genders. As expected, the strength and mobility scores have the highest
association with back-pain. This finding is consistent with other cross-sectional studies (Holmström et al., 1992).

**Physical Activity.** Our hypothesis is that the general exercise, level measured as an energy consumption index by exercise per week, must be differentiated. The results show only a low association between the exercise level and the total fitness score \((r=0.34 \text{ (men)}; r=0.22 \text{ (women)})\). There is no significant correlation between musculoskeletal fitness and the general energy expenditure among women. General exercise level is most strongly associated with cardiorespiratory fitness.

| Table 5. Correlations of the FFB-Mot with measure of physical activity |
|------------------------|------------------------|
| Men \((n = 229)\)       | Women \((n = 229)\)    |
| **FFB-mot**             | **Energy Index**        |
|                        | **Physical Activity**   |
| Cardio-respiratory Fitness | 0.44                  |
| Motor Fitness          | 0.23                   |
| Musculoskeletal Fitness/Mobility | 0.22                |
| Musculoskeletal Fitness/Strength | 0.22             |
| Total Fitness-Score   | 0.34                   |

4. **CONCLUSIONS**

In relation to measures of perceived health, symptoms and back pain, the FFB-Mot-questionnaire proofed to be valid for health-related-fitness in this cross-sectional study among adults in middle age. Other hints for the criterion validity are the expected differences dependent on age, sex and exercise:
- decline of health-related fitness with age
- men have - excepted for flexibility - higher fitness values than women
- physical active people have higher fitness values - especially cardiorespiratory fitness - than inactive people

For further evaluation of association between exercise and fitness dimensions it is necessary to differentiate exercise not only in a quantitative energy consumption index. It is also necessary to differentiate on the one hand different muscular types of exercise and on the other hand different types of movement for the neuromuscular system.

Prospective studies are needed to assess the predictive health-related validity of the FFB-Mot-Questionnaire. For the time being, the FFB-Mot
provides an individual age- and sex-specific fitness profile based on norm-reference values derived from the present data. The development of a test manual (Bös et al. 1998) and also an English translation of the questionnaire are in preparation.

5. LITERATURE


14.

ASSOCIATIONS BETWEEN PERFORMANCE-BASED MEASURES OF MOBILITY AND SELF-ASSESSED OUTDOOR MOBILITY IN 75-YEAR-OLD WOMEN. A FIVE-YEAR FOLLOW-UP STUDY

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Faculty of Sport and Health Sciences, Dept. of Health Sciences and the Finnish Centre for Interdisciplinary Gerontology, University of Jyväskylä, Finland

1. INTRODUCTION

The ability to get about outdoors is a prerequisite for independent living in the society. Outdoor mobility often requires vigorous physical capacities, such as the ability to walk very fast and to climb high steps. Fast walking is needed for example at traffic lights when crossing the street as a pedestrian. Climbing high steps is required when entering a bus or train. In the study of Hoxie and Rubenstein (1994), 27% of older pedestrians were unable to reach the opposite pavement before the light changed to allow crossing traffic to enter the intersection. Lundgren-Lindquist et al. (1983) showed that 61% of women who were not able to climb higher than 30 cm steps reported difficulties when using public transport.

Self-assessed outdoor mobility deteriorates by age, which has been shown both by cross-sectional and longitudinal studies (Jylhä et al. 1992, Bowling et al. 1994, Sakari-Rantala et al. 1995, Sonn 1996). In addition, mobility performance, when measured as walking speed or step climbing ability, declines with increasing age (Winter et al. 1990, Ferrandez et al. 1990, Era and Rantanen 1997). In previous cross-sectional studies gait speed and step-mounting ability have been associated with poor self-assessed mobility (Avlund et al. 1994, Cress et al. 1995, Hoeymans et al. 1996).

Furthermore, it has been shown that poor performance in mobility tasks predicts subsequent disability (Harris et al. 1989, Gill et al. 1995, Guralnik et al. 1995). This is in line with the models of the disablement process, where functional limitations in basic physical or mental actions are assumed to precede disability in a person’s everyday life (Nagi 1991, Verbrugge and Jette 1994). A related aspect is the concept of preclinical disability. According to Fried et al. (1991) disabilities often have a so called preclinical level where a person’s functioning has somewhat diminished or altered but overt disability has not yet occurred or the person has not yet recognized it. The practical consequence is that if this early stage of limitations could be
identified, it would be possible to focus preventative measures on people at risk of developing disabilities. The problem with traditional ADL (Activities of Daily Living) questionnaires is that they detect only clinically apparent disabilities which often is not reversible. With performance-based tests it might be possible to detect mobility problems in time when preventative measures would be the most benefit.

The aims of this study were: 1) to investigate how outdoor mobility changes in 75-year-old women over a five-year follow-up, 2) to evaluate the associations between performance-based tests and self-assessments of outdoor mobility and, 3) to detect how performance-based tests of mobility predict the development of new difficulties in outdoor mobility over five years.

2. MATERIAL AND METHODS

This study was part of the Evergreen project, which is an extensive research project concentrating on health and functional capacities of elderly people in Jyväskylä, Finland (Heikkinen 1997). All 75-year-old women (women born in 1914) were invited to participate in the study in 1989. Of the eligible persons, 236 (92.6%) were interviewed at the baseline and 191 (74.9%) visited the laboratory. Five years later, in 1994, the same persons were invited to participate in the follow-up measurements. 161 persons (89.4% of the eligible persons) were interviewed and 126 (70.0%) examined in the laboratory. Because the present study set out to investigate the change in outdoor mobility, only those women were included who participated both in baseline and follow-up phases. There were 145 women who had a result in performance-based mobility tests at baseline as well as in self-assessments of mobility both at baseline and at follow-up.

The interview was carried out in the participants' homes. The questions concerning outdoor mobility were asked in connection with questions about activities of daily living (Avlund and Shultz-Larsen 1991). The mobility variables used in this study were walking outdoors and using public transport. The categories in these tasks were: 1) needing help or not able, 2) perceiving tiredness or managing more slowly than before when doing the task and 3) without difficulty (no tiredness, slowness or need of help).

The performance-based mobility tests were carried out in the laboratory. The maximal walking speed was measured over 10m in the laboratory corridor by a stop-watch. In the step-mounting test the result was the highest step that the subject could mount on one single step without support (Aniansson et al. 1980). The possible step heights were 0, 10, 20, 30, 40 and 50cm.

The subjects were asked to assess their health status during the home interview. The question had 4 response categories varying from 1) unusually good to 4) very poor. The subjects were also asked to assess their usual physical activity by a question where alternatives varied from 1) inactivity to 6) active sports (Grimby 1986).

Transition tables and McNemar's test were used to describe the change in
Part 1: Health conditions and physical mobility

self-assessed outdoor mobility. In these tables as well as in further analyses the variables were dichotomized. The first category included those who were able to do the task without difficulties. In the other category were those who had difficulties, i.e. those who reported tiredness, slowness and/or needed of help. Logistic regression models were constructed first to analyse the associations between performance-based tests and self-assessments of mobility at baseline. The second set of logistic regression analyses was addressed to investigate the predictive value of the performance-based tests for the development of new difficulties in self-assessed outdoor mobility. In the latter analyses, only those women were included who did not perceive difficulties in mobility tasks at baseline. Because of the problem of multicollinearity between the maximal walking speed and step-climbing ability it was necessary to analyse these variables in separate models. Self-rated health and the level of physical activity functioned as control variables in logistic regression models.

3. RESULTS

The distributions of self-assessed ability to walk outdoors and to use public transport at baseline and at follow-up five years later are presented in Table 1. Only one person (<1%) needed help at baseline in walking outdoors and three (2%) in using public transport. At follow-up the proportion had increased to 12 and 20 per cent, respectively. In walking outdoors, the proportion of those who did not have any difficulties diminished from one half to one third. Also in using public transport the proportion of those managing without difficulties decreased.

Table 1. Self-assessed ability to walk outdoors and to use public transport among initially 75-year-old women in 1989 and five years later in 1994

<table>
<thead>
<tr>
<th></th>
<th>Walking outdoors</th>
<th>Using public transport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Without difficulties</td>
<td>74 (51.0)</td>
<td>48 (33.1)</td>
</tr>
<tr>
<td>Tiredness/slowness</td>
<td>70 (48.3)</td>
<td>79 (54.5)</td>
</tr>
<tr>
<td>Need of help</td>
<td>1 (0.7)</td>
<td>18 (12.4)</td>
</tr>
<tr>
<td>Total</td>
<td>145 (100.0)</td>
<td>145 (100.0)</td>
</tr>
</tbody>
</table>

The transition tables regarding the change in the ability to walk outdoors and to use public transport are presented in Tables 2 and 3. Of those who did not have difficulties in walking outdoors at the baseline, 61 per cent developed difficulties during the follow-up. In using public transport, it was more usual to
Associations between performance-based measures...

remain without difficulties at both time points (70%). Most of those who initially had difficulties, had them also at follow-up (73% in walking outdoors and 59% in using public transport). Still in some cases, the difficulties disappeared during the follow-up. The change was statistically significant in McNemar's test both in walking outdoors (p=.002) and in using public transport (p=.018).

Table 2. The ability of the initially 75-year-old women to walk outdoors at follow-up (1994) according to the baseline (1989). Numbers and transition probabilities (in parentheses).

<table>
<thead>
<tr>
<th>Walking outdoors in 1994</th>
<th>No difficulties</th>
<th>Difficulties*</th>
<th>Row total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No difficulties</td>
<td>29 (0.39)</td>
<td>45 (0.61)</td>
<td>74 (1.00)</td>
</tr>
<tr>
<td>Difficulties*</td>
<td>19 (0.27)</td>
<td>52 (0.73)</td>
<td>71 (1.00)</td>
</tr>
<tr>
<td>Column total</td>
<td>48</td>
<td>97</td>
<td></td>
</tr>
</tbody>
</table>

*) reported tiredness, slowness or need of help

Table 3. The ability of the initially 75-year-old women to use public transport at follow-up (1994) according to the baseline (1989). Numbers and transition probabilities (in parentheses).

<table>
<thead>
<tr>
<th>Using public transport in 1994</th>
<th>No difficulties</th>
<th>Difficulties*</th>
<th>Row total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No difficulties</td>
<td>66 (0.70)</td>
<td>28 (0.30)</td>
<td>94 (1.00)</td>
</tr>
<tr>
<td>Difficulties*</td>
<td>12 (0.41)</td>
<td>17 (0.59)</td>
<td>29 (1.00)</td>
</tr>
<tr>
<td>Column total</td>
<td>78</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

*) reported tiredness, slowness or need of help

The mean of the maximal walking speed of the participants was 1.56 (±0.29) metres per second. In the step-mounting test, about one third of the subjects (39 women, 35.1%) was able to climb only the 30 cm step or less. About one half (69 women, 47.6%) rated their health as poor. Persons whose usual physical activities included only the activities of daily living or some light walking once or twice a week were considered as physically inactive. In this way, 27 women (18.8%) were classified as inactive.
The logistic regression models concerning the baseline situation can be seen in Table 4. Those who had a poor result in walking speed (result below mean) had more than three times greater probability of having difficulties in walking outdoors when compared to those whose result was better than mean. The same applied to using public transport. Poor self-rated health increased the probability of perceiving difficulties in walking outdoors and in using public transport threefold. Physical activity was not significant. In the models with step-mounting ability it can be seen that a poor result in this test increased the risk of having difficulties by 4.6 in walking outdoors and by 4.5 in using public transport when compared to those with good step-mounting ability. Poor self-rated health also increased the risk for perceiving difficulties in walking outdoors and in using public transport. In addition, physically inactive women had almost three times greater probability of having difficulties in walking outdoors when compared to more active persons.

Table 4. Logistic regression models for perceiving difficulties in walking outdoors and in using public transport at baseline. Odds ratios (OR) and 95% confidence intervals (CI), ns = not significant.

<table>
<thead>
<tr>
<th></th>
<th>Walking outdoors OR (95% CI)</th>
<th>Using public transport OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Models with walking speed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximal walking speed (below mean vs. above mean)</td>
<td>3.36 (1.56-7.25)</td>
<td>3.61 (1.53-8.51)</td>
</tr>
<tr>
<td>Self-rated health (poor vs. good)</td>
<td>3.05 (1.46-6.38)</td>
<td>3.06 (1.28-7.30)</td>
</tr>
<tr>
<td>Physical activity (inactive vs. active)</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Models with step-mounting ability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step-mounting ability (0-30cm vs. 40-50cm)</td>
<td>4.60 (2.14-9.90)</td>
<td>4.51 (1.92-10.56)</td>
</tr>
<tr>
<td>Self-rated health (poor vs. good)</td>
<td>3.39 (1.60-7.15)</td>
<td>3.53 (1.48-8.45)</td>
</tr>
<tr>
<td>Physical activity (inactive vs. active)</td>
<td>2.87 (1.05-7.84)</td>
<td>ns</td>
</tr>
</tbody>
</table>

Finally, in the Table 6 are shown the logistic regression models which illustrate how much walking speed and step-mounting ability predict the development of new difficulties in walking outdoors and using public transport among women who initially did not report difficulties. The women
Associations between performance-based measures...

with the walking speed below mean had 6.6 times greater risk for developing new difficulties in walking outdoors during the follow-up time when compared to the women whose walking speed was above mean. Self-rated health and physical activity were not significant. Those with a poor result in walking speed had about 3.6 times greater risk for developing new difficulties in using public transport when compared to those with a better result in walking speed. Still the impact of self-rated health was somewhat greater in this model. In the models with step-mounting ability, those with a poor result in this test had four times greater risk for developing new difficulties in walking outdoors when compared to those with a better result (Table 7). In the model of using public transport, poor step mounting ability increased the risk for developing new difficulties by 2.76, which was very near significant (95% CI 1.00-7.63, p=.051). Poor self-rated health at baseline was again strongly associated with new difficulties in using public transport. The level of physical activity was not significant.

Table 6. Logistic regression models for developing new difficulties during the follow-up in walking outdoors and in using public transport. Odds ratios (OR) and 95% confidence intervals (CI), ns = not significant.

<table>
<thead>
<tr>
<th>Models with walking speed</th>
<th>New difficulties in walking outdoors OR (95% CI)</th>
<th>New difficulties in using public transport OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal walking speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(below mean vs. above mean)</td>
<td>6.58 (1.19-36.36)</td>
<td>3.60 (1.23-10.53)</td>
</tr>
<tr>
<td>Self-rated health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(poor vs. good)</td>
<td>ns</td>
<td>5.59 (2.06-15.21)</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(inactive vs. active)</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Models with step-mounting ability</th>
<th>New difficulties in walking outdoors OR (95% CI)</th>
<th>New difficulties in using public transport OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step-mounting ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0-30cm vs. 40-50cm)</td>
<td>4.02 (1.01-16.08)</td>
<td>2.76 (1.00-7.63)</td>
</tr>
<tr>
<td>Self-rated health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(poor vs. good)</td>
<td>ns</td>
<td>5.68 (2.11-15.29)</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(inactive vs. active)</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>
4. DISCUSSION

A large number of older women develop difficulties in their outdoor mobility during a five-year follow-up time. This applies both to minor difficulties such as tiredness and slowness, as well as to losing independent mobility. This has been seen in previous studies. In another Finnish study (Jylhä et al. 1992), the proportion of 70-79-year-old women managing without difficulties in walking outdoors decreased from 82% to 38% during 10 years. Sonn (1996) showed that dependence in using public transport increased in initially 70-year-old women from 6% to 18% during 6 years. In a study of Guralnik et al. (1993), 51-61% of 75-84-year-old women lost independent mobility during a four-year follow-up. In the present study there also were some persons among whom the difficulties disappeared during the follow-up. The amount of disappearing difficulties in walking outdoors was comparable to the results of Crimmins and Saito (1993). In the study of Jylhä et al. (1992) the proportion of those among whom the difficulties disappeared was smaller which was probably due to the longer follow-up time (10 years compared to 5 years in this study).

Poor performance-based mobility was significantly associated with difficulties in self-assessed outdoor mobility at the baseline, when self-rated health and the level of physical activity were controlled for. The probability of having difficulties in self-assessed mobility was 3.4 - 4.6 times greater among those who had a poor result in walking speed or the step climbing test. In previous studies the associations between performance-based tests and self-perceived mobility have varied from modest to relatively strong (Avlund et al. 1994, Cress et al. 1995, Hoeymans et al. 1996). The differences between studies are probably due to differences in selected tasks as well as in classification and scoring systems. The performance-based tests and self-assessed mobility tasks in this study were purposely selected as functions close to each other but representing different levels of the disablement pathway by Nagi (1991) and Verbrugge and Jette (1994). In this way the functions measured by performance-based tests could be considered as functions required for successfully coping outdoor mobility tasks. To avoid obscuring the information, both self-assessments and performance-based tests were used in the analyses as separate variables without constructing sum scores.

Furthermore, the results of the present study showed that poor mobility performance increased the risk of developing new difficulties during the five-year follow-up. This result is in line with the results of several studies. Guralnik et al. (1995) showed that lower extremity performance predicted need of help in mobility tasks in initially independent subjects after four years. In the study of Gill et al. (1995), poor walking speed was significantly associated with the onset of dependence in walking (need for personal assistance or technical aids) during one year. In addition, Schroll et al. (1997) showed that poor walking speed and stair-mounting ability were predictive for needing more help in mobility functions over a five-year follow-up. It has also been found that lower maximal walking speed predicts disability, including dependence in using public transport, after six years in initially 70-year-old women (Sonn 1996). Still, it is worth of remembering the
complexity of the relationship between these kinds of functions. Poor performance does not inevitably lead to poor self-perceived functioning, and all persons with disabilities do not necessarily have poor performance (Gill et al. 1995, Hoeymans et al. 1996).

An interesting finding was that the predictive value of the performance tests for the development of new difficulties in self-assessed mobility was much smaller in using public transport than in walking outdoors. Self-rated health was a stronger predictor, even though mobility performance had its individual impact. This is probably due to the complex nature of the task using public transport. It is obvious that the ability to use public transport is to a great extent determined by other factors than pure physical performance, e.g. cognitive aspects, which fell outside the scope of the present study. Another factor which might have some impact is the use of technical aids. In walking outdoors, technical devices often diminish perceived difficulties and enhance the feeling of safety (Sonn 1996, Verbrugge et al. 1997). However, in public transport they may cause trouble and even restrain the use of buses and trains.

5. REFERENCES


Part 1: Health conditions and physical mobility


TEST FOR THE ERGONOMIC QUALITY OF CONSUMER PRODUCTS – A METHOD APPLICABLE FOR DESIGNERS, PRODUCERS AND USERS

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1. INTRODUCTION

Since May 96 the Fraunhofer Institute for Industrial Engineering and the University of Stuttgart analyse benefits and deficits of products for elderly people. Background is the research project "Domestic technologies to support independent living of the elderly" which is funded by the German Federal Ministry for Family, seniors, Women and Youth.

After discussions with experts in designing products for elderly people, three kinds of different interview types have been worked out to find solutions for the research project:

- Interviews with elderly people,
- Interviews with producers,
- Interviews with service providers.

These interviews result in an action plan for politicians, producers and service providers (figure 1).
2. SOME RESULTS OF THE INTERVIEWS WITH ELDERLY PEOPLE

Designing products for elderly people with the only information of their age is not the right way to set focus on this market segment. There must be something else to describe this target group.

2.1 Attitudes towards life

Based upon a study from 1989 about living conditions of elderly people in Germany [1], the researcher team found all mentioned “attitudes towards life” in the interviews with elderly people (figure 2).
Part 1: Environment: accessibility and traffic safety

Figure 2: Attitudes towards life

31% with duties and domestic attitudes

29% safety and community oriented

15% resigned

25% active

2.2 Attitude towards technique

After this, the interviewed persons were divided up into four kinds of special groups of technique:

• The pragmatist,
• The non-reviewer,
• The reviewer,
• The innovative person.

The "pragmatist" is a person using technologies to compensate (healthy) restrictions. The "non-reviewer" is a very passive person who buys technical equipment only motivated by a third person. Technical equipment is used as long as possible. The "reviewer" is motivated by advertising, brochures and trade journals. Before buying goods he benchmarks them. The "innovative person" is using information and communication technologies. Trial and error is a method the person is able to use.

2.3 Domestic techniques

In the field of consumer products, the interviewed persons were asked questions about

• Great devices (washing machine, dishwasher ...),
• Small devices (electric iron, coffee percolator),
• Entertainment and communication devices (phone, TV ...),
• Healthy devices (things for pedicure and manicure...).
Criticism and suggestions for improvement were as well mentioned as age, range, acceptability and use of the devices.
All statements have to be sorted to a market focussed ergonomic criteria catalogue.

3. ERGONOMIC QUALITY

In parallel work to the interviews, a test for the ergonomic quality of consumer products is worked out. Basic questions of ergonomic workplace [2] and automobile cockpit design [3] are modified towards consumer products. This test is divided up into 12 ergonomic important items with 10 engineering and 2 hardware items. Every item is weighted by a weighting factor in between 1 to 5. A number of questions are developed to qualify the items.

3.1 Ergonomic items

In the test the ergonomic items are
• Forces and torque,
• Degree of action,
• Precision,
• Time,
• Feedback,
• Pollution,
• Safety,
• Posture,
• Evidence,
• Usability,
• Controls,
• Displays.

3.2 Weighting factors

The items were weighted by a team of ergonomic researchers according to the scheme presented in Figure 3. To calculate the weighting factor you have to take the highest factor according to the items safety, potential health impairments, stress / strain fatigue, efficiency and comfort.
Figure 3: Scheme for the determination of weighting factors

<table>
<thead>
<tr>
<th>Weighting factor</th>
<th>Safety operation</th>
<th>Potential health impairments</th>
<th>Stress/strain fatigue</th>
<th>Efficiency</th>
<th>Comfort</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Very high</td>
<td>Very high</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>High</td>
<td>High</td>
<td>Very high</td>
<td>Very high</td>
<td>Very hi</td>
</tr>
<tr>
<td>3</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>1</td>
<td>Very low</td>
<td>Very low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Example: Feedback was qualified as one of the most important thing for safety operation. Without visual, physical, acoustical or any other feedback else, the user is unable to handle any product.

Figure 4 shows the result of ergonomic items and weighting factors.

Figure 4: Ergonomic items and weighting factors

3.3 Ergonomic test

To every ergonomic item, a number of questions have to be answered. After defining the task of the tested product most questions are answered with yes (1) or no (0). Exceptionally there are also questions that can be rated in between yes (1) or no (0). If a question does not fit to the tested device, it will not be taken into account summing up the value of the test.

In the first loop, questions relate to healthy persons. In the next loops the same issues are related to people with different needs such as physical handicaps, sensorial impairments and tremor (Figure 5). The degree of
disability has to be defined before.

**Figure 5: test loops**

3.4 Example

Task: fill clothes into a washing machine with porthole.
Person: healthy.
Item: Forces and torque.
Weighting factor: 4.
Forces and torque for a healthy person to fill clothes into a washing machine could be qualified as medium. Depending on the lever arm, torque is variable and in worst case increasing. A frequency can not be noticed. Acceleration and deceleration refer to the first point (forces) and can be qualified as medium too. To fill a washing machine, permanent forces are necessary. There is no help and the posture of the person is unpleasant. All in all force could be qualified as unpleasant for a healthy person, too. 17% of the weighted points appear from the mentioned proceeding. Conclusion is that this kind of filling a washing machine is not very pleasant for every person due to forces and torque.

3.5 Relevance for researcher project

Opinions of the interviewed persons now can be sorted and qualified with the test. Weighting factors could be changed by the opinion of the users. All statements can be compared with statements of ergonomic experts. All statements can be founded by following the test events.

4. CONCLUSION

For mobility in their homes it is especially necessary for elderly people to be satisfied with their home. Thus, they need no further help and could live in their environment as long as possible.
This test is applicable for designers, producers and users. The ergonomic test is essential for optimising ergonomic design processes and applies to any product in and outside the home. The test is suitable for the evaluation of a ticket machine as well as for a dishwasher. It is reproducible in any state. This tool will contribute to the discussion of issues such as design for all and the involvement and participation of special user groups in the design of products.

5. REFERENCES


6. APPENDIX

Often users are overcharged with nearly 100 questions. So for a user of consumer products all questions a summed up in Figure 7.

Figure 7: Summed up questions for users of consumer products

| Question                                                                 | Yes | No | |
|-------------------------------------------------------------------------|-----|----| |
| Force and torque: I am able to interact with the device without high forces? |     |    | |
| Degree of action: I am able to interact with the device without unusual movement at any time? |     |    | |
| Precision: No high precision is demanded?                               |     |    | |
| Time: The device leaves enough time to work with it?                     |     |    | |
| Feedback: I understand the product in every situation?                   |     |    | |
| Pollution: The device could be handled under bad light conditions?       |     |    | |
| Safety: There is no risk for my health?                                  |     |    | |
| Posture: By using the product I feel relaxed?                            |     |    | |
| Evidence: Handling the product seems logical for me?                     |     |    | |
| Usability: Is any mistake handling impossible?                           |     |    | |
| Controls: Using the controls is easy for me?                             |     |    | |
| Displays: Reading and understanding the displays is easy, too?           |     |    | |

If 75% of the questions could be answered with “Yes” the only reason not to buy the product or not to accept using it is the price.
Part 2
Environment: accessibility and traffic safety
16.

SAFETY AND LIFE-QUALITY OF ELDERLY ROAD-USERS

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1. INTRODUCTION

Life-quality and health are main topics in the frame of this contribution. In this respect, talking about mobility of the elderly and its support needs consideration of some general basic preconditions:

Area 1
transportation (both private and public) has to satisfy the following needs of individuals:
- safety and security
- individual mobility
- equity (nobody wants to be a second class road user)
- comfort and aesthetics
- costs

Area 2
transport has to satisfy needs in respect to meso- and macro-level like distribution of goods

Objective safety has to be guaranteed as one of the important societal issues

2. CONTRADICTIONS/CONFLICTING INTERESTS

The fact that authorities focus mainly on problems of area two leads to the following conflicts between interests within and between individuals and groups:

The conflict between safety & fluidity is a well known contradiction

Contradiction 1: unequal consideration and satisfaction of needs
Reflecting the development of traffic (= car traffic) during the last decades it is obvious that needs of car drivers related to area 1 have been taken into consideration very well, esp. by car-industry and the lobby it belongs to. Other transportation modes did not get so much attention, and the elderly often choose, or have to choose, these other modes.

Contradiction 2: unequal distribution of disadvantages
Needs for safety of pedestrians and cyclists mostly are needs for being safe from car-traffic. These needs often are taken into consideration in a way which hinders unprotected to move freely and self-determined. So the elderly
not only may choose whether they want to feel unsafe or uncomfortable by being "protected" by barriers. Consequently, a big contradiction exists between the restrictions which are felt by those who produce the danger and the restrictions for those who feel endangered. 

Contradiction 3: safety measures reduce attractiveness of alternative mobility modes like walking or cycling  
As a result of these restrictions for those who are unprotected, car-transport often gains dynamic and speed. As a further result walking and cycling become more unattractive, while at the same time not becoming safer.

3. MOBILITY AND HEALTH

In many societies you hear voices which more or less call for reduction of mobility of the elderly viz. try to force people of a special age to give back their driving licences. This measure is meant as a solution to improve safety of the elderly and therefore support their health. But we doubt that this is compatible to the definition of health as it is done by the WHO.

3.1 Health - Definition of the WHO

According to the definition of WHO (Ottawa Charta), health implies the possibility of leading a self-determined life. The support from society should be provided in order to enable people to strengthen their own health. Health includes physical, psychological and social well-being. To gain this, individuals as well as groups have to be able to satisfy their needs, to recognise their wishes and hopes and to make them come true. This includes being able to cope with environment and to modify it.

In many countries traffic-safety measurements are discussed which focus on restriction for senior drivers like forcing them to undergo psychological testing. It seems to be unacceptable to ask for this only because a person has reached a special age. Not only would this lead to a restriction of mobility of a special group of people. It does not even lead to the wished-for effect namely of better traffic safety: according to accident statistics elderly people are endangered much more as pedestrians than as car drivers.

If one wants to improve the situation of elderly people not only in respect to safety but also to mobility, this according to the definition of health of the WHO needs a lot of considerations.

3.2 How to support the Mobility of the Elderly

A healthy life according to the definition of the WHO should reflect following aspects:

self-determination (e.g. elderly should be supported to keep on being mobile without the help of society, like going to the doctors or visit their friends)

physical wellness: this encloses freedom from injuries as well as freedom
from exhausting situations. For instance, walking lanes for pedestrians, or crossings have to be "consumer-friendly" (e.g., no difficult fly-overs, etc.)

**Typical accidents and accident sites of car-drivers**
However, we know that freedom from injuries is not exactly given for the elderly. Many accidents are registered under the following circumstances:

- at crossings
- crossing against red
- parking or reversing
- turning left against on-coming traffic
- driving behind one another

**Typical accident-causes of pedestrians**
- system related
  - too short green-times for crossing
  - too high vehicle speeds
- individual related
  - uncertain behaviour before crossing the street (hesitating, difficulties with speed assessment)
  - focusing the traffic light but not on the traffic itself
  - relying on the proper behaviour of the others without further safety measures

**Social and psychological wellness:** for a social being it is necessary to keep social contacts. The traffic climate often makes it difficult especially for the elderly to keep these contacts because of uncomfortable feelings of being pressed and frightened under special conditions. Elderly car drivers talk about these conditions as follows (Risser et al. 1988):
- on the street one chases you, you cannot drive slowly
- you cannot keep distance because as soon as there is a little space another car driver takes it
- I am often overtaken because I am driving slowly

Pedestrians suffer from traffic because of the following conditions
- high vehicle speeds
- too short green-light phases
- high pavements
- uneven or not well cleaned pavements under bad weather conditions
- problems when reading traffic information (e.g., at bus or tram-stops) (Stähl 1991, bfu 1992, Chaloupka et al. 1993)

**Ability to cope with and to modify environment:** in this respect only few activities exist of the kind that the elderly are asked and taken into consideration when environment is to be changed, e.g., when new residence areas are created. Car industry has designed some high-tech equipment, like navigation-systems or different kinds of car display. But for pedestrians, cyclists and users of public transport.
4. SOME POSSIBLE MEASURES TO SOLVE PROBLEMS

To solve mobility problems of the elderly, improve their life-quality and change the above discussed contradictions it needs work on different levels. There already exist a lot of measures, although differently accepted and implemented till now.

4.1 Society measures

Norms and rules regarding traffic processes have to be more adjusted to the contradictions which means that needs of road users who do not drive a car in general have to be taken into consideration much more, safety and attractiveness of transportation-modes which are not bound to car traffic should be combined better car drivers should provide more activities for non-car drivers in order „to be safe from cars“

4.2 Measures with respect to infrastructure and enforcement

In this respect three main starting point can be focused on:
- vehicle-speed reduction
  - re-dimensioning of roads (making them smaller, optical changes like different colours, to make orientation easier)
  - mobile speed control
  - rumble-stripes, humps
- improvement of user friendliness of traffic sites, especially for pedestrians
  - broader pavements
  - better separation of pedestrians and cyclists
  - better organisation and control of parking
- improvement of user friendliness of public means
  - design of public means and stations
  - information policies
  - frequencies
  - better intermodal accessibility
  - affordance improvement

4.3 Measures with respect to cars

During the last years car and supplier industries have been very creative in this respect. In the frame of telematic systems there seems to be a lot of possibilities to improve comfort and safety of elderly car drivers
- telematic-systems like:
Part 2: Environment: accessibility and traffic safety

- speed-limiters
- AICC (Autonomous Intelligent Cruise Control = Speed and distance Control)
- route and traffic information
- handling aids (for steering, braking, windows, changing of seats position, etc.)

4.4 Measures with respect to communication

All these measures have to be advertised in public mostly to gain acceptance and understanding for their sense. Before starting a campaign it is very important to know which arguments are accepted and which are not. Therefore it is necessary to make sure that one knows as much as possible about the target groups who have to be addressed and to be sure about the behaviour or the behaviour changes, one wants to achieve.

In the frame of campaigns the following table could be helpful to assist campaign-leaders in reflecting different needs and according to this contents of the communication measures.
Overview 1: Contents of Communication Measures

<table>
<thead>
<tr>
<th>A) Who has to be addressed</th>
<th>B) Target</th>
<th>C) Which contents should be discussed</th>
<th>D) Which behaviour should be addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Car drivers in general</td>
<td>elderly car drivers</td>
<td>one has to be able to recognise them, one has to know their potential errors or &quot;unusual&quot; behaviour (e.g., slow driving, problems at crossings), one has to accept this and be aware of this</td>
<td>adapt behaviour to potential problems, pay regard to the elderly, be patient, the transport system has to be &quot;forgiving&quot;</td>
</tr>
<tr>
<td>b) Car drivers in general</td>
<td>elderly pedestrians</td>
<td>crossings (elderly start moving at the wrong moment, they need more time, etc.)</td>
<td>adapt to different kinds of behaviour</td>
</tr>
<tr>
<td>c) Cyclists</td>
<td>elderly pedestrians</td>
<td>elderly pedestrians are afraid of cyclists: therefore cyclists should not pass the elderly too close, should ring the bell from a longer distance;</td>
<td>adapt behaviour; do not drive on pavements, avoid pedestrian paths etc.</td>
</tr>
<tr>
<td>d) Elderly car drivers</td>
<td>they have to be enabled to take part in traffic in a safe way</td>
<td>driving schools, especially driver-improvement courses for the elderly</td>
<td>they should undergo special training and/or accomplish driving hours</td>
</tr>
<tr>
<td>e) Elderly car drivers</td>
<td>they should voluntarily change to other transportation modes</td>
<td>information about special offers, possibilities, advantages;</td>
<td>they have to be motivated to change to other transportation modes</td>
</tr>
<tr>
<td>f) Elderly pedestrians</td>
<td>walking should be easy for them</td>
<td>tips &amp; tricks</td>
<td>e.g., traffic lights (just walk on smoothly when the light goes to red)</td>
</tr>
</tbody>
</table>

5. CONCLUSION

Reflecting all these aspects leads to one main conclusion: Although the elderly are especially focused on, it seems obvious that all these measures can also improve life quality and safety of all other road users. It seems to be necessary that all activities for supporting acceptance of the above discussed measures have to underline this aspect. If this is possible, it will be much easier to find a lobby for the needs of "unprotected" road users, especially the senior citizens.
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17.

ELDERLY DRIVERS - DEFICIENT AND RISKY OR EXPERIENCED AND SAFE?

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1. ACCIDENTS AND RISKS OF ELDERLY DRIVERS

The demographic development in Germany as well as in most other industrialised countries clearly shows a shifting of the age-structure of the population. While in Germany in 1991 every fifth citizen was over 60 years old, it will be every third human being in the year 2030. As a consequence there will be incisive social changes which some people describe as a "soundless revolution": Changes concerning the physical and social infrastructure, the social insurance systems, the consume behaviour, changes on the housing market, of the leisure time behaviour and changes of the mobility and traffic behaviour as well.

In 1950 there were only 0.5 million private cars in West Germany. Until 1990 this number increased to ca. 30 million. While 1.7 million people owned a driver's licence in 1952, this number had increased to ca. 33.9 million in 1986 (Hartenstein et al., 1990). In one generation holding a driver's licence and owning a car has become a matter of course, and this has had a substantial effect on everyday life.

As traffic participants elderly people are going to play a much bigger role in future than they did in the past. First of all this concerns their presence as car drivers. Here the ageing process of the society as a whole is superimposed through an even faster increase of elderly persons who possess a driving licence and who are active drivers: The ageing society will be - even more than today - a society on wheels at the same time. Many of the people now growing older did drive for all their life and they are not willing to give up this matter of course in old age. They got habitualized to the car and, moreover, they organised their live in a way that makes them more or less (at least in their subjective understanding) dependent on their car. Mobility chances are seen as a decisive precondition for the participation in social life and of a satisfying process of growing old.

At present there is an increasing population of ageing persons for whom driving has always been a part of their lives. In West Germany, according to estimates of Hartenstein et al. (1990) as well as Schlag (1986), the number of driver's license holders at the age of 60 and more is increasing from 4.1 million in 1985 to 8.9 million in 2000. In East Germany, these tendencies are developing even more dramatically. In 1982 not more than 5% of all pensioners in East Germany had access to a motor vehicle; three quarters of
those had a car (the others a moped, e.g.; Coers and Ackermann, 1988). Considering that one of the predominant demands during the movement for liberty in 1989 was the call for "Reisefreiheit" (freedom to travel), one can imagine how great the desire is for mobility in all age groups. Thus a very great increase in the amount of driving (and in the first years after reunification of accidents too) has already been registered since the year 1990 in East Germany.

Until now, in Germany, elderly persons have not been over-proportional involved in traffic accidents. But when they had gone through an accident, the aftermaths are often extremely bad. In Germany in 1997, 1350 persons aged 65 years and older have been killed in road traffic, further 31478 have been injured. Among these deads around 40% have been pedestrians, again ca. 40% car drivers and ca. 20% bicycle riders. Among the injured, especially the minor injured persons, the part of the car drivers and passengers predominates.

The prognosis mentioned above gives reason to anticipate considerable effects on traffic development and, perhaps, great traffic safety problems, if elderly drivers really are a source of increased danger. But it is precisely this point, which is still under discussion.

Contradictory results, however, are often caused by the use of different statistical reference parameters. The following tendencies concerning the frequency of accidents among elderly drivers can be pointed out at the present time:

(a) The absolute number of elderly private-car drivers involved or injured in traffic accidents has been comparatively low until now.

(b) The risk of being injured or killed in case of being involved in a traffic accident rises with increasing age.

(c) Elderly drivers involved in traffic accidents are more often classified by the police as being at fault for the accident.

(d) If the number of elderly drivers involved in traffic accidents is considered in relation to the number of people in their age group, elderly drivers are not involved more frequently in traffic accidents than middle-aged.

(e) If the number of people in the respective age group holding a driver's licence or owning a car is chosen as a reference, the view of the situation remains virtually unchanged: on the average elderly motorists drive less annually than other age groups, which accordingly reduces their exposure to danger.

(f) However, if the reduced amount of driving is taken into account and the actual exposure to danger is considered, either as distance or time parameter, this accident performance ratio (injured drivers per 1 million km driven) or accident time ratio (injured drivers per 1 million hours traffic participation) increases. This increase, which is still far below the accident
involvement of the youngest groups of drivers, is shown in Figure 1 on the basis of the KONTIV-investigations (Hautzinger and Tassaux, 1989) for West Germany. Internationally there are marked differences concerning the extent of this increase in risk with age, as well as the age when it is assumed to begin.

![Figure 1: Fatal injured drivers per 100 Mio km driven in West Germany (Hautzinger, Tassaux, 1989).](image)

If we relate the accident risk to exposure figures, it becomes clear that the accident risk for over 65 year old drivers is slightly rising and probably for over 75 year old drivers it is rising even more markedly. This clear rise in high age has been emphasised especially in US-American studies. Compared to Germany, in the U.S.A. we find a far higher part of active elderly drivers in the present population: There the broad motorization of the whole population began just a generation in advance.

Results concerning the kind of accidents typically caused by different driver age groups are more consistent: "Typical" for elderly drivers are accidents at intersections and junctions - three quarters of the accidents caused by elderly drivers occur there - due to failures to yield right of way or other mistakes when changing direction. Preusser et al. (1998) calculated the risk of fatal crash involvement for older drivers in the U.S.A. relative to drivers aged 40-49. Drivers aged 65-69 were 2.26 times and drivers aged 85 and more were 10.62 times more at risk for multiple-vehicle involvements at intersections. In all other situations the 65-69 year old have been 1.29 times and the 85 + old 3.74 times more at risk compared to the 40-49 year old drivers.

The accident risk and - above all - the risk of fatal injuries for elderly pedestrians are clearly rising already from the 65th year on.
2. PSYCHOPHYSICAL CHANGES IN OLDER AGES RELEVANT TO DRIVING

Ontogenetic development as a lifelong process does not mean a steady loss of capabilities. Development is generally characterised by both, gain and loss. Its course is not only different for different people; differences also exist for one person between various scopes of behaviour, often even within the same category of behaviour in different contexts. This shows that development is not a linear, solely biologically determined process, which might be deduced directly from the chronological age (see, among others, Maddox, 1987).

But today, Gerontology sometimes seems to be a "happy science": Gerontologists in Europe often seem to deal with people whose problems are rather small compared to others, they share a positive image of old age and sometimes tend to deny problems - nevertheless asking, on the other hand, for better support for the elderly. But, as stated the humanist Erasmus in Rotterdam some centuries ago: Who is praising old age, did not yet look him in the face.

For describing the problems of elderly road users in general and especially the situation of elderly car drivers, the analysis may be guided by an information processing model of relevant aspects of the driving task, spreading between perception and reaction (Figure 2; Schlag, 1993; Panek et al., 1977).

![Figure 2: Problems of elderly drivers in perception and reaction (Schlag, 1993).](image-url)
Five major problems may be pointed out:

1. For the traffic participation of elderly people first of all changes of their psychophysical abilities are important for their achievement. It is understandable that the deterioration of vision abilities with rising age has an unfavourable influence on the road use. Beginning already around the 40th year, the vision abilities during twilight and darkness get worse. Furtheron, the dynamic visual acuity which is very important during road use (seeing of moving objects during own movement), the accommodation ability (close / far away) and the adaptation of the eye (bright / dark and after glare) diminishes. But in vision tests mostly only the visual power at daylight (far and close) is measured. The deterioration of eyesight is often a creeping process becoming conscious only late - sometimes just after some conflict. This points out that a periodical screening of the vision (if possible with its different parameters) is very important, because at least a part of the eyesight can be compensated through glasses etc.

2. In general research results show decreases in the speed of performance with older age. This may affect the whole range from sensation to action and manifests itself in slowed perception and processing of the information yielded, an increased need for orientation and a prolonged amount of time needed for decision as well as more time required for the motor reaction. Insufficient opportunity to prepare themselves and actual unreadiness to react moreover can considerably retard the speed with which the elderly perform. This increase in the amount of time they need sometimes makes their actions appear hesitant and uncertain; it becomes even more of a problem when this is not tolerated in society.

3. A danger of overstrain which increases with the complexity of the demands: weakness of memory and more significantly a reduction in alertness and in the ability to adapt, as well as a tendency to tire more quickly may be of great consequence here. Multiple demands to meet at the same time are characteristic in road traffic. As well the problems to react fast on changing situations grow in older ages.

4. A diminished ability to deal with new situations and new problems: This applies especially if they are complex and there is little time to solve them. Similar problems may also arise on occasions when elderly people are required to execute tasks with which they have not had to deal for an extended period. If there is continuous training, the problems become less. Already Cicero said in his script „de senectute“, that old people do hold a high degree of (mental) competence - under the condition that the functions, which are basic for such a competence, have been in use the whole life through.

5. Problematic effects on the social interactions in road traffic are often due to the marked discrepancy between the image of older people in society and the self-assessment of the same elderly. The social age stereotype, and especially the stereotype towards elderly drivers, is far more unfavourable than the self-image and the self-esteem of the elderly. While in the society elderly drivers often are assessed a very negative image, the elderly drivers
sometimes think very positive of themselves, their abilities and fitness (Schlag, 1986). Perhaps just because of the negative social stereotypes on older ages they don’t admit themselves that some relevant functions are worsening. This may cause too late interventions and perhaps too late adaptations so that things are going from bad to worse. And the differing sights may cause problematic interactions between the generations on the road as well.

Besides the described developments in the normal ageing process it should not be forgotten that with growing age diseases occur more often and the use of medicaments increases, which has an important impact on the performance and efficiency of the elderly concerned.

3. RESULTS OF LABORATORY AND DRIVING TESTS WITH ELDERLY

The central topic of our study are driving tests with 80 elderly drivers (60 - 82 years old), compared with a reference group of 30 middle-aged motorists (40 - 50 years), and their relation to laboratory performance data and interviews.

3.1 Main results of laboratory tests

Performance differences between the age groups were substantial in laboratory tests, especially those concerning vision and reaction speed. Significant differences were found mainly:

(a) in the visual acuity by daylight, far and close (measured by the Tytmus-Vision-Tester), even when assisted by optical aids;

(b) in the visual acuity at twilight and in the dark, with and without glare (measured by the Rodenstock-Nyktometer);

(c) in a discrepancy, steadily increasing with age, between objective and (upon questioning) subjective assessment of visual performance;

(d) in the number of omissions in a traffic-related tachistoscopic test of perceptive faculty (TAVT-N), especially in failure to notice two-wheeled vehicles and traffic signs: Possibly the reduced visual acuity of elderly people has an additional influence on the perception of details in complex traffic situations in such a perception test;

(e) in an increase in the amount of time needed, but only seldom in a reduction in the standard of performance in experimental situations comprising error- and time-variables, in the present case in a tracking experiment and tests with the "Wiener Determinations-Gerät" (WDGT). In the latter test fewer stimuli were correctly dealt with by the elderly, more stimuli were answered with delay and more were omitted, but the number of finally erroneous reactions did not increase.
Results such as these in laboratory tests are generally considered relevant to driving performance. Thus, the prognosis for elderly drivers on the whole, based on these findings, would be relatively discouraging. This point is all the more valid as the results of the interviews show that the elderly persons’ perception of these changes is limited. On the contrary, most of them attributed themselves with a psychophysical capacity virtually equal to that of middle-aged persons. A comparative test of the actual driving performance of elderly motorists in real traffic situations, however, had not yet been carried out in Germany before.

3.2 Essential results of driving tests

With a grant from the Federal Highway Research Institute we could test in a differentiated manner the hypothesis that elderly motorists compare unfavourably with middle-aged in their driving behaviour and that this is essentially due to deficiencies in the psychophysical domains of perception and reaction (cf. Ellinghaus, Schlag, Steinbrecher, 1990).

With a test car of the Federal Highway Research Institute (compare Kockelke, 1980) we carried out a ca. 1 h driving test on a standard route of 35 km in the Cologne area with the above-mentioned 110 test persons, 40 between 60 and 64 years, another 40 in the over-65 age-group (up to 82 years) and, for comparison, 30 in the 40-50 age-group. The course included motorways, country roads and above all city traffic with a total of 38 differently regulated junction situations, comprising various degrees of complexity.

With the aid of two colour video cameras on the car-roof the traffic situation (forward and backward) was recorded. The following parameters were automatically registered on tape, so as to be synchronous to the video-recording: Absolute time, distance, car velocity, brake operations, position of gas pedal and angle of steering wheel. In addition to this, comments and conversations were recorded by means of a microphone in the car’s interior. Driving data, visual and auditory information were thus available in synchronised form on videotape. A number of further parameters were derived from the combination of objective data and visual recordings. These were mainly: Beginning and course of speed reduction and acceleration, especially at junctions, spacing to the front, to the back and to both sides on different roads, gap acceptance at junctions, homogeneity of speed, keeping track on the road, in bends and in turning right and left, dealing with other road-users. In this way an objective representation - as objective as possible - of the driving behaviour in a multitude of different traffic situations was obtained. This allowed manifold calculations at a predominantly high data level.

These automatically registered driving parameters were supplemented by standardised observations on the part of the persons who conducted the test. A special observation sheet related to this particular route was developed for this purpose. It was designed to immediately focus on offences and conflicts at the different junctions and various sections of the
course during the test, and thereby complement the continuously recorded objective driving parameters.

For evaluation of the data we used uni- and multivariate statistics, first of all for comparisons between the age groups (chronological age). Subsequently the relationships between driving behaviour parameters and indices of the "biological age", obtained operationally by the laboratory performance parameters (vision, perception and reaction tests), were considered more closely.

The results of the laboratory tests (if they can be credited with high prognostic validity) gave rise to the assumption that the driving behaviour differs markedly between the age groups tested. This hypothesis is checked here by comparing the 40-50 age group, the 60-69 age group and the test participants aged 70 years and older.

Actually, however, the differences in the concrete driving behaviour between the age groups were small in the overwhelming majority of driving situations. This is true when the groups are compared on the basis of the chronological age; but this is also the case when the different laboratory performances of the age groups were examined in relation to driving parameters.

In individual situations, however, and then for specific behaviour parameters, we obtained several interesting differences between elderly and middle-aged drivers.

The elderly drivers tended to drive more slowly on motorways in traffic of comparable density, and some elderly drivers had difficulties (more often than younger drivers) getting into lane at complex motorway entrances. Elderly drivers often tried to enter the lane hesitantly, attempts were interrupted, and the result was sometimes very late and hence risky merging into the traffic-flow (Figure 3).
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Figure 3: Increase in speed when getting into lane at a motorway entrance (Ellinghaus, Schlag, Steinbrecher, 1990).

On country roads the elderly motorists on the average displayed a particularly uniform driving style with fewer accelerations and braking actions and with a tendency to drive more moderately.

City traffic normally allows less room for exhibiting individual driving behaviour. Hence few but rather critical differences between the age groups were observed in the inner-city sections. There was a markedly higher incidence of incorrect action among elderly motorists above all in 2 situations at junctions (Table 1):

(a) At junctions regulated by traffic lights the elderly drivers (even though the number of driving tests was relatively low) ignored "red" lights more often, whereas driving through "yellow" lights was observed less frequently among the elderly.

(b) Furthermore they disregarded significantly more often the right-before-left priority, and, similarly, more often failed to reduce speed adequately at road-level railway crossings.

Insecure behaviour at junctions occurred increasingly from the age of 65 onwards. But on the whole, the elderly drivers showed a tendency to approach junctions more slowly; they had in most cases reduced speed earlier and thus slowed down more "smoothly".
Table 1: Problematic behaviour of elderly drivers at junctions

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>40-50y</th>
<th>60-69y</th>
<th>70y+</th>
<th>Sign. p (\ldots)% (VA resp. (x^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic line overrun x</td>
<td>2,8</td>
<td>2,8</td>
<td>2,8</td>
<td>2,9</td>
<td>n.s. (df = 16)</td>
</tr>
<tr>
<td>observed at least once %</td>
<td>86,4</td>
<td>80,0</td>
<td>88,5</td>
<td>89,5</td>
<td></td>
</tr>
<tr>
<td>Traffic light: Red overrun x</td>
<td>0,1</td>
<td>0,0</td>
<td>0,0</td>
<td>0,2</td>
<td>5% (df = 4)</td>
</tr>
<tr>
<td>observed at least once %</td>
<td>5,4</td>
<td>0,0</td>
<td>0,0</td>
<td>21,1</td>
<td></td>
</tr>
<tr>
<td>Traffic light: Yellow overrun x</td>
<td>1,0</td>
<td>1,5</td>
<td>0,9</td>
<td>0,7</td>
<td>1% (df = 10)</td>
</tr>
<tr>
<td>observed at least once %</td>
<td>64,5</td>
<td>90,0</td>
<td>55,7</td>
<td>52,6</td>
<td></td>
</tr>
<tr>
<td>STOP: Not stopped x</td>
<td>0,3</td>
<td>0,2</td>
<td>0,4</td>
<td>0,5</td>
<td>n.s. (df = 4)</td>
</tr>
<tr>
<td>observed at least once %</td>
<td>29,1</td>
<td>16,7</td>
<td>32,8</td>
<td>36,8</td>
<td></td>
</tr>
<tr>
<td>Right-before-left disregarded x</td>
<td>0,5</td>
<td>0,1</td>
<td>0,5</td>
<td>0,7</td>
<td>1% (df = 4)</td>
</tr>
<tr>
<td>observed at least once %</td>
<td>39,1</td>
<td>13,3</td>
<td>45,9</td>
<td>57,9</td>
<td></td>
</tr>
</tbody>
</table>

If one compares the vast number of similarities in driving behaviour between elderly and middle-aged motorists with these individual differences (which in some cases increased the safety of the elderly drivers but which were in others extremely dangerous), one must conclude that the similarities far outweigh the differences. Far more dramatic differences have been reported in driving studies comparing young beginners with a middle-aged reference group (Schlag et al., 1986).

Factor analyses of the driving data led to a 4-factorial solution, the interpretation of which, however, in some aspects suggests an age-related driving typology, too. The first and statistically most important factor is a velocity factor. Higher driving speed (maximum and average speeds on the different sections of the course and speed of approach to junctions), faster acceleration, more overtaking manoeuvres and the acceptance of smaller time gaps especially for turning left are closely correlated with low age and certainly do not contribute to greater driving safety. The second factor is also closely related to age, but in the reverse direction. It characterises part of the behaviour of elderly drivers. Above all, inadequate reactions at critical places (ungated railway crossings, right-before-left priority) the regulation of which seems rather indistinct, and sometimes even failure to react at all, characterise this sub-group of elderly drivers. Factor 3 describes a dynamically changing driving style (rapid acceleration in different situations, markedly varying use of the gas pedal, sometimes sharp braking before junctions, etc.) which could be found in all age groups. Factor 4 is again typical for a part of the higher age groups. It concerns the behaviour on winding country roads where the elderly, whenever possible, tried to drive with greater distance between themselves and the vehicle in front of them, thus increasing their safety.

Furthermore the relationships between chronological age, laboratory performance data and parameters of driving behaviour measured on the road were investigated by means of variance- and covariance-analyses and
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multiple regression analyses (path-analyses). In the analyses of covariance, for instance, the explanation value of age and sex, and of five test results (long-range vision and twilight vision without glare, omission errors in the tachistoscopic perception test, time needed in the tracking experiment and the main result in the "Wiener Determinations-Gerät") was examined individually as well as jointly for the different driving parameters. Chronological age then proved a relatively decisive factor in some cases of inadequate driving, especially in relation to speed (elderly drivers tending towards lower speeds) and reactions at difficult junctions (less satisfactory among the elderly), when the statistical influence of test performance data pertaining to age was not especially filtered out. The chronological age thus represents a complex aggregation of influential parameters which, however, combine to yield a certain predictive value for the aspects of driving behaviour mentioned.

A factor exercising influence to a similar degree is that of the sex of the test person. This manifested itself mainly as a tendency of women to drive more slowly (maximum and average speeds and speed of approach), to accelerate more smoothly and to overtake less often. This applied to all age groups and was independent of the various results in the laboratory tests. Looking at the joint influences of age and sex some relationships become apparent: namely that comparatively younger men are generally the fastest and elderly women the slowest drivers.

Even though the differences between middle-aged and elderly drivers in real traffic situations turned out to be much less obvious than to be expected, for instance, on the basis of the performance tests, these very results correspond to the expectations and estimations of the elderly drivers themselves: they do not regard themselves as highly different from middle-aged drivers, and as far as they realise changes with ageing they mostly consider them irrelevant to their own driving safety.

How can it be explained that elderly drivers perform worse in the laboratory while in most cases their driving behaviour compares not unfavourably with that of middle-aged motorists? There are mainly three considerations:

1. Firstly, one has to note that statistical comparisons have a levelling effect: Even if, for example, the behaviour of the least capable 5% - 10% of elderly motorists tested had often been conspicuous, this would still only have become statistically relevant in extreme situations. Precisely this was the case with the "red light" drivers, the ignoring of right-before-left priority and inadequate reactions at railway crossings.

2. It is also possible that the measurement of psychophysical performance exposes differences in its field more sharply than driving tests in road traffic are able to. The elderly usually meets average driving demands with as much skill as by middle-aged motorists. Moreover, unsatisfactory psychophysical fitness as measured in the laboratory perhaps only has unpleasant consequences in extreme situations in real traffic. This leads to methodological difficulties: A strategy of "testing the limits", intended to
Elderly drivers – deficient and risky or experienced and safe?

assess the potential flexibility of behaviour must be confined to the lab; it is out of the question for driving tests.

Perhaps it is also true that the capacities measured in the laboratory are less relevant to normal driving demands and in most cases may be compensated by adequate ability to adapt. This is indicated by additional factor analyses combining laboratory with driving data. By markedly reducing the complexity of the data, the result was that on the one side the laboratory data, and on the other side the driving data constituted certain factors, but their interdependence remained low.

4. CONDUCIVE MANNERS TO HANDLE AGE-RELATED CHANGES

A lot of elderly people are to a high extent able to handle changes and losses in a successful way - of course under the precondition that they are aware of the biological, sometimes unfavourable changes related with ageing and that they do not palliate them.

Above all gerontological research emphasises on three adaptation strategies, which can decisively contribute to a good life in old age under changing personal, social and situative conditions:

Selection - optimising - compensation.

Just compensation is underscored as the main factor for a good practise despite of reduced basic abilities in road traffic, but both the others are worth mentioning too. And we should bear in mind that real adaptation enables the person to reach continuing aims on other ways - not to give up the aims (which could rather be called resignation).

The three ways mentioned above to handle changes in growing old are described best by an example, which is taken from Baltes and Carstensen (1996):

The 80-year-old pianist Arthur Rubinstein once was asked in a TV-interview, how he managed to stay such an amazing pianist over all these years. Rubinstein answered that he was trying to master the weakening of his abilities in his age first of all by reducing his repertoire - playing less pieces of music (selection), secondly he was practising these pieces more often (optimising), and thirdly he was using some tricks - for example before extremely fast parts he would slow down the tempo, so that there would arise an impression of a following faster play (compensation). These three strategies offer essential chances for successful ageing.

Regarding their mobility elderly people partly choose these strategies. They select times, places and circumstances for their road use - for instance they do not drive during peak hours or under unfavourable weather conditions. Some of them especially stress on optimising their possibilities and ways of acting - for example by choosing specific car equipment which support
comfort and safety, or by participating in offered programmes for elderly drivers or for elderly people as pedestrians - optimising this way some physical preconditions as well as their own performance. Many elderly people are also familiar with compensation strategies. Under normal conditions elderly drivers do not show more problems than middle-age groups, but on the thresholds, when reaching the limits, difficulties grow and at the same time may get more important. Compensation however requires a self-critical assessment: I only can compensate consciously for what I confess (at least to myself) as a problem.

But we did found, too, that a marked part of the elderly showed a rather uncritical self-assessment in relation to their abilities and fitness when it came to discussions about driving. Elderly drivers tended to neglect changes in their own fitness or failed to regard them as relevant to their driving behaviour. Just the denial of differences between elderly and middle-aged drivers might be of interest if it indicates a discrepancy between subjectively perceived ability and the actual capacities of elderly people. Thus, a major concern is whether older persons will voluntarily modify or restrict their driving (Sterns and Camp, 1998).

One factor commonly cited in favour of elderly drivers is their experience. The importance of this factor to the behaviour of the elderly drivers, however, is also not confirmed by our studies. High driving experience should result in an increased ability to anticipate the development of possibly dangerous situations at an early stage from a few slight cues and consequently to react in an adequate way without further delay. Through practice the behaviour in these familiar situations will typically be optimised and thus become increasingly more constant, more exact and more rapidly executed. In a complex sequence of actions, such as those involved in driving, the actions then seem to fuse, they must no longer be controlled individually, they are executed more naturally and with less effort, they come to be "automatic". But these positive effects of increased experience apply to elderly drivers only to a limited degree. On the contrary, elderly drivers require more information before they decide, and they need more time for their decisions. This is especially true under conditions of insecurity and complexity. They are more cautious in preparing their actions, perhaps to compensate for actual or assumed negative developments in perception and information processing. They seem to want to control their actions consciously during driving ("monitoring"), and it is precisely this what interferes with the flexible attentiveness necessary in the preparation of subsequent actions. On the other hand such an increased control may improve the possibility of rectifying errors, provided that enough time is available.

Nevertheless elderly drivers do compensate for their possibly reduced fitness in perception and reaction. These compensatory changes, however, become manifest solely secondarily in the driving style. Primarily they are apparent in an altered way of traffic participation. Complementary interviews showed that elderly drivers increasingly avoid difficult times of day, high traffic density, driving at twilight and in darkness, in general; under especially stressful conditions. Furthermore they avoid bad weather conditions whenever this is
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possible, and they simply drive less on the whole. Hence they reduce their exposure to danger. They themselves alleged that they no longer felt forced to drive at any time and under any conditions. They are in a position to avoid stressful situations, and they prefer to do so. The elderly drivers themselves do not want this fact to be understood as an admission of a deficiency on their part; they merely profit from the possibility, for example in pension age, to spend their time more independently.

Maybe that the situation of elderly drivers might develop less favourably than is suggested by the results reported above when in future not only a group of socially privileged people in comparatively good health drive at old age. The absolute number of accidents involving elderly drivers will rise in future in most countries of the EU; the relative risk for the individual elderly driver could rise especially if their expressed wish to continue active driving in old age combines with an uncritical attitude toward their personal fitness.

5. IMPROVEMENTS IN FAVOUR OF ELDERLY

As tentative conclusions may be summarised:

1. Elderly drivers do not drive as bad as some may fear - and they do not drive as well as some seem to hope. In most instances they drive rather "normal" - but normal too is that ageing brings along some changes relevant to driving.

2. Not all the elderly choose conducive manners to handle changes in older ages. Thus, a part of elderly drivers may become a traffic safety problem in the future.

3. Tests usually applied in traffic psychology for measuring basic driving requirements do not allow for a sufficient valid prognosis of driving performance of the elderly. Thus the possibly problematic part of elderly drivers is hardly to select. Nevertheless one can discuss whether the duty to undergo some screening test in older age, as is required in most European countries, will give an opportunity to a critical self-assessment (and maybe self-selection).

4. This underscores the necessity to look for adaptations of the traffic environment as a whole to the needs, demands, and skills of the elderly.

Thus, if we think of improvements in favour of elderly road users, which shall ensure their mobility and increase their safety, we should not only look at the elderly themselves, but also at their environment and at the other road users.

In general, we can distinguish five approaches, which basically contribute to an improvement of the mobility chances as well as of the safety of elderly road users. The most favourable effects can be reached if we connect these approaches to a bundle of measures:
1. Adaptation of the **roads and the traffic environment** to the needs, demands and skills of elderly pedestrians, bicycle riders and car drivers.

2. Reorganisation and extension of **public transport** that preserves mobility chances especially for elderly people (see e.g. Schlag et al., 1996).

3. Adaptation of traffic **regulations and speed** to the possibilities of elderly persons.

4. Educational work and **support** for elderly people in their different traffic participant roles to keep their safety and mobility (in Germany for example programmes of the German Traffic Safety Council: „Elderly people as pedestrians“ and „Elderly active car drivers“).

5. Informing and gaining of **the other road users** about needs and problems of elderly people to organise more favourable interactions in road traffic.

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18.

SOME ASPECTS OF THE SAFETY OF ELDERLY PEDESTRIANS AND CYCLISTS

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1. INTRODUCTION

The numbers of elderly people are increasing world-wide. Also, the mobility of the elderly people increases and the elderly generation of the coming years will spend much more time and distance in traffic than the present elderly generation; as car drivers, but also as pedestrians and/or cyclists. Pedestrians and cyclists are among the most vulnerable road users, in the sense that they are both most at risk in traffic and generate little risk to other road users. Among vulnerable road users, some are more vulnerable than others are, in particular are the elderly, the disabled, and children.

In this paper some aspects of the safety of elderly pedestrians and cyclists will be addressed. First, fatality data concerning older pedestrians and cyclists will be presented for a number of countries. Then, attention will be paid to fatality rates per 100,000 inhabitants, and the risks of elderly pedestrians and cyclists to become a victim in a road accident relative to kilometres travelled. Furthermore, a number of underlying factors that may have contributed to the involvement of elderly pedestrians and cyclists in accidents, and to the accident severity will be discussed. Finally, some (strategies for) countermeasures to increase the safety of elderly pedestrians and cyclists will be presented. The paper concludes with raising the issue why, despite the amount of available knowledge on the safety of the elderly road users, so few intervention programmes have actually been implemented. In this paper, I will use some of the work of a scientific expert group of the OECD which has recently finalised a report on the topic of the safety of vulnerable road users (OECD, 1998); in addition some other (Dutch) research findings will be used.

2. THE SAFETY OF ELDERLY PEDESTRIANS AND CYCLISTS: AN OVERVIEW

In this section, international data provided by the IRTAD database are used to illustrate the safety of elderly pedestrians and cyclists. The data of the following countries is used: Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, United Kingdom, and the USA.
2.1 Fatalities

In Figure 1 the composition of fatalities by age group for pedestrians and cyclists in a number of countries is shown (1992 data). It appears that for most countries the elderly pedestrians of 65 years and older make up the largest share of all pedestrian fatalities. This share is greatest in Switzerland, where pedestrian fatalities among people from 65 and older have a share of 64%, followed by Japan (50%); in Germany, UK, Spain, the Netherlands, Sweden, Denmark and Finland their share is around 40-45%. In the USA the share of elderly pedestrians is relatively small, 23%.

When fatalities among bicyclists are considered, it appears that there is more variability between countries in the size of the shares of elderly cyclists. In general, though, the share of elderly (65+) cyclists is generally somewhat smaller as compared to the pedestrian fatalities. However, the fatalities among bicyclists of 65 years and older in Sweden make up the largest share (73%) of all age groups, and this share is larger than in all other countries. In Japan, the Netherlands, and Finland the share of cyclists aged 65 or older is of the same magnitude as their share among pedestrian fatalities (51, 44, and 42%, respectively). The share of fatalities among elderly cyclists in the USA, the UK, and Switzerland is relatively small (6, 15, and 20%, respectively) as compared to the fatalities in other age groups.

One could conclude from Figure 1 that in many countries the relative large shares of cyclist fatalities among those aged 65 or older indicates a safety problem of importance. However, one cannot conclude that a relative small share of these fatalities in some countries - such as, e.g. in the UK or Switzerland - indicates that cycling is relatively safe there for the elderly. (The same reasoning can be applied in the case of elderly pedestrians.) They can still be over represented in the fatality statistics relative to the number of persons in a particular age group, and/or the number of kilometres travelled. These two issues will be discussed in the next paragraphs.
2.2 Fatality rates per 100,000 inhabitants

Considering that about 13-16% of the population of the selected countries is 65 years or older, the percentage of older pedestrians killed is greater than their representation in the overall population in all countries; the same can be said for killed cyclists of 65 and over - although less pronounced (and not in the UK and the USA).

When the number of fatalities is viewed with respect to the number of people in the population for the various age groups, it appears that - although the absolute rates differ markedly between countries - the fatality rate for elderly pedestrians (65+) is two (USA) to eight (Switzerland) or almost nine (Denmark) times higher as compared to the figure for those aged 25-64. In most countries the fatality rates for elderly pedestrians are three to five times higher as compared to pedestrians aged 25-64 (e.g. Germany: 4.6; UK: 4.5; France: 3.1; Spain: 3.5; Netherlands: 3.8; Sweden: 4.6; Finland: 4.1; Japan: 5.1; see also Table 1).
Some aspects of the safety of elderly pedestrians and cyclists

Table 1. Fatality rates for pedestrians and cyclists per 100,000 inhabitants by age group and country in 1990 (Source: OECD, 1998).

<table>
<thead>
<tr>
<th></th>
<th>Pedestrians</th>
<th>Cyclists</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age-group</td>
<td>Denmark</td>
</tr>
<tr>
<td>25-64</td>
<td>0.97</td>
<td>1.52</td>
</tr>
<tr>
<td>65+</td>
<td>8.61</td>
<td>6.19</td>
</tr>
</tbody>
</table>

For elderly cyclists the fatality rates are considerably lower than for elderly pedestrians in most countries, except in Denmark, Finland, and the Netherlands where fatality rates for elderly cyclists are higher than for elderly pedestrians. The fatality rate for elderly cyclists (65+) is generally two or three (France, Spain, Switzerland, Denmark, Sweden) to four or five (Germany, the Netherlands, Japan) times higher as compared to the figure for those aged 25-64. In Finland the fatality rate of elderly cyclists is even more than seven times higher. In the UK and the USA the fatality rate for elderly cyclists is equal or even somewhat lower as compared to that of cyclists aged 25-64 (see also Table 1).

The data of Table 1 indicates even more strongly than the data presented in Figure 1 that elderly pedestrians and cyclists are generally over represented - based on the number of persons in that age group - in the fatality statistics of most countries. These fatality rates are, in most countries (except for Finland and the Netherlands), much higher for elderly pedestrians than for elderly cyclists. However, one can still not conclude from this data that it is, for instance, safer for an elderly person to ride a bicycle in, say the UK (fatality rate of 0.45), than in the Netherlands (6.09), because it is very well possible that people - including the elderly - cycle more in the latter country. Unfortunately, exposure data (number of person kilometres travelled) for pedestrians and cyclists are not available in the IRTAD database. Only in a limited number of countries this type of data is regularly collected (and even when collected this data is not always very reliable, and due to variation in the collection procedures it is not clear if the data of various countries are directly comparable).

2.3 Exposure and risk

For a few countries data have been obtained to indicate the average distances travelled by (elderly) pedestrians and cyclists. Figures 2 a-c show the average distances walked per person per day by age and sex in Denmark, the Netherlands and Great-Britain in 1992 (see OECD, 1998 for more examples). As becomes readily apparent from this figure, there are substantial variations between countries in walking patterns. In Denmark and the Netherlands elderly people walk most, whereas a gradual decrease in
distances walked is seen with increasing age in Great Britain. The distances walked per day vary between about 0.5 and 2 kilometres for all age groups and both sexes, except for middle-aged English men who do not (seem to) walk at all.

Figures 3a-c illustrate the distances cycled per person per day by age and sex. The Netherlands is the country where most kilometres are covered by bicycle (2-8 km/day/person), but Denmark as well covers a relatively high number of kilometres. In Great Britain less than 1 km is travelled by cycle per day per person. In all three countries the average distance travelled by bicycle decreases with age.

When the number of fatalities, the number of persons in a particular age group, and the kilometres travelled are combined, the fatality risk can be calculated relative to the amount of exposure. On the basis of these risk figures it can than be determined whether elderly pedestrians and cyclists are more at risk in certain countries as compared to others. As stated, due to a lack of comparable exposure data this exercise cannot be conducted. For illustrative purposes, these risks have been calculated for the situation in the Netherlands (see figure 4). As can be seen in this figure, per distance travelled, the elderly pedestrians and cyclists are much more at risk than any other age group.

In summary, fatality figures have been used to illustrate the (un)safety of elderly pedestrians and cyclists. (The same trends are present when victims who are injured are used, however less pronounced.) It appears that when involved in an accident, the outcome is more severe for elderly pedestrians and cyclists than for road users in other age groups. For example, in the Netherlands, of the pedestrians injured or killed approximately 18% (and of the cyclists 14%) were 65 or older. This is somewhat higher than their 13 percent representation in the overall population. However, adults 65 or older made up more than 50 percent of pedestrians killed (and 38% of the cyclists killed) in 1994 in the Netherlands. Thus, in the Netherlands the elderly are somewhat more likely than other pedestrians or cyclists to be involved in an (injury) accident, but once in an accident they are much more likely to be killed. Similar patterns exist in other countries, in particular for the elderly pedestrians (see OECD,
Some aspects of the safety of elderly pedestrians and cyclists

Figure 2 a-c. Distances walked per day per person by age and sex in Denmark, the Netherlands and Great Britain in 1992 (OECD, 1998).
Figure 3 a-c. Distances cycled per day per person by age and sex in Denmark, the Netherlands and Great Britain in 1992 (OECD, 1998).
When the distances travelled are taken into account, Dutch data show that walking is extremely risky for the elderly (as compared to other age groups); the risk figures for cycling are also much higher for the elderly.

![Figure 4. Fatality risks (per average billion 1992-1994 kilometres travelled) according to age group for cyclists and pedestrians in the Netherlands (Source SWOV/BIS-V/OVG/VOR).](image)

In order to be able to calculate and compare risk figures for various countries, exposure data concerning walking and cycling will be needed; such data are, at present, hardly available.

### 3. FACTORS CONTRIBUTING TO THE UNSAFETY OF ELDERLY PEDESTRIANS AND CYCLISTS

In the previous sections it was shown that elderly pedestrians are relatively over represented in the fatality statistics. However, before being able to design and implement (strategies for) countermeasures in order to increase the safety of elderly pedestrians and cyclists, one has to know which factors contribute to their unsafety. For example, in which types of traffic situations or road characteristics are elderly pedestrians and cyclists (over)involved? But also, which general characteristics of the elderly people themselves make them more vulnerable as pedestrians and cyclists than these types of road users of other age groups? These issues will be discussed in the next paragraphs.
3.1 Accident circumstances

Only a few recent studies have been found dealing with age-specific accident circumstances of the elderly bicyclists and pedestrians.

In the US a study was carried out (Zegeer et al., 1993) to create a better understanding of the causes and characteristics of motor vehicle crashes involving older pedestrians. The results showed that on a population basis, older pedestrians (65 or older) are slightly less likely than younger pedestrians to be struck by a motor vehicle; however this statistic does not take into account the amount of walking, accident location, and so forth. Once injured, older pedestrians have a much higher likelihood of being killed - 20 percent - compared to 5 to 10 percent for younger age groups. Pedestrians aged 65 or older were over-represented in crashes during daylight hours, on weekdays, and in winter. Zegeer et al. also found that older pedestrians are over-represented in intersection crashes (particularly involving turning vehicles) and in crashes involving wide street crossings. Similar findings have been reported in the Netherlands (SWOV, 1987). In addition, compared to other age groups, elderly cyclists are more often involved in accidents in the smaller municipalities (ibid.). A study conducted in Great Britain showed that most pedestrian accidents involving older people occurred in daylight, in fine weather, and in familiar surroundings (Grime, 1987; cited in Carthy et al., 1995).

Goldenbeid (1992) studied accidents of elderly bicyclists in the Netherlands. The study indicated that the passenger car is the principal collision partner in these cases. (Compared to other age groups, the proportion of collisions with cars, trucks and buses is about 25-40 percent higher for the elderly than for younger cyclists in the Netherlands; SWOV, 1987.) In many of these cases the cyclist has to cross a multi-lane road, which is an indication that it may be difficult to judge the situation, that cars may have high speeds, and that it may take much time to cross. It is also an indication of a high volume of cars on the main road, but the police reports did not mention high volumes at the time of the accident. Such incidents (63% of all accidents) occurred particularly inside the built-up area (50%), at intersections (19%) and at T-junctions (15%). Amongst accidents at intersections and T-junctions, most accidents occurred at T-junctions and intersections controlled by traffic signs (25%). The difficulties experienced by older cyclists at intersections and T-junctions controlled by signs related primarily to manoeuvres such as crossing the road or turning left at the intersection. Accidents hardly occurred as a result of right-hand turns at these intersections. With the majority of these accidents, the car was driving on a priority road while the cyclist approached from a side road.

Goldenbeid (1992) also reports that the manoeuvre of turning left not only poses problems at intersections and T-junctions for older cyclists, but also on straight roads. 4% of all accidents occurred when the older cyclist turned left on a straight road (to cross) inside the built-up area and was hit from behind by a car. It is worthwhile noting that with these accidents, the cyclist involved was always driving on the main road, never on a separate cycle path. About one fifth of all accidents were found to occur with other light traffic, viz. cycles.
and mopeds. With collisions between elderly cyclists and light traffic inside the built up area (15%), cyclists and moped riders were found to be involved in equal numbers as collision partner. Outside the built up area, other cyclists were more often the collision partners than moped riders. Accidents involving light traffic often occurred on straight roads (10% of all cases). These accidents often involved a cyclist on the main road who turns to the left, colliding with a car coming from behind. In the majority of cases, the car driver is noted to have seen the cyclist, but either found no indication of the intended left turn or assumed to cyclist would wait. The cyclist seems to rely on hearing to find out if there is a car coming from behind, because it is physically difficult to look to the rear. As a result, he/she makes a risky decision. The same type of accident is found on road sections inside built-up areas as well (see also, Noordzij, Hagenzieker & Goldenbeld, 1993).

Finally, those accidents involving heavy traffic (5% of all cases) are distinguished from the other accident categories because the other party less often saw the older cyclist. Often, the driver did not see the cyclist at all when overtaking, turning off or reversing. For this category of accidents, the erroneous expectation of the cyclist or the driver with respect to the behaviour of the other party was noted relatively more often than with the other accident categories.

### 3.2 Physical and psychological factors

As a consequence of ageing, perceptual, cognitive and motor skills deteriorate. For example, visual acuity, peripheral vision, and the so-called useful field of view decrease with age, and distance perception is impaired at low luminance levels. In traffic situations this could lead for instance to difficulty in estimating distance and speed. Furthermore, overall performance on two simultaneous tasks (divided attention) that require motor responses usually shows age-related decrements; and in selective attention tasks it is shown that older adults have more difficulty ignoring irrelevant information.

Complex situations, such as heavy traffic at high speed, are more likely to cause problems in the selection of information and in decision making. Decisions are less likely to be taken almost simultaneously and executed in parallel, but rather in sequence. Hearing impairments related to the ageing process occur in 13% of people aged 65 and over. Hearing impairments may cause problems in localising sounds and consequently in ascertaining from which direction a vehicle is approaching. (For more examples, see, e.g. Carthy et al., 1995; Korteling, 1994; Sivak, 1995; Wouters, 1988, 1991, 1994).

Another factor is vulnerability. With increasing age, biological processes result in a reduction of resilience to trauma. Lethality increases progressively with age and is higher for men than for women. The great vulnerability of the elderly is an important aspect of the dangers they run.

These phenomena become obvious at about the age of 45, vary greatly from person to person, and become more marked with age. They can partly be
compensated for by, for instance, lessening frequent traffic participation, the avoidance of certain traffic situations, or by taking more time to observe situations. Loss of function is reinforced by a diminishing practice of functions, and is usually coupled with a reduction in routine (Wouters, 1988). However, a clear relation with the occurrence of traffic accidents is not (yet) demonstrated. Because of methodological and statistical reasons, it is very difficult to demonstrate such a relationship anyway; moreover, factors such as self-selection and compensating behaviours complicate matters even more. Although the Some of the above-mentioned phenomena have been demonstrated to be related to driving behaviour (see, e.g. Sivak, 1995; Korteling, 1994), but research relating age-related diminishments to pedestrian and cycling behaviour is virtually absent.

More often observational studies have sought to identify behaviour that may account for the higher accident involvement (in certain types of accidents) of elderly pedestrians. For instance, walking speeds and crossing behaviours have been studied in order to investigate the possible relation with the relatively high involvement of elderly pedestrians at intersections (see, e.g. Bowman and Vecellio, 1994; Knoblauch et al., 1995; Virkler and Elayadath, 1994; cited in Wouters, 1995). Elderly pedestrians (65 or older) showed an average speed of 1.19 m/s, whereas younger pedestrians- average walking speed was 1.43 m/s. This difference in walking speed primarily originated from a smaller step-length by the elderly pedestrians. These findings were intended to adjust (guidelines for) traffic light installations to the walking speeds of the elderly.

Wilson and Grayson (1986; cited in Carthy et al., 1994) did not find distinctive crossing behaviours within the older group of pedestrians. Other studies have shown that older pedestrians appear to exercise more caution (for example, stopping at the kerb, making head movements, standing further back etc.) when crossing streets (e.g. Carthy et al., 1994); but this does not necessarily result in greater safety. Furthermore, it appears that elderly pedestrians stop more often before crossing a road, show longer waiting times and make more and longer head movements before crossing. On the other hand, during crossing elderly pedestrians appear to make less head movements compared to pedestrians of other age groups (Wilson & Grayson, 1980; cited in SWOV, 1987).

When studying police records of accidents involving elderly cyclists, Goldenbeid (1992) found indications that with about 10% of the accidents, inadequate control over the bicycle contributed to the accident. In particular, the following forms of loss of control were noted: startled by another party and falling, not keeping a straight course, driving erratically. This was found more often for female cyclists aged 65 and above than for male cyclists.

All factors mentioned in this section are interrelated: ageing leads to a loss of function; road use decreases with age; less frequent road use leads to a loss of practice of functions, thus leading to an extra loss of functions and of routine. The feeling of the elderly that they are no longer able to function in traffic which is tailored to the >average= road user, and fear of their own vulnerability - feelings which questionnaires have shown to exist - have the effect that old people become even less frequent road users (Wouters,
3.3 Strategies for countermeasures

With the knowledge of factors, which relate to the traffic safety problems of the elderly, the question arises as to which strategy this offers for the development of solutions. Three main points can be distinguished (Wouters, 1988):

- Loss of function should be slowed down as much as possible and routine should be continued.
- Where it is no longer possible to retard loss of function, compensatory behaviour should be reinforced.
- When the possibilities of compensating for and halting loss of function and routine have been exhausted, the vulnerability of the elderly - which one can do little to help - demands that certain situations should be adapted or that exposure to such situations should be avoided. Other road users should also (learn to) deal better with the elderly.

Practice and routine help to slow down the loss of function. Walking and cycling are particularly suitable to maintain active participation in traffic. By adapting bicycles they can be easier to mount; rear-view mirrors fitted to the cycle could improve the safety of the left-hand turning manoeuvre. Elderly people can also switch to tricycles. These supportive measures can increase the elderly persons' capacity of anticipation as well as their self-confidence. The change over from driving a car to walking, cycling and other transport modes (e.g. public transport) - a change over which is encouraged for other age groups by more and more government policies anyway; but elderly people more often start to refrain from driving due to >self-selection= - can be facilitated by providing the elderly with tailored information on route choice and travel schemes.

Elderly people should know how important it is to keep moving, which possibilities there are for them to use safe walking and cycling facilities and how to practice their skills. Traffic education aimed at elderly cyclists can point out ways to apply suitable compensating behaviour and discourage hazardous compensation strategies. For example, traffic education can point out what situations (e.g. T-junctions and intersections controlled by signs) and manoeuvres (left-hand turns) could pose a danger to older cyclists, why these situations are potentially hazardous, what options for compensating behaviour are available (taking another route, stepwise performance of complex tasks, physical training) and what forms of compensating behaviour (relying too much on hearing) are in fact inappropriate.

The infrastructure determines to a great extent under what conditions one travels. If traffic situations are predictable, early anticipation and compensation are easier. By arranging traffic situations clearly and making traffic rules and the regulation of traffic comprehensible, much can be gained. In this context it is important that traffic signs should be visible and recognisable to poor visual acuity and that traffic rules, particularly new ones, should be known. The incompatibility of pedestrians and cyclists with
motorised vehicles can effectively be solved either by separating or integrating these categories. A more specific problem for the elderly is that of complex situations, which demand the performance of a number of tasks, and rapid and accurate perception, selection of information and reaction. For elderly cyclists, the design of the traffic area should offer sufficient time to assess the situation and perform the various tasks required of them in sequence. For example, measures aimed at reducing the speed of motorised traffic and simplifying the design of intersections. Simplified design in more concrete terms implies that elderly cyclists can easily see where they can safely stop as they approach the intersection. Many infrastructural facilities can be thought of that could help improve the safety of vulnerable road users. I will just name a few examples.

Facilities such as pedestrian refuge islands provide the opportunity to cross a street in stages, thereby subdividing a complex situation into a number of more simple ones. And since most accidents involving elderly pedestrians and cyclists occur inside urban areas, the design of, e.g. safe residential areas such as 30 km/h zones will be beneficial to the safety of (elderly) pedestrians and cyclists. In general, these types of solutions are important for pedestrians and cyclists of all ages; and for elderly people even more so. Instead of designing an infrastructure for the >average< road user, an adequate infrastructure for a broader group of people - including elderly (and very young) pedestrians and cyclists - should be the primary aim. Wouters et al. (1995) conclude that with the current strategy to aim for a >sustainable-safe< infrastructure, different separate measures for the elderly need be applied, although certain forms of application may require some adaptation to better suit the elderly road users. For example, these authors point out that facilities such as the >drawing pin<, the traffic hump with deflected cycle passage, the axis deviation and the intersection plateau should be critically re-examined. Both >road safety experts< and elderly people themselves judged these facilities as difficult to comprehend and/or to use.

One can also imagine unwanted side effects of facilities particularly adjusted for certain groups of road users. Turning left in two stages, for example, is easier and is considered to be safer than turning left diagonally, and might therefore be particularly suitable for elderly cyclists. However, from observational studies (Twisk & Hagenzieker, 1993) it is known, those (especially younger) cyclists often do not use such facilities and turn left diagonally anyway. It is therefore possible that some facilities are >good< for (certain groups of) cyclists, e.g. the elderly, but not necessarily so for others. When large groups of cyclists do not use facilities as intended, unsafe rather than safe situations might be a result of them.

Another example might be the adjustment of traffic light installations to elderly (slow-moving) pedestrians. The traditional system has some drawbacks. Adapting the clearance time to the small group of very slow-moving pedestrians would cause excessive waiting times for other road users, possibly resulting in an increase of red-light violations and unsafe situations. A better solution is provided by so-called PUSSYCATS (Pedestrian Urban Safety System and Comfort At Traffic Signals; called PUFFINS in the UK). One feature of PUSSYCATS is that the length of the
>green-period= is adjusted to the actual presence of pedestrians on the crossing (detected by infrared sensors), resulting in longer green phases when slow-moving pedestrians cross as compared to faster moving pedestrians (see, e.g. Levelt, 1994).

In the collision phase hardly any specific opportunities for solving the road safety problems of the elderly can be thought of. With the accidents involving light traffic, even light collisions could result in severe injury. The possibility of minimising the severity of injury by means of special clothing might be investigated. Research has shown that the use of bicycle helmets can markedly reduce head injuries among bicyclists. However, in most countries only a small minority of bicyclists wears helmets (usually children, elderly and other adults hardly wear them). It is not an easy task to promote the use of a bicycle helmet, because in general negative attitudes to the usage of helmets exist among cyclists (see, e.g. Hagenzieker, 1997).

4. DISCUSSION AND CONclusions

From road safety studies, it appears that elderly road users are over represented in the fatal and serious injury statistics. This holds in particular for elderly pedestrians and cyclists. Reviews and accident studies focussing on the road safety of elderly road users have typically paid attention to this aspect of the increased probability of becoming a victim in a road accident. However, only a limited number of (in-depth) accident studies have been conducted that specifically investigate the (particular) accident circumstances of elderly pedestrians and cyclists. The results of these studies show, for example, that cyclists tend to be (over)involved in accidents inside urban areas, at intersections, and when turning left.

Studies into the ageing process show that, as a consequence of ageing, perceptual, cognitive and motor skills deteriorate. Complex situations are more likely to cause problems in the selection of information and in decision making. Decisions are less likely to be taken almost simultaneously and executed in parallel, but rather in sequence. In addition, with increasing age, biological processes result in a reduction of resilience to trauma (greater vulnerability). However, a clear relationship of the diminution of functions with the occurrence of traffic accidents is not (yet) demonstrated, and research relating age-related diminutions to pedestrian and cycling behaviour is very scarce.

So, it appears that on the one hand a lot of general knowledge is available indicating and - partly - explaining the safety problems of elderly pedestrians and cyclists, both in terms of fatality rates among elderly as well as in identifying underlying contributing factors related to the ageing-process. This knowledge enables us to formulate strategies for countermeasures, which should focus on the slowing-down of the loss of function, the reinforcement of compensatory behaviour, and the adaptation of certain situations in traffic to a broader group of road users than just the >average= ones. On the other hand, very few intervention programmes for older pedestrians have actually been implemented (and evaluated). Carthy et al. (1995) note that this is a product perhaps of scarce publicity about the problem, lack of resources and
ignorance about empirical evidence on the high pedestrian accident rate. Another explanation may be that although a lot of general knowledge is available, the exact relationship with specific traffic behaviours is not clear at all. Such specific knowledge is needed in order to design and implement tangible countermeasures. Furthermore, the recommendation that one should design an adequate infrastructure for a broader group of people than the average road user does not necessarily imply how such an infrastructure exactly looks like. In other words, what needs to be done is to somehow translate (operationalise) the available general knowledge in the area of traffic safety, and physical and psychological abilities and limitation of humans, into specific solutions and facilities (e.g. guidelines). A state of affairs, by the way, which applies to the entire field of road safety, not only for the elderly in particular.

5. REFERENCES

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DESIGN FOR THE AGEING SOCIETY.
IMPLICATION OF TELEMATICS APPLICATIONS.

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By the fall of 1996 we conducted a survey in Meerzicht, a neighbourhood of the Dutch town of Zoetermeer. One of the goals of this survey was the gathering of information in order to understand the situation of a sample of elderly people when confronted with different components of their surrounding living environment. This information can be used to provide necessary knowledge to designers in order to plan the (physical) future of the area when considering improving the living situation of seniors. In particular, it is interesting to investigate the role of telematics applications for the benefit of senior citizens, and what may be the implications for designing for the ageing society of the introduction of telematics applications at the scale of the dwelling and the neighbourhood.

The Meerzicht survey.
Modalities and results of the Meerzicht survey are presented in greater detail in another part of this publication (Tacken). Here we want to discuss any among the main findings of the survey, in order to point out some critical elements deserving further consideration as we focus on the situation of senior citizens in the survey area and on the possibility to design an intervention to improve the quality of life of elderly people. Referring to the map of Meerzicht in figure 1, we divided the neighbourhood in three sub-areas, according to the characteristics of the physical environment: low-rise area, high-rise area, and central area.
The low-rise zone has the best dwellings and the best physical structure of the buildings render possible some social contacts (they have been rendered free from garages and redesigned as places of circulation and exchange); the functional environment is acceptable (not far from shops and station which no relevant hindrances impede to reach) even if improvements are possible and would be welcomed. Instead, the experience with the physical structure of the zone is less positive: the mentioned redesign of the large courts also aims to render more pleasant the environment by making each court different from the others and thus more recognisable.

All in all, the high-rise zone seems to be appreciated by its inhabitants more than the other zones' dwellers. Dwellings are good; the large courts in front of the buildings render possible some social contacts (they have been rendered free from garages and redesigned as places of circulation and exchange); the functional environment is acceptable (not far from shops and station which no relevant hindrances impede to reach) even if improvements are possible and would be welcomed. Instead, the experience with the physical structure of the zone is less positive: the mentioned redesign of the large courts also aims to render more pleasant the environment by making each court different from the others and thus more recognisable.

The low-rise zone has the best dwellings and the best physical structure of

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the whole neighbourhood. Problems are experienced with social contacts (probably because of the lack of a clear meeting place) and with the functional environment, including public transport. The position of the main neighbourhood street for car traffic (4 lanes) certainly plays an important role about this last point. It must be crossed to get to the shopping centre and this has relevance on the perception of the distance. The aerial bridges for pedestrians seem to be not efficacious enough.

A particular concern regards the social contacts in the neighbourhood, which seem to be not satisfactory enough. This is confirmed by the general low score of leisure activities. Apart than the high-rise area, the other zones have a structure which hardly allows to foster social contacts. We have the impression that the elderly of the area will experience problems of social isolation as their capacity of mobility declines. The sample reported that major hindrance for meeting relatives and friends is that they live too far away (40%). At the same time the share of elderly persons who will choose to go living closer to relatives and friends in the case of decline of health situation is very low (6%). This tells us that they will choose to defend their independence even at cost of social relations.

The above mentioned items are the main points to be considered as we want to define a new programme to design the future Meerzicht in a way that is beneficial to elderly people too. In this respect, it is interesting to confront these items with the potentialities of telematics applications. This will be the focus of the next section.

The information society and the elderly.
What has the information society in holds for senior citizens?

Telematics applications are powerful tools to improve the personal communication potential of users. Accessibility of services can be enormously facilitated by new telecommunications tools due to their time-space compressing properties. The traditional regime of constraints introduced by Hägerstrand (1970) conditioning the “daily path” of individuals, is radically challenged by telematics. The loosening of these categories of constraints can be especially favourable for the elderly for it facilitates the performing of a desired behaviour by reducing the relevance of

1 Individuals can be conceptualised as on a path through space within a time frame. According to Hägerstrand (1970) this path is governed by three groups of conditions:
- Capability constraints "are those who limit the activity of the individual because of his biological construction and/or the tools he can command" (p.12).
- Coupling constraints "define where, when, and for how long, the individual has to join other individuals, tools and materials to produce, consume, transact" (p.14).
- Authority constraints refer to a domain defined as "a time-space entity within which things and events are under the control of a given individual or a given group" (p.16).
physical impairments. Notwithstanding the undoubted potentialities, the benefits offered by telematics to seniors can be vanished by an inappropriate introduction of services. In relation to this, four “a” factors can be pointed out that are crucial for meeting the needs of elderly people in the information society (PROMISE, 1997): awareness, availability, accessibility, and affordability.

**Awareness.** Lack of familiarity with the new technologies and services are among the most relevant barriers experienced by elderly people to participation in the information society. Elderly people are hardly aware of potential benefits and risks of accessing telematics networks. Scarce awareness towards the problems of elderly people in this context is also shown by those actors in charge of promoting participation in the information society.

**Availability.** Although many services targeted on elderly people are presently available, as it will be described below, a larger effort should be done to render a larger number of services actually available to older users. It seems important to stress the relevance of don’t segregating services according to category of users but trying to realise as far as possible integrated services.

**Accessibility.** The design of equipment and services is often another constraining factor for the older person who wants to access the networks. The needs of elderly people, and especially of those persons experiencing some kinds of cognitive impairments or visual and hearing limitations, are hardly considered in the design of technologies. Design for all is a basic concept that should be promoted.

**Affordability.** Finally, costs of equipment and of access to services, as well as maintenance costs, are very relevant barriers for elderly citizens, traditionally not a wealthy social category. From the one hand market competition will contribute to lower costs, but on the other hand this will be hardly enough to ensure larger access of elderly people to newer technologies. For instance, specialist equipment is very expensive, as in the case of Braille users. It is important to develop policy measures in this area.

Keeping in mind these basic four factors, the relevance of telematics applications to improve the situation of elderly people in socio-spatial settings can be investigated in relation to three dimensions:

**Independence or self-determination.** The degree at which the older person is able to dictate the path that his or her life should take (Fisk, 1986).

**Social participation.** The capacity of the older person to take part in social events or activities. This largely depends on the ability to overcome contextual barriers (Tacken, 1993).
Community care. The degree at which a given community is able to supply (informal) care to the older person who need it. Quality of life in old age is deeply influenced by the existence of supporting networks of social nature around the elderly (Cullen & Moran, 1991; Knipscheer et al., 1995).

Many telematics applications can improve the ability of the aged to carry out independent life styles by reducing the importance of (early) physical and cognitive limitations caused by the ageing process. Tele-health care or telemedicine can render possible the remote monitoring of those elderly people affected by chronic diseases or which are likely to face health problems. Control may refer to a variety of situations, from the medical check ups - screening, diagnostics - to surveillance, from drug prescription to health education (Veneris, 1992; Gott, 1995). According to the service required or needed, and thus the relative equipment, and the type of medical case there are different possibilities of introducing application of telematics in the health sector in the context of the home care option: in the house of concerned people (patients, carer) or in specialised centres in the residential area (Caso & Tacken, 1993).

Teleshopping can be an alternative to traditional shopping in the cases of temporal or permanent impediment, or when the aged is no longer able to carry the heavy bags of shopping (Cullen & Moran, 1991). An impediment can also be the difficulty to reach a given shop located elsewhere because of mobility constraints. The applicability range of teleshopping depends on the good to be purchased - perishable goods as fresh food are usually dealt with personally- and on the goals involved - functional shopping is more likely to be remotely performed than recreational shopping (Keyzers & Wagenaar, 1989; Tacken, 1990).

Telebanking is another useful application (also) for the aged person. It allows to check bank accounts and to carry out simple operations from a remote location, thus avoiding undesired queues at counters or the need of physically going to the bank office when one is impeded or doesn’t simply like to go there. Telebanking is also a complement for purchasing activities as teleshopping and shopping, since it provides a system of automatic paying (Paltz, 1988). This last factor can be attractive for old persons since it avoids the use of physical money, which could be dangerous in certain contexts.

Governmental information and forms e.g. for the request of subsidies are sometimes a reason of concern for older people. Also these ones can be rendered more easily accessible by telematics applications. Telework can support the choice of remaining active on the labour market after retirement age. Other applications facilitate the participation in educational or cultural programmes independently from eventual constraints of physical nature (Cullen & Moran, 1991).

Some telematics applications can have a positive influence on the participation of elderly people in social life. Better information on events and transportation modes can render easier the performing of outdoor activities.
Design for the Ageing Society. Implications of telematics Applications

(Tacken, 1993). Many telematics networks dedicated to the elderly, as the Seniornet, the Senior Link, the SCIP (Seniors Computer Information Projects), or the Friendly 4 Seniors -all sites available on the Internet together with many others- have seen the light throughout the whole world-especially in North America. They provide the aged and caregivers with useful information on a variety of items, from legal to medical or technical, and occasions of social exchange as chat-lines, home pages, and event information as well as leisure time activities. Videotelephony can become an important tool for the elderly experiencing problems of constrained mobility (Cullen & Moran, 1991; Gott, 1995). Safety on streets can be improved by tele-surveillance especially in those areas with criminality problems or hosting a denser elderly population, but this is a controversial item due to the potential threat to individual privacy (Graham & Marvin, 1996).

The community care context can benefit of applications of telematics. Both formal and informal caregivers may enjoy telecommunications to improve potentialities. Specialised resources on different fields, as medical staff or technical personnel become more easily accessible from any location. The informal caregiver may enjoy telematics applications to conciliate their daily tasks and activities with the care of their older relatives. They can keep an eye on them also from afar, while remote monitoring of housing functioning combined with smart home technologies can reduce the risk of domestic accidents, improving at the same time the feeling of security and safety of the elderly person (Cullen & Moran, 1991). Smart home technologies can also be remotely operated with the aim to carry out some other tasks of caring. A relevant application can be the surveillance of demented elderly people or the aged persons experiencing early cognitive problems, who do not like any physical control but may accept this sort of more virtual surveillance (Bjorneby, 1994).

Against these positive aspects there are also relevant negative potentialities to be considered. As first, the lack of resources can threaten the positive effects. This refers to both economic resources-how affordable the necessary equipment is- and skill resources-the ability of using the equipment. The relation with advanced equipment can be rendered more difficult by declining cognitive capabilities, as in the case of Alzheimer's disease. Others may refuse the use of advanced technologies because of e.g. psychological motives-even if this problem is likely to loose relevance for the newer elderly cohorts.

For the frail elderly, experiencing problems of mobility or of declining cognitive capabilities, introduction of telematics applications for a number of tasks traditionally performed by caregivers can become a double-edged sword. For instance, surveillance no longer requires physical presence-since it can be remotely performed-thus potentially resulting in more isolation in spite of the increased communicative potential enabled by telematics (Cullen & Moran, 1991; Graham & Marvin, 1996).

On the other side, the physical performing of activities as e.g. shopping or banking implies a social valence for the performer which can be very attractive especially for those elderly who experience a certain degree of
Social isolation. Other factors to take under consideration are the design and user-friendliness of equipment, which influence their attractiveness.

Relation with design.
Potentialities and risks summarised in the previous section have to be bare in mind as we are going to introduce telematics applications in the design of the future Meerzicht. However, to establish a relationship between telematics innovation and the design of future socio-spatial settings is a very complex task, which has been hardly pursued in design research. In a previous paper we have already had the opportunity to analyse the main elements linking telematics innovation to the design of future socio-spatial settings (Caso, 1997). The scheme represented in figure 2 is built around the basic statement that the direct impact of telematics applications on the physical component of socio-spatial settings is rather irrelevant, their more significant influences being of an indirect type.

![PEST diagram](image)

**Fig. 2: From innovation to design.**

Interrelated Political, Economic, Social, and Technological (PEST) factors push towards the development of new applications of telematics. On the basis of current state of the art and the direction of R&D activity, a number of telematics applications can be thought of. The introduction of such applications has effects on both internal and external organisation of services. Say, the way in which they function and the way in which they are rendered accessible to users: this is the functional component of the built environment. Similarly, telematics applications may also produce new patterns of social interactions: this is the social component. Relations of reciprocal influence exist between these two components: the functional environment conditions at high degree the behaviour of individuals; while social structures are in turn the target of functional organisations. Both functional and social components reflect themselves in the three territorial levels of the built environment – the home-settlement system (Moran, 1992): this is the physical component. On the other hand, the physical component produces feedback which influences the other two components. These feedback –shown by dotted lines in figure- can be regarded as processes of reciprocal adaptation. The interrelation at different scales among these factors originate problems, questions, and needs to be matched (also) on the field of design. Since designers are mainly concerned with the physical
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environment, it is from here that the proper design process usually begins. How this process further develops, including ex-ante evaluation and post-occupancy evaluation and monitoring, is not at issue here.

A new design programme for the ageing society.
An essential step in the whole design process is to confront possible futures with desired futures. In the case at issue in this paper, desired futures can be deduced from the discussion of the main findings of the survey, while potentialities and risks of telematics for the old age configure possible futures.

By operating this confrontation, it should be immediately evident that no one of mentioned items can be improved through the sole and simple introduction of telematics applications. The reality is very complex and no deterministic position can be assumed as a departure point. Notwithstanding this, the applications of telematics we discussed earlier in this paper can be usefully employed to partially reduce the remarked deficiencies. On the field of design, this means to integrate telematics applications in a new design of the socio-spatial context which is able to realise positive potentialities and reduce the possible negative consequences. This concerns not only the design of equipment and software, but also the position of equipment (and services) in relation to users and the availability of alternatives to match different (and often contradictory) needs and changing circumstances. Recent conceptualisations on designing for the aging society fit good in this task. According, the new cultural environment in which design for the aged should be placed leaves behind the idea of design specifically targeted on the needs of elderly people, to welcome more integrated concepts (design for all, universal design concept) aiming to the design of socio-spatial settings which are able to accommodate different social categories with minor adjustments in the course of their life (i.a. Ambrose, 1997; CIB/TG19, 1997). Life-cycle housing are an important element in this respect.

The position of performing places for telematics activities in the area have a central importance for what concerns the (re)design of dwellings and the neighbourhood. The interviewed sample mentions health-care, shopping, information - especially asking forms, housing monitoring and control, and surveillance as the services/activities for which telematics can be relevant. But also applications as videotelephony and others supporting personal communications can be important especially for those persons with mobility impairments who didn’t participate in the survey. Applications like telework, leisure tele-activities, tele-education, and telebanking are not often mentioned but they can be more important for the future elderly cohorts. Furthermore, they can be relevant applications for other social groups in the area.

The dwellings in the area should be (re)designed in a way to render possible the performing of different tele-activities without interference with traditional ones (Caso & Tacken, 1993). The user should be able to choose the preferred spatial configuration according to (changing) needs. Many dwellings in the area have a spare room, which can permit some flexibility. But this may be not enough, especially if the concept of life-cycle housing
Part 2: Environment: accessibility and traffic safety

has to be pursued. Which dwelling allows the elderly (or another subject) to perform telework at home? Which one render possible health-care? What about those parts of the dwelling which become underused after the dismiss of their original functions? Some elderly people will need to realise several possibilities at home since they need to perform them on regular basis, like the chronic patient who needs a constant monitoring, while others will prefer to make use of them less regularly for choice or because they lack of resources. In these cases an alternative in the neighbourhood should be found.

A possible option is the neighbourhood telecentre, which offers space and facilities for the performing of tele-activities, as well as skilled personnel. The telecentre could host a health care centre, machines for teleshopping or telebanking, videotelephones, monitoring of dwelling functioning and surveillance, meeting places. The same telecentre could also host rooms for the performing of telework or educational activities which may be rented also to the elderly who intend to get involved in these activities. Other possibilities concern (tele-)library and a small conference hall where a number of (remote) happenings can (be received) take place (Caso & Tacken, 1993).

These possibilities can contribute to improve the situation in the neighbourhood of Meerzicht as far as they are complemented by a design aimed to modify the structure of the area to respond to detected deficiencies and potential negative side-effects of telematics.

The main concerns arise in the social context, particularly in the low-rise and the central zones. A possible answer can be to improve possibilities of meeting and exchange among people by creating places of social aggregation. Some residential streets can get a more mixed character by introducing other activities as workshops and shops (or telework places), thus rendering these spaces more alive and attractive for both elderly and other social groups. Most of the times this operation will require a redesign of the dwellings and the modification of zoning regulation to allow the performing of small scaled, quiet productive activities in residential areas. Also the neighbourhood telecentre could have a social function, being a daily destination for many (aged) persons. This potential can be improved by the design of the centre which, besides services, should offer the possibility to e.g. seat and meet other persons in an attractive environment both inside and outside.

Mixing functions can also facilitate to match the deficiencies of the functional context, as it is the case especially in the low-rise zone, because it brings services closer to inhabitants -which is a positive aspect in particular for seniors. Telematics applications can greatly contribute to improve the functional context but alternatives should always be present to make it easier to meet the desired behaviour of people.

The main problem in the high-rise area is the quality of the physical environment. Observation of “physical traces” (Zeisel, 1981) renders evident the desire of a more recognisable environment and a better quality of the physical context (redevelopment of the courts and new design for these
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places). In this area a pattern of shops, workshops, telework places, and the location of other services, a telecentre, life-cycle dwellings can be spatially organised to integrate the pattern of high-rise buildings in order to improve its quality. This is not only a problem of shape but also of accessibility of the physical environment: hindrances, feeling of safety and security outdoor, social control. One way to do this can be to underlay a pattern of low-rise building to the existing high-rise to link them in a single urban fabric.

The central area seems to be the less attractive of the whole neighbourhood. This zone needs a more global redevelopment to improve social and physical environments. At present the area is the supplier of the most services for the whole neighbourhood, which are concentrated in the area of the shopping centre. If these services are spread along the whole neighbourhood, the current concentration is no longer necessary and the shopping centre area can be redeveloped for different uses (a main neighbourhood telecentre?) or substituted.

Conclusions.
If appropriately introduced, telematics applications can significantly contribute to the quality of life in old age. As the future city is increasingly going to be configured by a hybrid combination of virtual spaces and physical places, access to telematics networks becomes a basic resource for a better life. An important element that bears onto the possibilities of introducing telematics for the benefit of senior citizens is the lay out and design of the built environment.

From the presented paper it is clear that the introduction of telematics services and applications alone are not sufficient for the improvement of living circumstances at any age. A re-design and re-consideration of the built environment should accompany this introduction in order to permit positive possibilities to be exploited and negative consequences to be tackled.

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20.

OLD PEOPLE AND THEIR MOBILITY IN A THEME PARK: THE PARK OF PINOCCHIO'S EUROPEAN FRIENDS AT COLLODI.

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1. INTRODUCTION

Over the last few years our society has been getting older. That is the reason why growing attention has been devoted to the issues of how old people use the city they live in. This has originated a number of studies into the issues of the practicability and liveability of urban areas. Our study is one of them and has dealt with the problems that old people face in order to use and integrate into the life of a park. In particular, thanks to the commission given by the Collodi Foundation to enlarge the already existing park dedicated to Pinocchio, it has been possible to work out a project aimed at adjusting it to the requirements of old people, both as regards its practicability and its cultural offer. Great attention has been paid to the issues of old people’s mobility in and use of the park, since a survey carried out before the project itself showed them to be its usual visitors, especially thanks to the presence of the near-by Montecatini thermal waters.

2. PINOCCHIO PARK AND THE NEED TO CHANGE

The park dedicated to Pinocchio was established - and is still managed - by the Collodi Foundation nearly forty years ago and has since been visited by some six million people, thanks to the decisions made by the Collodi Foundation concerning its cultural characteristics, the level of its artistic representation and its evocative dimension, all of which have made it a unique park in Italy.

Pinocchio Park is the best example of cultural park in Italy and is very different from commercial parks in that it retains a strong relationship with the historical and cultural roots of the territory. It is also characterised by the peculiar relationship it has established with Collodi, a small town still having all the features typical of the last century and impressive for its long range of houses clinging to the steep side of a hill which fades into a valley where are Villa Garzoni and a beautiful XVIII-century garden.

The park was designed to be a poetic place where it is possible to walk and it, being inhabited by the characters and the places of Pinocchio story in a
highly artistic dimension, brings back the fundamental elements of the story and invites its visitors to remember, by taking a simple walk there, all the excitement they had once felt on reading Pinocchio.

From the point of view of accessibility, the park is characterised by a substantial enclosure. Narrow and winding paths, stairs, the lack of places where to stop: such features were all designed to give visitors a feeling of discovery. As a consequence the park can be visited only by people without any disabilities to move around, in spite of the fact that nowadays lots of visitors are over 60-65 years old attracted there by the near-by Montecatini thermal waters. In spite of its high cultural offer, the park cannot guarantee that its older visitors are not discriminated. That is the reason why a project aimed at enlarging and adjusting the park\(^1\) has been worked out in order to maintain its cultural offer and at the same time guarantee its practicability by all visitors, regardless of their age and culture, or their ability or disability to move, see and hear.

3. THE GENERAL CHARACTERISTICS OF THE PROJECT

According to the Foundation's wishes, the study group has worked out the project with the aim of guaranteeing the integration among people of different ages and physical abilities, and also trying to be in line with the park and its artistic and cultural level as they are today.

The basic points of the project may be summarised in three key words: memory, discretion and poetry.

The relationship of the project with memory consists in highlighting the characteristic elements of the local culture by bringing back the features typical of the landscape and by reproducing a structure similar to the ascent on which the small town of Collodi Castello is situated and which is characterised by the out-of-alignment XVIII-century garden of Villa Garzoni, the first element on the way up the hill.

Similarly to the system of the village, the project provides for a regulating element at the base (the square-stairs in the project and Villa Garzoni at Collodi), a steep ascent (a rack in the project), a central element, the heart of the system (an element metonymically recalling the real town in the project), and a terminal element (a large cone out-of-alignment to the ascent).

We have in this way tried to repropose some important elements of the landscape so that the visitors can experience an ascent as similar as possible to that of the town of Collodi, from which it is possible to perceive the real elements belonging to it. In this case the project is based on the possibility to recall the elements of the landscape, i.e. the fact itself of visiting some places of the park makes the visitors remember the other places.

As concerns the architectural structure, the square, with its metaphysical appearance, is the regulating element marking the passage from the old to the new structure. From this square the visitors can either walk up the steep ascent by a long path, or take the rack or the fast ascent along the fish-bone. The place of arrival is a large cone, which is too wide to be a nose and too narrow to be a hat, a signal in the passage and in the same axis as the square so as to obtain an analogy with the non-alignment of Villa Garzoni
and of the Collodi ascent in relation to the XVIII-century park. Walking along the fish-bone is like living again Pinocchio's adventures into the whale. After the square, the visitors enter a tunnel extending under the wood and, on stepping out of the tunnel, they are faced with a large wall dedicated to temporary exhibitions of various artists. After it, they go into the village whose small walls and paved places gently recall Collodi Castello ascent. After the village they enter the tunnel again, passing under the road and reaching the top of the hill.

The central fish-bone, which is necessary in order to guarantee the access to the park, is a mechanised ascent (rack) appearing and disappearing behind the mountain, and which is never completely visible as it is covered with the vegetation, the two walls defining the descent and a pedestrian path making it possible to reach the top of the hill. The fish-bone - light and harmless scar of the mountain-represents the ascent to the small town of Collodi Castello and a metaphor of Pinocchio's adventures into the whale.

The second peculiar element of the project consists in the giving up of any play and folklore features, typical of amusement parks. The park is a discreet base for the setting up of a whole series of play and artistic events. The fundamental elements above described can be reached through a long path which winds across the park (with a 5% slope) and never interferes with the landscape. It just hosts the events without creating any particular features around them.

The transversal paths of the park enable the visitors to come into contact with nature and to discover, thanks to a number of different botanical elements, the culture which has produced such an interesting landscape over the years. They also catch sight of play and artistic objects and computer events making them doubt the real appearance of things and urging them to dwell upon what is often taken for granted as a part of our everyday life. They are thus invited to experience sensations related to the culture of the reference characters.

Going up the park the visitors do not enter any areas dedicated to the various characters, as such settings have been refused both from the cultural and the architectural point of view. Three fundamental characters (Pinocchio, Alice, Le Petit Prince), whose presence is more or less evident according to the different areas according to the principle of indefiniteness, are recalled both by means of simple events and hints, and spaces dedicated to them. They accompany the visitors up the ascent in a few theme paths or in ever-changing paths based on a sort of treasure-hunt, where any element leads to another element, not only in a physical order, as far as the final goal.

The third basic element is the poetic and magic dimension assigned to the architecture.

The architecture as well as the infrastructures are used in a poetic and evocative form. The rack is no longer a technological element but becomes a part of the game. The square is a flight of stairs so as to be a symbol of the ascent in the park; it is geometrically defined as the large cone on top the ascent, and acts as a regulating element in disagreement with the casual arrangement of the paths in the park. The final tower becomes a cone, a hat, a nose, a hint at Pinocchio, through pure form. Geppetto's house recalls the
carpenter’s tools, related to one another (a reference to Gehry’s architecture for the Vitra museum). Alice’s den discloses the theme of the paradox through elements becoming larger and smaller out of all proportion.

4. THE SOLUTION TO THE PROBLEMS OF MOBILITY

The whole approach to the project of the new park has been based on the fundamental criterion of making it accessible to all kinds of potential users, with particular attention to old and handicapped people. This has been considered a priority, in order both to comply with the new strict rules in this regard and to build a structure able to cancel any discrimination. This kind of approach has made it necessary to overcome great difficulties due to the topographical position of the area, which extends over the side of a hill with a relatively steep slope.

Accessibility affects all sectors of the new park. A mechanised ascending system will be set up making it possible to reach four different stops leading to all the segments of the path, planned with a slope never exceeding 5%. Both the rack and the transversal paths can also be accessed by people with physical inabilities and represent the culmination of the visit. We have tried to organise a park where the difficulties of ascension will be the same for people with and without physical problems. This has given rise to the rack, the central fish-bone of the park, quickly leading to some locations in the park, and also to the articulated paths - which have a slope never exceeding 5%, as already said - and are the fundamental elements of the park. The park is intended to be a meeting place among people and between people and nature and events, and not at all a tiring alternative to a quick ascent.

The only area which is served by paths with a steeper slope is the area situated at the base of the hill and traversed by an already-existing road through the wood. The decision to maintain the existing layout was made so as not to upset the environmental equilibrium of the area by considerably modifying the landscape. We have on the contrary preferred to fit the new park into the typical nature of the area. The possibility of making that area accessible too has nevertheless been taken into consideration by working out a variation on the project to build paths with a 5% slope inside the already-existing road.

From the thematic point of view, the paths have been structured with the aim of avoiding a predetermined ring structure and on the contrary of making the places recognisable with regard to one or more themes. The points of departure and of arrival of the paths are not clearly defined. There are a few elements hinting at the departure (at least 2) and a focal point of arrival. The paths were intended to be irregular and visitors may go either way, the direction being dictated by the relations among the various elements. The intent is to arouse in the visitors as much curiosity and anticipation as possible.

Along the paths there are spaces either dedicated to events or useful to have a temporary rest (simple low walls to sit on) or even a longer rest (these are the main rest areas).

The aim was to clearly distinguish the paths from the areas where to stop so that there will never be too many people in the way when other visitors are
coming up. All events are situated close to the paths on small areas which are nevertheless useful for the visitors to move around freely. The larger rest areas (four) are dedicated to the fundamental characters of the park and can be used both as equipped places where to have a rest (with bars and restaurants) and as open spaces where to go during rush hours. The services can be found along the rack in spaces close to the rest areas so as to make the structure of the park simpler. The services and the restaurants and bars are located in such a way that it is possible to reach them within 15 minutes from any point in the park.

5. CONCLUSIONS

The park, winding up a long ascent as far as the top of the hill, was intended to be a place able to bring together rather than divide visitors of different ages and physical abilities. We have made it possible to walk around the park either freely or according to the various themes so as to meet the requirements of all potential visitors and to solve the problems they might have.

The difficulties related to the particular orographical characteristics of the area have been used in order to work out an original and stimulating project for the park, whose structure is now to be taken as an example for all theme parks. These, as a matter of fact, not only must be accessible but must also guarantee an actual integration among people with different ages and physical possibilities. That is why the park of Pinocchio's European Friends will be a park where anyone will be able to have fun, make discoveries and learn new things together with the others.
Figure 1.2
Figure 3.4
Old People and their Mobility in a Theme Park

Figure 5,6
21.

A SUSTAINABLE MOBILITY FOR AGED PEDESTRIANS: AN EXAMPLE OF APPLIED RESEARCH. ACCESSIBILITY AND SAFETY IN A ROMAN URBAN AREA

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1. THE INTERVENTION LOCATION

This short note concerns a new mobility system designed within a rehabilitation proposal for Pietra Papa District, at Viale Marconi, in Rome. Such proposal, run by a university interdisciplinary working group uses intervention methods and techniques, suitable for planning a better life and urban environment quality, and for increasing pedestrian safety, in order to enhance pedestrian mobility and public transportation use.

It represents the applicative phase of a long term research called "Urban rehabilitation and pedestrian mobility" run within the COST Program (European Cupertino in the Field of Scientific and Technical Research - EC-DG XII) Action C6 "Town and infrastructure planning for safety and urban quality for pedestrians", and therefore it takes advantage by the exchange of knowledge promoted by this co-ordination.

The area of Pietra Papa, has been chosen for this pilot project because its negative features are common to many roman residential districts, located in semi-central or suburban zones and recently developed: social services and gathering points lack, valuable environmental and architectural features absence and car massive use, with traffic and parking, air and noise pollution related problems.
The low level of life quality, that characterises these areas, stems from the fact that here urban spaces have been designed mainly to meet car mobility requirements; so pedestrians mobility has been compelled to use the "leftover" spaces, unsuitable for the required performances, and above all, for fostering social relationships. Such car culture is so deeply rooted that also when pedestrian urban spaces are planned anew, they are designed in a way that doesn't succeed in inducing users to start an identification process.

Being not thought from the pedestrian's point of view, they often are not popular, then misused and finally assume such a state of neglect that they reach exactly the opposite goal, which they have been created for.

2. THE WALKING PROMOTION

One of the sustainable urban development goals is to promote the walking mode for short distances and the use of public transport system for the longer ones, in combination with private car traffic reduction.

To promote walking it is necessary to re-make cities friends of pedestrians; to succeed in this, it is necessary to re-consider the pedestrian as the main actor in the urban scene and so to design urban spaces putting him at the centre of the planning process.

This statement does not mean that cities must become huge strictly pedestrian areas, but that they should be organised in sectors, which can be ruled and structured, in order to allow the coexistence among various kinds of mobility at different speeds. This choice prefigures a continuous pedestrian network characterised by a sequence of smaller pedestrian areas mixed to and supported by a ruled, calm road system. From that comes the
need to study the traffic calming measures, checking and re-balancing the vehicles locations, in order to gain new pedestrian mobility spaces, usable also, and above all, by the most vulnerable users.

The implementation of traffic calming techniques and devices allows to increase safety for pedestrians, by creating pedestrian islands with controlled speed levels, and to better the environment decreasing air and noise pollution, both very dangerous, above all, for elderly and children, by slowing down traffic and by avoiding car accelerations, queues and braking.

By means of this betterment, traffic calming becomes one of the main ways to promote walking, but not the only one.

It seems indeed of great importance to focus the study, not only on traffic control interventions and on pedestrian safety, but also at the same time, on the re-design of urban spaces, aimed at making the different pedestrian categories to see them not only as usable but also as desirable ones; this means to create a mobility system just suitable to pedestrians, that acts as a "connective tissue" supporting some urban activities, in which rest areas are alternated with movement ones. A pedestrian size city means indeed the promotion of social and cultural relationships, besides offering affordable use conditions for the most vulnerable categories.

Users are the top priority and so pedestrian's requirements are considered the heart of the approach; this gives to the proposal run methodology an anthropocentric aspect.

3. THE METHODOLOGY

In point of fact, the used design methodology, developing a process for the
reorganisation possibilities and achievable qualitative levels prefigurations, is based on analyses and selections consecutive steps, in order to put a comparison between people requirements and places performances, to individuate new possible uses for the existing spaces and the related adjustments; then, as the alternative solutions of each intervention have been set, it is possible to sift them aiming at defining their compatibility level and at esteeming, and thence at guaranteeing their suitability, always considering the environmental quality control on its whole.

The run methodological practice has been articulated according to the following procedure: once defined the "intervention programme", the receptivity analysis has been run, in order to study the status quo of the considered area, especially their features concerning mobility, services and environmental situation, and to enlighten existing potentialities and lacks. Then, the "desirability analysis" has been run, for a deeper definition of users and requirements, as imposed by new uses. Last comes the "opportunity analysis", i.e. a control of bounds and chances set by current, cultural and architectural, rules and valuations.
4. URBAN QUALITY INDICATORS

Since users are considered the research main element, for a deeper insight they have been divided into big classes, according to the road prescriptive definitions; on the basis of pedestrians requirements and no more of the drivers ones, interferences and relations have been determined, controlling related priorities, conditionings elements and compatibilities.

Then has been set down a pedestrian requirements ranking list, originated by the previous outline.

Among the various deepened requirements, it is necessary to mention the accessibility one.

Accessibility, meant as general exchange opportunity, must be assured to all city dwellers; if this possibility doesn't take place, elders and other vulnerable categories pay the cost in terms of segregation, which is only seemingly to their detriments, but is to the whole of society's. In this way, the walking promotion, as different transport soft mode, set accessibility as a basic element of urban public outdoor spaces, as also emerged by D.P.R.503/96 new indications. It must be also said that, according to the researchers operating line, accessibility has been intended as included in the definition of urban space itself and so it is meant as unavoidable by the design culture; this means that adjustment interventions, targeting to satisfy given requirements, are directly aimed also at making space accessible, too.

By the run investigations, emerged different requirements, that could be more or less interrelated, and more or less compatible with each others, but two of them can be considered as basic ones, also because broadly felt by users. These are safety and comfort.

Safety is related to the user safeguard from various dangers and is considered under its physical and psychological aspects; first of all is meant as safety from traffic, secondly as safety in the use of the pedestrian space itself, and finally as security. Comfort means physical and psychological wellbeing and ease.

Anyway, to make an urban space more than usable, i.e. desirable, it's necessary to go ahead, considering other, more difficult to outline exigencies, as for example the surroundings lookout related ones, and the connected cultural, social, psychological, behaviour, language requirements.

Because of the previously mentioned possible conflicts among exigencies, the different pedestrians categories have been first focused, and then analysed one by one; in this way it is possible to operate a comparison aimed at defining the compatibility levels among their different requirements, and then among the following measures needed to satisfy them, and lastly at reaching the achievable satisfaction global level.

On the basis of the mentioned requirements, the first step to take is to turn spaces into safe pedestrians dedicated ones, and then to increase and to better their quality.
5. THE ENVIRONMENTAL ISLAND AND TRAFFIC CALMING DEVICES

From the due research about the topic prescriptions and rules, it comes out that a recently proposed Italian law concerning the Traffic Urban Planning, introduces a new concept, to be applied in urban areas: the "environmental island" and shows a particular care to the enhancement of the "pedestrian network continuity".

Under this updated point of view, it is possible to look at pedestrians as new characters of the urban scene, and no more at cars; one of the most favourable effect is then a severe reduction of speed limits and a private vehicles circulation control (at least for what concerns the Italian standards and habits). Pedestrians “regain” walking areas, moving in suitable spaces.

The group\(^2\) which has made the proposal for Pietra Papa, in the environmental island, with the imposed speed limit at 30 km/h, has adopted a vehicular scheme based on a “rooms and corridors” one way pattern, plus a U shaped two way distribution ring. This scheme has been used for its smoothing effect on the vehicles flows and for it discouraging the through traffic, which is very dangerous; common urban services such as rubbish collection or others public duties have been taken into account, designing specially provided paths; the rescue teams vehicles accessibility has been also carefully studied and organised, in order to meet, since the starting phase, all the related duties, especially considering the need of ambulances quickest services.

The consideration of the different exigencies and conditionings coming from all public services duties led to some changes in the design proposal. These modifications have been seen not as simpler solutions of what previously proposed, but as indications to reach a kind of relative “optimum” solution, as the complexity of all the variables of the play imposes.

One of the most important issue, for what concerns the area infrastructure design, is the use of traffic calming solutions, starting from foreign usual practice of the topic and introducing new directions in the Italian way to face these problems. Main used devices are: “gate” entrance to the environmental area, aiming at informing drivers about the lower speed limits in force in the area; cul de sacs, roundabouts, chicanes and carriageway reductions, with the goal to reduce cars speed and to keep them low running; indeed, a soft way of driving avoids continuous gear shifts, sudden accelerations and braking, main causes of exhaust emissions and related problems of noise and air pollution, vibrations and acoustic annoyances. Also for what regards

\(^2\)The applicative phase of the research run to the design of an "Intervention proposal for the realisation of a safety system for the pedestrian mobility at Pietra Papa, Rome", co-ordination by Prof. arch. Lucia Martincigh, working group: Prof. arch. Lucia Martincigh, arch.i Maria Vittoria Corazza, Alessandra Tosone; collaborators: arch.i Ugo Bevilacqua, Arnaldo Marino; CAD designer: arch.Laura Feliciani; consultants: prof.arch.Giorgio Braga (use of materials); prof.arch.Francesco Bianchi, arch.Oscar Santilli (urban lighting); prof.ing.Stefano Gori, ing.Stefano Carrese (vehicular mobility); arch. Patrizia Ferro (environmental aspects), dott.Rosella Squarcia (psychological aspects); partecipants: Arch.i Marco Canciani (cartographical basis elaborations), Franco Fabrizi (researches and spot investigstion), ing. Claudio Napoleonii (hydraulic arrangement), Luca Urbani (road construction), Chiara Villani (visual problems).

The design proposal is going to be executed by the Department of Public Work and Urban Maintenance of Rome Municipality.
the traffic calming implementation, the problem approach was multidisciplinary, and all the related issues concerning materials, building techniques choices have been deeply studied.

Crosswalks are for the vulnerable users, mainly for elderly and children, one of the most dangerous points of the urban environment, due to many factors. Very often, children don’t understand the danger related to traffic, while aged people, even if aware of it, don’t realise it clearly. Therefore, crosswalks have been deeply studied and defined, especially designing two different kind of them: raised crosswalks, as useful device to guarantee pedestrian path level continuity and safe use, especially for impaired people; and chockered ones designed by carriageways width reduction, allowing people to shorten their distance to cross. In particular, all chockered crosswalks are provided with ramps for wheelchair people. Concerning the raised crossings, two different kinds have been designed, according the first to the European prescriptions, and the second to the Italian ones. In the first case the crossing parterre is raised to the sidewalk level (up to 15 cm), so to avoid any kind of hindrance for disabled people, and to let them cross the street easily. In the second case, according to our Traffic Code prescription that allows only 7cm height humps, the parterre is raised to this level and connected to the sidewalk by a ramp and by a step, the latter for people who can find ramps uncomfortable, such as limping or ill-sighted people.

Public lighting, normally planned in order to serve road duties, has been turned towards pedestrian’s exigencies, not forgetting anyway the importance to solve conflict points among drivers and pedestrians, such as pedestrian crossings. The pedestrian priority lighting design was mainly aimed at preventing car accidents, at guarding from micro-crimes such as mugging for instance, and also trying to make users safety feeling stronger about urban spaces. Lighting design allowed also playing with twilight effects, to give importance to positive elements and to obscure negative features, enhancing the area aestethic agreeableness.

Regarding pedestrian mobility, it can be said that a main axis has been created, connected by two protected pedestrian paths and two raised crosswalks to the nearby riverside area, for which the Town Municipality Office has planned river park and sport areas. Part of the pedestrian path is also usable by blind people, since it has been designed with a special track for them, using natural and artificial leading devices, (for instance smelling hedges, special tiles for indicate directions, carriageway rumble strips to alert cars arrivals, and so on).
The proposal sets an alternation of exclusively pedestrian zones and at the same time vehicular and pedestrian mobility zones, with mixed-use different levels and modalities. The problem is not to oppose pedestrians rights to drivers ones, but to study the two binomial terms at the same time, in order to make possible a life in common without damaging only pedestrians, as till now.

6. PEOPLE PARTICIPATION

The new activities adjustment interventions, the performances to offer, and the characterising equipment come from the ergonomic configuration and from the related analyses, from the study of the anthropometrical data, of the specific ergonomic capabilities and of the behaviours; the compatibility control between given performances and requirements has been operated. To give an idea of the run work, it can be mentioned the study concerning the student behaviours and habits on their way to school, which allowed to individuate the most recurring paths. The residential private traffic oriented streets, within the environmental island, have been structured in order to alternate spaces with the presence (at different levels) of the vehicle mobility, at the same time with bicycle and pedestrian ones, selecting just few "pedestrians only" zones.

Other important information come from special investigations concerning mainly people walking habits and car traffic amount during a working day as usual, within the studied area.

The first deepening about people walking habits was studied and run by some members of the working group. The group decided that the way how
dwellers walked and moved could be inquired basically by a written questionnaire, supported also by some face to face interviews.

The first problem was how to prepare the questionnaire: easy to understand and to fill in; so it was articulated in few, simple questions to answer just crossing yes or not. The questions concerned the interviewed people “yesterday - activities”, especially about their shifts out of or within the neighbourhood, or within Pietra Papa area (this last question was related to the matter that Pietra Papa is part of a bigger neighbourhood, called “Quartiere Marconi”) Each one of the above mentioned question was to complete with more information about reasons, destinations, modes, travel times of the shifts.

If the related crossed answers were about cars, it was also asked, “how many km did you drive along?”.

Last questions were: “Did you have something to remark about your movement possibilities?” and “Did you have something to remark about your city movement possibilities?”

This questionnaire, about 600 form copies, has been distributed among the districts dwellers, especially at schools (in order to make schoolchildren parents and grandparents fill it) and at the church elderly centre. Besides that, as previously said, some street interviews have been run, during a working day, from 9.30 to 12.30. Most of interviewed people were aged ones, and after answering all the asked questions, they still stopped and start complaining their personal problems and difficulties, mainly concerning movements within the area, but also their rage for being left apart by the “society”, as a useless part of it. Even if the results are still under exam, one of the most important aspect emerged from the direct interviews is that old people remain the main pedestrian users, in respect, for instance to children who often go with their parents by car; but notwithstanding this, there is no care in equipping urban spaces with the most simple elements such as benches, for example, useful for them.

This forced the working group to think the pedestrians entirely or partially dedicated spaces to be articulated into resting or walking areas, where different uses modalities and suitable environmental settings are allowed, just to pass over the impasse of only finding space for pedestrian use in the modern urban residential areas, as at the beginning mentioned.

To denote such urban spaces, indeed some traffic control or exclusion devices, and few street furniture elements are not enough. It is necessary to look for the events variety, that is characteristic of “centres”, the landmarks alternation, those features constituting the “places”, according to Norberg Schulz (i.e. place as a significative space) and that polarise social life: spatial spots, shapes, colours, enjoyable pedestrian size perspectives and views.
22.

METHODOLOGICAL AND STATISTICAL APPROACH IN THE STUDY OF THE ENVIRONMENT AND MOBILITY OF THE ELDERLY.

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Isto Ruoppila
(Department of Psychology - University of Jyväskylä, FINLAND)

1. INTRODUCTION

In sociological research it is difficult to perform a comparative study taking into account the nature of the measures that many a time could not be homogeneous in the systems of different countries and the statistical methods that need to answer simple questions. Survey data generally includes a number of responses to questions in completely different form (nominal, ordinal or continuous data) that imply the application of adequate statistical methods.

The resultant data are often summarised only marginally by histograms or tables of frequencies. Such a summary could not be sufficient in revealing the interesting patterns of response among the groups and to this aim it is interesting to approach some multivariate statistical issues especially in comparative study.

Today social scientist use multivariate statistical techniques to analyse cross-national data sets and they hypothesise relatively complex patterns of statistical relationships and interactions. Often they meet some problems concerning the sample size and the comparability of different countries. In this contest we tried to understand if a lack of mobility in the elderly comes from a relationship between people and environment.

2. METHODS

We analysed variables concerning living environment and its improvements from the European Survey "Keeping the Elderly Mobile: technology to meet
their outdoor mobility needs" developed among three countries (Italy, Finland, Germany).

We examine the following variables: means of transport to reach important services, services available in the housing area, difficulties when reaching for services, reasons for difficulties to reach for services, insecurity when alone in the area around the house and the cause of insecurity.

We considered also four demographic variables: sex, age, residential areas and countries. They are used to design the survey and they represent the basis on which we have analysed the environmental variables to discover the possible differences among the three European countries.

The multiple correspondence analysis was employed to provide a method for examining the relationship among the variables. This multivariate statistical technique is an exploratory approach that converts a data matrix into a particular graphical display of points in a multidimensional space, and identify the association structure of the data.

The correspondence analysis makes easier the description of categorical data and it allows to identify the underlying structural model of them. It is a technique with which it is possible to find a multidimensional representation of dependence among the variables, it is able to identify the association and the complex interactions among them suggesting which main effects and interactions are to be into account in the model. It is based on decomposition of the association in order to find latent factors which are a smaller and more manageable multiple-variables set and represent an expression of the observed variables.

The analysis assume as hypothesis a geometrical rather than a probabilistic model that maximise the distances among the points that represent the coordinates of the variable in a multidimensional Euclidean space. It tries to measure any indications of similarity, affinity, association or interaction between row and column variables and it finds a low-dimensional graphical representation of them. The plot of the points identifies the association among the variables by the distances from the axis and measures the contribution of each ones to any particular axis.

3. RESULT

We present the results of multiple correspondence analysis in the content of environment and mobility of the elderly for three European Countries: Germany, Italy and Finland.

Fig. 1 shows the transportation mode when reaching for food store and doctor. We chose to analyse these two services because we believe that are basic for the elderly and they could be a good indicators of mobility.
On the right part of the graph we find males aged from fifty-five to seventy-four near car as driver and moped for food store and doctor. In the left part of the graph there are older females near car as passenger, taxi and driving services, while females aged from sixty-five to seventy-four are near bus for food store and doctor. It means that sex and age are associated with transport modes, in particular men used car as driver for reaching food store and doctor while females drive less because they use car as passenger and other public transport mode. The outcome is the same for the three countries in fact we can note that the towns combined with the residential areas are in the centre of the graph near the zero point.

People who uses the bicycle to reach the basic services are in the top of the graph far from the other variables, it indicates that it is a particular transport mode of few people.

Fig 2 analyses the difficulties when reaching for food store and doctor.

The graph shows that females aged seventy-five and over say that have difficulties or don't go at all, while the younger women and males don't have any difficulties. Ancona and Jyvaskila are the towns that are near the difficulties especially: the centre and internal area of Ancona, the internal area and outskirts of Jyvaskila and the outskirts of Mannheim.

Finally we have examined the reasons for difficulties to reach for service. Fig 3 shows the results of multiple correspondence analysis for the three countries.
Fig. 2 Difficulties when reaching for food store and doctor

We can see that females aged seventy-five and over say that the main reasons are: health, bad road conditions and bad connections, while the younger groups of age independently from sex say that the main difficulty is no parking. As we noted in the previous graph there are certain areas like:
the internal area and outskirts of Chemnitz and the centre of Jyvaskila that, even if are associated with no difficulties to reach for services, reveal some problems of parking underlining by the younger people. The last plot concern the insecurity when alone in the area around the house and causes of insecurity (Fig. 4).

**Fig. 4 Insecurity when alone in the area around the house and causes of insecurity**

The graph shows that all the residential areas of Jyvaskila are very secure. The centre and internal area of Mannheim and the outskirts of Chemnitz area associated with quite insecure and very insecure with the majority of the causes of insecurity, especially: dangerous crossing, dense shrubbery and to be mugged in daytime. The people that say these causes of insecurity are namely females aged seventy-four and over. All the residential areas of Ancona, the outskirts of Mannheim and people aged fifty-five-sixty-four are associated with quite secure.

In conclusion we want point out that it could perform a comparative study in sociological research using a multivariate statistical approach like multiple correspondence analysis. In this way we can better understand the role of modalities in variables interaction and can get an analysis that could reveal the interesting pattern of responses among the groups.

4. REFERENCES

Methodological and statistical approach in the study of environment and mobility of the elderly


23.

THE LOCAL ENVIRONMENT AND THE ELDERLY: GENERAL ASPECTS AND RESULTS OF A EUROPEAN PROJECT

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Isto Ruoppila
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1. INTRODUCTION

Although outdoor activities and mobility are important prerequisite for health in old age, it is well known that they decrease with increasing age, when, in different ways and at different times, the individual loses both physical and mental functions.

Losing ability to participate in outdoor activities can create a vicious circle of immobility, implying that an important stimulus for the elderly to remain active has gone: passivity affects health which in turn might induce still greater isolation and passivity (Passuth & Bengstone, 1988).

A decreasing mobility can be seen not only as the result of an impairing status emerging with age but also as a gap between person and environment. In fact, disability is not inherent in a person, but comes from a relationship between a person and her/his environment (Verbrugge & Jette, 1994).

Environmental obstacles can create serious barriers to social activities and everyday life of the elderly person. Although it is difficult to find standardised measures developed to evaluate objective environmental quality; some aspects of the objective environment can be clearly characterised as desirable or undesirable. (Lawton, 1983). In the perspective of outdoor activities of elderly people, we assumed that the optimum environment should have characteristics, which promote independence of activities (Fozard & Popkins, 1978).

The following work was conducted using the database of the European Survey “Keeping the Elderly Mobile: technology to meet their mobility needs” developed among three countries in the framework of COST (European Co-operation in the Field of Scientific and Technical Research) A5 “Ageing and Technology”, and concerns some characteristics of the living environment of four samples of elderly people living in the towns of Jyväskylä, (Finland),
2. PRESENCE OF SERVICES IN THE LIVING AREAS, MAIN TRANSPORT MODES, SATISFACTION

In order to maintain participation in the daily life of the city, proximity of the everyday commercial and social facilities is extremely important for the elderly person.

In general there is a diffused presence of facilities and services, which are accessible in about 15 minutes.

With regard to the main transport modes the table displays only the first two higher percentages for each service and country. We can see that the first option is always on foot, while the second option is often car as driver with the exemption of Chemnitz, where there is a diffused use of public service, and Ancona, where the respondents go to the doctor and post office by car as passenger.

In Jyväskylä elderly people are less likely to go on foot.

The mean level of satisfaction with services and facilities of the living area expressed by the elderly in each country was rather high; nevertheless there is a significant difference with regard to the residential areas. In fact the mean level of satisfaction related to the outskirts was lower than the other ones for all the four towns. The variability depends on the residential area and not on age.

3. SOME CHARACTERISTICS OF THE HOUSES WHERE ELDERLY PEOPLE LIVE

Sometimes the characteristics of the house/apartment can create a vertical distance to the full use of the local neighbourhood.

The most diffused type of houses among the elderly of our samples is the blockhouse, while detached houses and row houses are less diffused. For this reason we were interested in analysing the presence of the lift especially at the upper floors. There are many apartments without a lift also at the upper floors.

In particular, in Mannheim 84% of people live at 3-5 floor without a lift. On the contrary, in Jyväskylä the percentage is only 18%.

The last table shows that there are many people in the group of age of 75 and over living at the 3-5 floor without lift. In Mannheim and Ancona the percentage is high, equal to more than 50%.

4. CONCLUSION

These results affirm the impression that in these middle towns one can find a good compromise between the presence of services and their proximity.
In fact the mean level of satisfaction with services and facilities of the living area expressed by the elderly is high in each country. With regard to the presence of vertical barriers, it is important to underline that there are many apartments without a lift also at the upper floors. Moreover, many elderly aged more than 75 are living in this condition in the four towns. Those persons are probably at risk of immobility both caused by age and environment.

5. REFERENCES


## Table 1  Presence of facilities and services in the residential area and main transport modes

<table>
<thead>
<tr>
<th>Facility</th>
<th>Food Store</th>
<th>Doctor</th>
<th>Bank</th>
<th>Post Office</th>
<th>Park</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jyväskylä</strong></td>
<td>93%</td>
<td>67%</td>
<td>74%</td>
<td>84%</td>
<td>97%</td>
</tr>
<tr>
<td>on foot</td>
<td>66%</td>
<td>42%</td>
<td>57%</td>
<td>70%</td>
<td>97%</td>
</tr>
<tr>
<td>car driver</td>
<td>15%</td>
<td>20%</td>
<td>11%</td>
<td>16%</td>
<td>-</td>
</tr>
<tr>
<td>other</td>
<td>19%</td>
<td>38%</td>
<td>32%</td>
<td>14%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Chemnitz</strong></td>
<td>97%</td>
<td>93%</td>
<td>95%</td>
<td>85%</td>
<td>65%</td>
</tr>
<tr>
<td>on foot</td>
<td>79%</td>
<td>75%</td>
<td>74%</td>
<td>73%</td>
<td>92%</td>
</tr>
<tr>
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<td>13%</td>
<td>13%</td>
<td>3%</td>
</tr>
<tr>
<td>other</td>
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<td>9%</td>
<td>13%</td>
<td>14%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Mannheim</strong></td>
<td>92%</td>
<td>89%</td>
<td>94%</td>
<td>98%</td>
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<td>67%</td>
<td>70%</td>
<td>73%</td>
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<tr>
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<td>13%</td>
<td>9%</td>
<td>8%</td>
<td>10%</td>
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<tr>
<td>other</td>
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<td>26%</td>
<td>24%</td>
<td>22%</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Ancona</strong></td>
<td>98%</td>
<td>86%</td>
<td>74%</td>
<td>89%</td>
<td>76%</td>
</tr>
<tr>
<td>on foot</td>
<td>72%</td>
<td>52%</td>
<td>79%</td>
<td>70%</td>
<td>97%</td>
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<tr>
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<td>14%</td>
<td>24%</td>
<td>16%</td>
<td>15%</td>
<td>-</td>
</tr>
<tr>
<td>other</td>
<td>14%</td>
<td>24%</td>
<td>5%</td>
<td>15%</td>
<td>3%</td>
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</tbody>
</table>
The local environment and the elderly

<table>
<thead>
<tr>
<th></th>
<th>0-2 floor</th>
<th></th>
<th>3-5 floor</th>
<th></th>
<th>&gt;=6 floor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with lift</td>
<td>without lift</td>
<td>Total</td>
<td>with lift</td>
<td>without lift</td>
<td>Total</td>
</tr>
<tr>
<td>Jyväskylä</td>
<td>49%</td>
<td>87%</td>
<td>51%</td>
<td>92%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Chemnitz</td>
<td>27%</td>
<td>39%</td>
<td>73%</td>
<td>106%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Mannheim</td>
<td>10%</td>
<td>16%</td>
<td>90%</td>
<td>150%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Ancona</td>
<td>20%</td>
<td>53%</td>
<td>80%</td>
<td>213%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3 Presence of the lift in the block houses by floor of the apartment
### Part 2: Environment: accessibility and traffic safety

**Table 2** Level of satisfaction with services and facilities of the living area by area for each participating country

<table>
<thead>
<tr>
<th></th>
<th>Centre</th>
<th>Intermediate</th>
<th>Outskirts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean ± s.d</td>
<td>mean ± s.d</td>
<td>mean ± s.d</td>
</tr>
<tr>
<td>Jyväskylä</td>
<td>7,9 ± 1,2</td>
<td>7,0 ± 1,8</td>
<td>7,0 ± 1,9</td>
</tr>
<tr>
<td>Chemnitz</td>
<td>7,3 ± 2,7</td>
<td>7,9 ± 2,0</td>
<td>6,4 ± 2,3</td>
</tr>
<tr>
<td>Mannheim</td>
<td>8,5 ± 1,8</td>
<td>7,3 ± 2,7</td>
<td>6,7 ± 3,2</td>
</tr>
<tr>
<td>Ancona</td>
<td>8,0 ± 1,7</td>
<td>7,0 ± 2,8</td>
<td>6,7 ± 1,3</td>
</tr>
</tbody>
</table>

ANOVA $F=20.76$ $p<0.0001$

**Table 4** Persons who live at 3-5 floor level of a block house without lift by groups of age

<table>
<thead>
<tr>
<th>age</th>
<th>55-64</th>
<th>65-74</th>
<th>&gt;=75</th>
<th>Total</th>
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<tbody>
<tr>
<td>Jyväskylä</td>
<td>19,5%</td>
<td>39,0%</td>
<td>41,5%</td>
<td>100%</td>
</tr>
<tr>
<td>Chemnitz</td>
<td>39,7%</td>
<td>23,3%</td>
<td>37,0%</td>
<td>100%</td>
</tr>
<tr>
<td>Mannheim</td>
<td>25,6%</td>
<td>20,9%</td>
<td>53,5%</td>
<td>100%</td>
</tr>
<tr>
<td>Ancona</td>
<td>18,3%</td>
<td>29,0%</td>
<td>52,7%</td>
<td>100%</td>
</tr>
</tbody>
</table>
24.
ELDERLY PEOPLE IN ROAD TRAFFIC: A PILOT STUDY

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1. INTRODUCTION

Due to the growing proportion of elderly people in the total population, the percentage of elderly road users will increase considerably in the near future. At the same time a growing need for mobility among elderly persons can be observed. Two important questions arise: Which effects of the elderly’s specific mobility behaviour on road traffic should be expected and how will elderly people in particular cope with the changing demands of future road traffic?

The problem focussed on here is how to keep the elderly mobile. Thus, the second question is of particular interest. Which factors support elderly people’s continuing outdoor mobility? Which factors contribute to the maintained competence of elderly persons to drive a car and are responsible for elderly drivers’ strategies to compensate for age-related limitations (see also Rudinger, in this report)?

These are some of the questions, which arise. The research project „Elderly people in road traffic“ (AEMEIS), poses - among others - these questions.

This study investigates the mobility behaviour of elderly people: In which way and how frequently do they participate in road traffic? The Federal Highway Research Institute, Germany sponsors it. Although different groups of elderly persons (e.g. pedestrians or cyclists) are of interest, the focus is on licensed drivers. This study is conducted in continuation of a project which investigated the life situation, attitudes and mobility behaviour of elderly people in road traffic in the mid-eighties (Hartenstein, Schulz-Heising, Bergmann-Gries, Kraüß, Rudat and Smid, 1990).

2. OBJECTIVES OF THE PROJECT AEMEIS

The main objectives of this project are to
- identify factors that influence elderly people’s outdoor mobility, their decisions on driving and their compensatory behaviour
- collect basic statistics of elderly people’s use of public transport and driving behaviour (e.g. amount of driving, frequency of driving)
Elderly people in road traffic: A pilot study

- estimate the way and frequency elderly people will participate in future road traffic
- develop group specific traffic-safety measures aimed at improving elderly's outdoor mobility and reducing vehicle crashes
- develop a scenario of future road traffic focusing on the role of elderly road users
- increase elderly's quality of life by supporting an independent and mobile ageing

3. A HEURISTIC MODEL OF BEHAVIOR IN ROAD TRAFFIC

We propose a heuristic model of traffic behaviour (Figure 1).

Figure 1: A heuristic model of behaviour in road traffic

This model is based upon the underlying assumption that the individual mobility behaviour (of young and elderly persons) is determined by different individual and environmental factors (e.g. Holte, 1994). Within this model, concepts with significant impact on the behaviour of an individual in road traffic are summarised in different levels around the centre. This model serves different purposes. First of all, it helps to structure the extensive field of important concepts influencing individual mobility behaviour. Second of all, it provides a theoretical framework for the process of selecting the constructs. This was important for the development of a special research instrument (the questionnaire). Keeping our objectives in mind, the model
provides a framework to determine which concepts should be considered in the study, and which ones could be excluded.

This descriptive model offers a general structure but says nothing about the causal relationships between the different concepts. One of the aims of the project is to specify the causal relationships between the concepts.

The different levels of the model represent constructs that have been identified as being important in the context of outdoor mobility of elderly people, with a focus on elderly drivers. These are also the concepts that we are currently studying. (see also Figure 1):

(1) **Behaviour in road traffic**

basic statistics of elderly people’s use of public transport and driving behaviour (e.g. amount of driving, frequency of driving)

(2) **Traffic-related affective, cognitive and behavioural characteristics**

- risk perception (‘state’)
- risk taking (‘trait’)
- perceived driving competence
- attitudes (e.g. toward public transport)
- mobility needs

(3) **Traffic-related demographic characteristics**

- vehicle ownership
- driving licence
- travel aims
- accessibility of a car
- alternatives to driving (e.g. using public transport)
- living area

(4) **General affective, cognitive and behavioural characteristics**

- (self-perceived) health
- life satisfaction
- self-efficacy
- social network
- subjective age
- sensation seeking
- lifestyle
- (self perceived) psycho-physical skills

(5) **Sociodemographic structure**

- age
- gender
- education
- employment status
Elderly people in road traffic: A pilot study

- income
- region
- marital status

4. THE PHASES OF THE PROJECT

A representative study with a sample of 2000 persons (55 years or older) was conducted between May and July 1998. For this survey, a comprehensive questionnaire was developed and evaluated in two pilot studies.

The first pilot study ran from August to November 1997. The main objective was to get information about the handling time of the scales and possible problems in understanding the items and instructions. Detailed interviews were conducted with 20 subjects who were 56 to 73 years old. The results of this first pre-test lead to a revision of the questionnaire.

The second pilot study started in December 1997 and ended in March 1998. The main aim was to analyse the structure and the quality of scales and items. After having conducted interviews with 107 licensed drivers (55 to 82 years old), factor analyses and reliability analyses were conducted to test the quality of scales and items. Multivariate analyses (such as Cluster analysis, ANOVAs) were applied for the purpose of validity. These empirical results lead to further modifications of the questionnaire.

5. THE DATA: TWO PERSPECTIVES

The main study is not yet finished. This is one of the reasons, why it is not possible to report final results in this paper. Nevertheless two different perspectives should be mentioned which were chosen to analyse the relationships between the significant variables which influence elderly people’s outdoor mobility.

The first perspective allows analysing the causal network of influencing factors. What are actually the relationships between the factors that influence elderly people’s outdoor mobility and traffic behaviour? For example, what sociodemographic and psychological factors are associated with the driving behaviour of elderly?

This perspective is chosen frequently in traffic research studies. This is not the case with the second perspective: This could be called a segment specific approach. According to this approach, an appropriate question would be: Into which homogeneous subgroups can the heterogeneous group of the elderly be divided? To give an example: How could elderly people be characterised who have a positive attitude towards public transport?

It is very important to bear this second perspective in mind, since ‘the elderly’ are a very heterogeneous group - and this is particularly true for the very old. So it is essential to distinguish between homogeneous subgroups. This helps to identify and understand the different mobility needs, driving behaviour and
compensatory strategies of the elderly.

Two advantages of the segment specific approach should be mentioned in particular:

This perspective allows to

- **quantify** the size of the different homogeneous groups of the elderly (How many people are actually parts of each subgroup?)

- **identify „social addresses“**: i.e. the knowledge about the characteristics of the different groups of the elderly can be the basis of the development of group specific measures to improve the traffic safety and outdoor mobility of elderly people

In the AEMEIS project the *lifestyle* concept was chosen to identify homogeneous groups of elderly. Other basic variables may also be suitable to identify homogeneous subgroups, e.g. *life situation*.

6. **HYPOTHESES AND CONCLUDING REMARKS**

To illustrate the different levels of hypotheses, which are investigated in AEMEIS, some of these hypotheses are briefly described.

1\(^{st}\) Hypothesis
The self-perceived health status is a significant predictor for a change in driving habits (e.g. less frequent driving, shorter trips, avoidance of demanding traffic situations).

Apart from these monocausal relationships, the significance of this (and the other) concept(s) will be examined within a *network* of influencing factors (using multivariate analyses).

2\(^{nd}\) Hypothesis
The heterogeneous group of elderly people can be subdivided into homogeneous groups on the basis of different lifestyles. These groups differ with regard to several significant aspects of their mobility behaviour.

For example: Elderly people who are intellectually interested and socially active drive more often in general and more often in demanding traffic situations (such as heavy traffic, bad weather conditions, darkness) than those who are rather indifferent and passive.

3\(^{rd}\) Hypothesis
The *subjective age* accounts better for differences in the self-perceived psychophysical skills, the risk perception and the frequency of driving than the chronological age.
In the literature on gerontology and developmental psychology we find much evidence for the diversity of the ageing process and for strong individual differences concerning the competencies, activity levels and cognitive and intellectual functioning of elderly people (e.g. Kruse and Rudinger, 1996). Nevertheless, most research studies in the field of traffic sciences still use the chronological age instead of also considering more significant variables such as the subjective age. Another gerontological research project of our department (which was called „Images of old age/ageing and social structure”) developed a highly reliable and valid scale of subjective age, consisting of six items. This scale is also applied in the AEMEÏS project.

Without reporting concrete results, it should be mentioned that supporting evidence was found for all hypotheses in the empirical results of the second pre-test of AEMEÏS. We are now analysing the data of the main study.

As has been mentioned above, the project „Elderly people in road traffic“ is trying to approach a multidisciplinary perspective, integrating (socio)demographic, traffic-related, psychological and sociological perspectives and constructs. It is worth thinking about the impact and significance that each domain or discipline has in order to understand elderly people’s outdoor mobility needs and behaviour.

7. REFERENCES


FULFILLING NEEDS OF OLDER PEDESTRIANS: A CHALLENGE

Willem Vermeulen
De Voetgangersvereniging (Dutch Pedestrian Association)

1. CONTEXT AND MOTIVE

FEPA, the Federation of European Pedestrian Associations, was able to study the situation of older pedestrians in the framework of the European year of older people (1993). Figures show that walking generally is the most important mode for older people when going out; one quarter to 40% of all movements of older people is done on foot. In cities this percentage is even much higher. Often, walking is the only way for older people to go out independently (without having to ask for help). Shopping, visiting people, or just going for a walk are the main motives of older people, and important ways to remain active and to be in contact with others. Thus, being able to go out on foot should be a basic right for everyone, and this right should be warranted by authorities on every level.

However, there are several factors threatening an independent life as older pedestrian. Most important are:
- traffic rush and unsafety. As we all know, older people are very vulnerable, and more than half of all pedestrians killed are people of over 60;
- lack of good amenities and provisions, stressing older people’s problems instead of solving them. Bad city planning, hampering people’s way to shops or parks, or enlarging distance, difficult crossing situations (great level difference between pavement and carriage way, too short green phase of pedestrian light, too complex situation), lack of shelter and benches, etc. can make a walk through the city a race with obstacles instead of an agreeable experience.
- anxiety for assaults. Older pedestrians feel unprotected, avoid certain places and often stay home in the evening and at night.

FEPA thinks that this situation is not acceptable. For everyone must be able to go out on foot. The Charter for the rights of the pedestrian, adopted by the European Parliament in 1988 states that pedestrians have the right to live in a healthy environment under conditions that safeguard their physical and psychological well-being. Moreover, the elderly have the right to expect towns to be places of easy social contact and not places that aggravate their weakness. Thus, the intentions are there, but practice offers a different picture.

FEPA wants to give insight into the needs of older pedestrians and existing situations in order to show the gap between the two, and offer possibilities to bridge this gap.
2. A WALK THROUGH EUROPEAN TOWNS.

In order to get a picture of the existing situation, a walk with older people was undertaken in several European countries. The problems that older people encountered on these walks are both unacceptable and readily avoidable, often at small costs. We offer an impression:

- very narrow pavements or lack of pavement. This seems to be common all over Europe. Space is first allocated to cars (riding and parking), pedestrians having low or no priority (except for city centres and shopping malls). In our walks, pedestrians were often forced to use the roadway, which they experienced as nasty and dangerous.

- Bad pavement construction and upkeep. This is reflected in holes, pits, puddles, slipperiness, dirt, unevenness of tiles or differences in altitude of parts of the pavement. The consequence is that many more older pedestrians fall victim to bad construction or upkeep of pavement than to collisions with vehicles (at least one in every 150 older pedestrians annually treated in hospital due to accidents on pavements; only one in every 700-1000 treated in hospital due to collision with vehicle).

- Obstacles on pavements, like terraces, scaffolds, advertisement boards, litter bins, stops, traffic signs, or parked cars and bicycles, forcing people on foot to use the carriage-way. The worst of this is that nobody seems to care. Often even illegal parked cars or bicycles are ‘overlooked’ by the police.

- Bad regulation for pedestrians. At traffic lights, pedestrians often have to wait for a long time, and when the light turns green, they may have to face conflict with drivers turning off at the same time. We saw our older pedestrians be frightened at such unexpected confrontation. Also, when green pedestrian light turned red during crossing, our older walkers sometimes had to make an athletic sprint in order to reach the other side safely. Sometimes pedestrians had to wait twice before being able to cross one road (waiting on a uncomfortable traffic island in the middle of the street).

- Lack of crossing provision on the spot where needed. Crossing provisions for pedestrians seem to be adapted to the needs of vehicle traffic, which means that they are mostly provided at intersections where vehicles meet. But often the logical pedestrian route was not on that spot. However, of course the older pedestrian wants to cross on the place where his or her route goes. Why should he or she make a detour in order to reach ‘provided’ crossings? It learns us that most designers do not think about pedestrian routes or a pedestrian network.

- Disobedience of traffic rules for the benefit of pedestrians by drivers and riders. This was most dramatically shown at zebra crossings, where many drivers did not show intention to stop for older pedestrians wanting to cross. It is known from research that the willingness to stop for older people is generally low, because drivers think that older people have all time of the world. Also turning vehicles often did not stop for pedestrians walking straight on.

- Lack of amenities like benches, litter bins, escalators or lifts when bridging altitude, provisions for people with a handicap, shelters at bus
Part 2: Environment: accessibility and traffic safety

stops, etc. If such amenities were present, they were often not logically situated, or badly maintained.

- Surroundings, amenities and public buildings breathing an ominous atmosphere. Especially in city centres pedestrian tunnels may be threatening. Some buildings or built environments are not constructed on 'human scale', evoking feelings of alienation. Lack of supervisors, or just other people in the street, especially those of similar age, gave people a feeling of needing to be alert all the time. Buildings which are partly demolished or neglected, evoke a feeling of being in a hostile environment.

- Lack of information. Often pedestrian finger posts were simply not present or not consequently repeated. There was a real chance of getting lost.

The walks were very instructive. Essentially, we were looking at a collective failure of our planning and providing for people. It is necessary to study this phenomenon, in order to tackle the problem.

3. AN AGENDA FOR ACTION.

The existing situation cannot be accepted. Things really should change, but that is not an easy job to do. We should work on several aspects at the same time:

- Rethink designers and engineers. They simply do not learn how to reckon with pedestrians. FEPA offers information, or some FEPA-members give courses to professionals in order to fill this gap. It may be a challenge to apply the principles of design for cars to design for pedestrians, as a kind of awareness.

- Appeal to policy makers, by showing them the difficulties and problems, but also possibilities. Policy makers just cannot imagine what difficulties older pedestrians meet, because they often do not see themselves as a pedestrian. And if they are pedestrians, they can easily overcome problems like the ones mentioned before. There have been walks with policy makers in several countries, showing them the failures and shortcomings in design, but also good initiatives and positive developments. We can offer a cost-benefit analysis, showing that investing in pedestrian provisions pays, because it keeps people fit and independent over a longer period. And we may convince them by pointing to the electorate that has interest in improvement of the situation.

- Mobilise the people concerning. Nowadays older people still tend to 'blame' themselves for not being able to cope with modern society or traffic. Sometimes they are confirmed to this idea by their own children or other young people. We should make people conscious of the fact that a society not able to provide for well adapted amenities is to blame. And we also should show that actions can have results (people often do hardly believe this fact). So FEPA-members give information to older people how to improve the situation, and especially how to address to the decision makers involved.

- Promote a change in social standards and priorities. Still, too often, the interests of older people are not taken serious by the most powerful ones
in society. Sometimes, older people are even seen as unproductive and demanding. Fortunately, a shift in thinking is perceptible. We do realise that older people form a substantial part of society, be it just by number. But we also begin to experience the problems of too much emphasis on cars and car driving. Governments get more aware of this fact, and try to convince people of the benefits of walking and cycling. Building programs begin to create space for amenities in the neighbourhood of dwellings, or regain living in city centres. Public transport receives more attention. Of course, it is only a modest start, but it offers chances for people on foot.

- Show the public that the needs of older pedestrians match the interests of all. Improvement of conditions for walking is good for everyone, because everyone is a pedestrian. Some groups may seem to profit more, like children, disabled people or people with low budgets. But everyone was once a child, hopes to become old, and can become poor. Thus investing in well provided amenities for pedestrians means investing in the future. Information campaigns may transfer this message.

Working on all these point may really be effective. Some planning may be needed for the short, mid, and long term. FEPA will further this point.
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26.

MOBILITY FOR ELDERLY PEOPLE: MARKET SUPPLY DEVELOPMENTS

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1. INTRODUCTION

In 1996 TNO carried out a survey on the market supply expectations in the field of mobility products for elderly over the next ten years. The research was commissioned by the research unit "Adviesdienst Verkeer en Vervoer" of the Dutch Ministry of Transport.

The emphasis of most research with respect to mobility of elderly people is from the viewpoint of the user (what mobility do elderly want/need, what products can/can't they use, what problems exist in using the current available products,...?). The focus of this study was on the supply side of the market. What products is industry developing for the mobility of elderly? What kind of trends can be expected in the field of mobility? Do these trends include or exclude elderly?

The study was divided in two phases. The first phase focused on the description of the expected developments of the supply of mobility products and their implications for the elderly population. The survey looked into the entire mobility chain, except the pedestrian, whereby the products were categorised in four main fields of attention:

- private transport (car, bike, etc.)
- public transport (bus, train, etc.)
- new vehicle concepts
- new services (information, payment, service-providers, etc.)

The second phase of the study comprised a workshop with experts in the field to discuss the main trends, their effects on the government policy with respect to a sustainable and safe society, and the possible role of the government to stimulate or slow down the expected trends.

This presentation focuses on a part of the first phase of the project, and describes the expected developments over the next ten years with respect to:

- travel information for private and public transport
- driver support systems for private transport by car
- developments in vehicle design
2. TRAVEL INFORMATION FOR PRIVATE AND PUBLIC TRANSPORT

An overview of the existing and/or currently under development systems for travel information is given in Table 1. The table is detailed with respect to:
- the place where the information is addressed (at home, during the trip, inside or outside the vehicle)
- the method of updating the information (static, dynamic)
- the type of transport system (private, public, intermodal)

Most information for the preparation of a trip will be addressed from the home situation. The information serves decisions with respect to the mode of transport, the timeschedule and the route.

During the journey there is a need for information if the trip can be carried out as planned (confirmation information) or what improvisation is needed because of unexpected traffic and/or weather conditions. In case of use of a combination of individual and public transport modes, there is a need for information on the connections, parking facilities, methods of payment, etc.

Static information is information that does not take the actual (traffic) situation into account. Systems which update the information on interval basis like teletext and traffic information on the radio are also considered to be static information. Dynamic information systems include the actual status on (traffic) situations like traffic jams, delays, road obstructions, weather conditions, etc.

Table 1: Overview of existing and/or currently under development systems for travel information

<table>
<thead>
<tr>
<th>Car</th>
<th>Static</th>
<th>Dynamic</th>
<th>Static</th>
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<tbody>
<tr>
<td>In-vehicle</td>
<td>-</td>
<td>route guidance -</td>
<td>-</td>
<td>route guidance teselservice</td>
</tr>
<tr>
<td>Outside</td>
<td>road maps teletext</td>
<td>road maps markings</td>
<td>PC telephone</td>
<td>electronic marking DRIP</td>
</tr>
<tr>
<td>Public transport</td>
<td>In-vehicle</td>
<td>-</td>
<td>route maps stop indication</td>
<td>-</td>
</tr>
<tr>
<td>Outside</td>
<td>timetables PC planner OVR</td>
<td>stop info-box</td>
<td>on-line PC planner</td>
<td>terminal at stop teleservice</td>
</tr>
<tr>
<td>Intermodal</td>
<td>In-vehicle</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Outside</td>
<td>PC planner</td>
<td>markings</td>
<td>PC telephone personnel</td>
<td>PRIP</td>
</tr>
</tbody>
</table>

PRIP - park & ride information screen
DRIP - dynamic route information screen
OVR - centralised public transport travel information service for the Netherlands (tel: 0900 - 9292)
P - personal computer
Especially elderly people need reliable travel information for their comfort and independence (social security). Persons with sensory impairments (deaf, blind) benefit from dynamic information during the trip. Especially in case of delays, platform changes and/or other deviations from the original travel scheme.

Elderly people like to get information inside the public transport vehicle on the next stop, visual as well as auditory. The technology to supply this information is available and also in use in some places. A more general implementation will mostly depend on the ease of retrofitting the existing vehicle fleet with the 'new' technology and/or whether transport companies will include this aspect in the specification list for new vehicles.

In the field of travel information the following developments are taking place:
- The information supply will grow steadily, especially by PC-programs, CD-ROMs and Internet
- Information is more and more dynamically presented (i.e. dynamic route information screens)
- More and more local dynamic information becomes available (i.e. local slippery situations)
- Travel information becomes a commercial product in itself with different service providers that supply user specific information
- Increased reliability of the presented information

The increase of information gives on one hand the opportunity to establish a travel plan that conforms optimal to the needs of the specific elderly traveller. On the other hand it becomes more difficult to make a (quick) selection of the relevant parts out of all the information available. The supply of (dynamic) travel information by service providers will be an attractive alternative for part of the elderly population. It allows for the relative quick realisation of a reliable travel scheme because the information is filtered by an experienced "info-processor" of the service. An advice on appropriate alternatives can be obtained the same way. Important is however that the initiative to get information lies in the hands of the elderly as well as the level of assistance.

Travel information will be more and more supplied by means of PC, CD-ROM, Internet, etc. Although a rapidly growing part of the elderly population is capable of handling these kinds of devices, still the major part is not accustomed with it. For those capable of handling these technologies, the increase of relatively cheap travel information is enormous. For example for the price of approximately 30 ECU a CD-ROM is available with information on the public transport system of Paris and its suburbs. The CD-ROM allows making travel plans with maps, costs and all relevant touristic information of the specific trip. It is expected that this coupling of travel and touristic information will stimulate travelling amongst elderly (as far as they have access to the new technology), especially by public transport in the major cities.

In general elderly need more time to process the information. This is partially compensated by routine and experience. By increasing the dynamic information load, the elderly can less depend on their routine and experience
and therefore need more attention and energy and will be more distracted from their travel task. This can be of importance for car driving especially. On the other hand the supply of reliable dynamic information reduces the uncertainty with respect to unexpected traffic situations and weather conditions like rain and fog. It is also known that elderly relatively easy cancel their intended travel when they become aware of problems during the trip.

The final advantage/disadvantage ratio of the increasing information supply will be mostly defined by the adaptive capacities of the elderly person and the training possibilities he gets to get used to the new technologies, given a properly designed user interface.

3. DRIVER SUPPORT SYSTEMS FOR PRIVATE TRANSPORT BY CAR

In the (near) future several systems will become available to assist the driver with its driving task. The systems can be divided into [4]:

- information systems - give the driver (on request) information that can be easily interpreted and turned into the appropriate action(s). The information can be supplied visual or auditive.

- assistive systems - systems that assists in performing a task that has been started by the driver (i.e. power assisted steering)

- automatically assistive systems - like ABS (automatic brake system) and ASC (automatic steering control) that keep the performance of the vehicle within the response expected by the driver

- automatically performing systems - like AICC (automated intelligent cruise control) that takes over part of the driving task with respect to longitudinal movement of the vehicle

Some important developments in the field of driver support systems are:

**Intelligent cruise control (ICC)**

 ICC systems are under full development. It concerns systems that keep safe distance to the car in front by adjusting the speed of the vehicle. Currently the automotive industry implements only a restricted deceleration. In case firm braking is needed the driver has to take over full control of the task. This might lead to reaction time problems for elderly drivers. On the other hand ICC systems will lead to a more moderate driving behaviour in general (less speed differences between cars) and safer distances between cars. Developments to adjust the characteristics of the ICC to the (physical) abilities of the driver are not spotted in the survey but it is envisaged to be on the agenda in the next 10 years.
Parking aids
Systems using sensors and/or video to give the driver information on the position of the car in relation to the surroundings. The European DRIVE II project EDDIT identified parking aids as one of the important possibilities to assist elderly drivers [5]. Elderly drivers need time to get accustomed with the systems.

View improvement systems
According to the participants of the second Automotive Night Vision and Enhanced Driving Conference in 1996 [3] especially elderly drivers will exert a pull on the market of vision enhancement systems. It should be noted however that the human-machine interface of the systems and the way of presentation of the information to the driver needs full attention, as also stated during the conference. Especially these features are of major importance for the applicability of the systems for elderly drivers.

It is expected that the next 5 to 10 year there will be no reliable telematic systems on the market that can assist elderly with reduced capacities in their direct performance of the driving task. The 'future' generations of elderly however will enjoy the benefits of transport telematic systems. Firstly because they get the opportunity to get used to these kind systems by buying them as attractive "toys" in the period before they are confronted with reducing of capabilities. Secondly because industry will steadily improve the driver support systems over the next years in order to "cope" with the increasing congestion and traffic safety problems in Europe and the United States.

Developments in vehicle design

The automotive industry is aware of the market potential of elderly drivers. Vehicle manufacturers like Daimler-Benz, Fiat, Nissan and Toyota work hard on new concepts for the elderly. Quite logical if taking into account that the average age of a Daimler Benz E-class owner is over 53 years.

Nissan works on vehicle concepts with the focus on the reduction of visual capabilities of elderly drivers [6]. In these concepts attention is given to aspects like:
- the field of view of the driver
- minimising the eye movement between displays and the long distance view during driving
- simple and easy to read displays
- shielding of less relevant displays when not in use

With respect to the physical impairments Japanese vehicle manufacturers focus on comfort during entering and leaving of the car and on adjustments of the seat and headrest.

Vehicle manufacturers recognise the danger of increased workload for elderly when continuously adding different technological novelties separately in new car concepts. Manufacturers will put many efforts in presenting integrated solutions. Therefor it is expected that new technologies will be implemented well balanced.
Most vehicle manufacturers are working on improving the comfort of the vehicle. This includes aspects like in- and egress, chair design, operability of controls and readability of displays. Since elderly usually go one class back when replacing their car, the medium term goal is to implement these comfort aspects in all vehicle classes.

Other areas of interest for the vehicle manufacturers are safety related comfort aspects like:
- automatic operation of the vehicle lights when dark (very comfortable when entering a tunnel or parking garage)
- automatic operation of the wipers if the windscreen becomes wet
- simplified operation of the safety belt (i.e. automatic attachment)

Although the ergonomic and comfort needs of elderly are taken into account seriously in vehicle design, the manufacturers will hardly advertise these efforts. The Fiat Punto is an example of a youthful car with good sales under the elderly population. Vehicle manufacturers are putting increased effort in training their salesman to take more notice of the user needs and his/her physical abilities, linking those to the relevant selling points of the different models. Furthermore several services are under consideration like a special maintenance scheme to ensure the reliability of the car and a training programme for possible problems in usage of the vehicle and/or its (new) components.

4. CONCLUSIONS

Transport related industry is becoming aware of the market potential of the elderly consumer. Although most systems for travel information are technology driven, elderly gives more and more attention to the usability. The increasing information flow gives ground to the development of new services to assist elderly in information handling.

With respect to private motoring the emphasis is currently on the comfort of the driver. Driver assistance systems are under development but not yet suitable to assist elderly with reduced functionality. Much effort is put in the development of integrated solutions to keep the workload for the driver at an acceptable level.

Hardly no attention is given to the development of possibilities to adjust the characteristics of the information / assistance systems to the (physical) abilities of the user / driver. It is however envisaged being on the agenda in the next 10 years.

5. LITERATURE

Part 3: (Public) Transport and new Technologies


AGEING POPULATION - A CHALLENGE TO THE TRANSPORT POLICY

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Introduction
What is the connection between the transport policy and the ageing of the population?

In Finland, the relative and quantitative share of population aged 65 will grow significantly already by 2000 and after that, according to forecasts, continues to grow by 2020. Especially the share of people aged 75 and 85 years will increase significantly. It is estimated that in 2030 already 25 % of Finland's population have reached the age of 65, while this share is now about 15 %.

Most of aged people have health problems which hamper movements. Problems are caused, among other things, by the weakening of perception and muscular strength.

If we consider the age distribution among persons who have been medically defined as severely disabled, it can be seen that the most significant group of them is the aged.

Transport Policy
The research conducted by Professor Ruoppila in the city of Jyväskylä on the possibilities of the aged to move outside their home has been separately presented at this conference. According to the above mentioned research the fact that the aged easily isolate from outside world and are unable to move outside their home could not be considered to be their own choice. On the contrary. The desire of the aged to move is the same as of the ordinary population. The aged wish to get more choices of transport, if they only had means which would facilitate their mobility. According to this research the aged appreciated particularly the opportunity to use a car of their own. I suppose, this enlightens the situation of Jyväskylä's public transport at the moment the research was conducted and the general attitudes of the Finns as well. The conflicts between public transport and private car transport are not as serious as in congested Central Europe.

However, at least in principle, the growth of private car transport is not regarded as a desirable goal of the transport policy. The motoring of the aged may become less important also due to their weaker financial situation compared to the rest of the population. It is clear that the eldest are no longer able to drive. Consequently, several reasons speak in favour of the significance of public transport services.
In December last year the Ministry of Transport and Communications has issued the Guidelines for Transport Operations until 2020 which are intended as a basis for long-term planning and development of the transport system. The purpose of the guidelines is to bring out basic aspects of the basis on which transport shall be developed until 2020. Transport decision-making shall, more and more, take into consideration the development and objectives of the whole society. The transport system shall be planned and developed as part of society as a whole, covering all modes of transport and as co-operation between various parties.

The guidelines map out the eight most important challenges to the transport policy. One of the most important challenges is the ageing of the population.

The ageing of the population concerns the general development of public transport, transport safety and the improvement of the conditions of light transport, i.e. bicycle and pedestrian transport, as well as the structure planning.

Thus the ageing of the population is significant from the viewpoint of the whole transport system. However, as an important challenge it was brought out only recently. Is it a new thing then? Has attention been paid earlier to the special relation between the aged and transport?

The answer is yes and no.

Traffic safety
From the viewpoint of transport safety, emphasis has already for long time been put on the quality of life of the aged. The aged - as well as, for example, children - have been seen as vulnerable road users. Consequently, the consideration of their traffic safety has been of vital importance. Particularly, efforts have been made on the improvement of their safety as pedestrians and cyclists. It was only recently that attention was paid also to the special problems of aged drivers. For example, special training has been organised for aged drivers.

The promotion of the safety of the aged has aimed at avoiding traffic accidents. In traffic accidents one suffering party is always a moving vehicle used in road transport. Cases in which a pedestrian slips or falls on the street or bus stop or looses his balance when getting off a bus or vehicle are not regarded as traffic accidents. As a matter of fact, there are no statistics compiled on these cases as traffic accidents. We can ask whether all necessary has really been done to prevent these accidents? In practice, the danger of slipping or falling may be one of the main reasons that places restrictions on moving outdoors.

In Finland, actions ensuring the safety of road traffic are regarded as the real traffic safety work. Road traffic safety is improved in many ways, particularly, by legislation, enlightening, and research.

As far as other transport modes are concerned, for example a situation when an old person falls from train or slips on a train trap, the responsibility and
Public Transport
But what about public transport policy? Is the consideration of the ageing population a new thing in public transport policy?

The answer is of course- no.

As a matter of fact, the mobility of the elderly has been focused for several years at international and national levels. The European Conference of the Ministers of Transport (ECMT) has already for over ten years paid attention to the fact that the needs of customers - particularly those of the disabled and elderly - shall be put at the centre in society. Ministers of Transport have committed to this objective through several resolutions on various transport modes. The Commission of the European Communities has also made efforts to further the consideration of these needs, e.g. by issuing the first Green Paper on the development of public transport, i.e. Citizens' network. It emphasises the flexibility and accessibility of public transport. The proposal of the Commission for the Directive on buses includes the user-friendliness as an essential part of the Directive. Research activities in the field are supported by the Commission as well.

In Finland, Act on Passenger Transport is amended so that it emphasises the obligation of municipalities to take into account the needs of the elderly, disabled and children in the design of public transport services. Currently, there seems to be a boom of low floor buses and service routes in Finland. Railways are introducing new low floor equipment. Under the guidance of the Ministry of Transport and Communications the future of the transport information services are being considered and efforts are made to create travel centres to facilitate the change from one vehicle to another.

But- even if some progress has been made there is still a need to convince that accessibility is an important issue. The market for accessible services is large. And the ageing population is a much more extensive question than generally understood. The aged should really have as equal possibilities to move as other citizens. It is not enough that journeys, for example, to a health centre are being ensured.

In Finland public transport is traditionally being operated mainly by private enterprises. Only the three biggest cities have municipal transport administrations of their own. The autonomy of municipalities is also emphasised.

One must also remember that it takes time to chance old attitudes based on transport policy carried out yesterday.

Special Transport Services
In Finland until recent years efforts were put mainly on maintaining public transport services and not so much on the attractiveness and quality of public transport while the special legislation on social welfare and public health service gave (and still gives) those elderly that had problems with their
mobility the possibility to use taxis at a reasonable price.

The possibility of the elderly to use taxis have depended -except those trips subsided by the National Insurance Institution- on the financial conditions of the elderly themselves and their residential municipality. These trips have been mainly paid by the social welfare and health care administration of municipalities. It is simply a question of special transportation mainly with taxis.

It has been typical for the Finnish transport system to use taxis, both minibus-type with equipment and ordinary passenger cars, for journeys subsidised by society as well as for ordinary taxi transport.

The important advantages of taxi services have been door-to-door transport, subsidised prices, equipment suitable also to the severely handicapped as well as good service. The service may include also assistance before leaving home for journey, for example, raising from bed and dressing. Other services, for example the delivery of meals to the elderly, have been added to taxi services, particularly in rural areas.

It is clear that the special transportation system based on taxis cannot solely ensure transport services required for ageing people.

As a matter of fact, elderly people have exactly the same needs to travel as others - they also want to travel more often or farther off than the municipality he or she lives in - even by air or train. Secondly, travelling individually by taxi is always expensive even within a municipality - if not to a traveller, but to society.

Besides, in recent years an increasing number of elderly people have been left even without these services. Many elderly people have realised to be in a so-called cleft stick. New legislation on the services for the disabled entered into force in 1992 obliging municipalities to arrange for severely disabled inhabitants - irrespective of their financial situation- not less than 18 one way journeys in a month, in addition to all journeys necessary for work or study. But just for severely disabled people. While the rights of the severely disabled were secured by this, other groups were ignored. To follow the strict legislation in favour for the most disabled people the municipalities started actually to reduce journeys of others. Since there were no obligatory rules on these. Thus, many such old people whose taxi journeys had earlier been compensated by municipalities, were left without any transportation. The strict legislation solely on the rights of the disabled, progressive in itself, reduced in practice the mobility possibilities of many elderly.

So, there was something wrong with the system.

The quality of public transport
Now - for many reasons- more and more emphasis is put on the development and quality of public transport, and not solely on maintaining services. The importance of the accessibility and user-friendliness of public transport has been better understood also outside Helsinki (where the City
Council has made a principal decision on accessibility.

From the point of view of the operators accessibility can be seen as one of the most important quality factors in the competition with private car. From the point of view of the customer it can be seen as a question of civil right and better convenience.

For operators the main motive is, naturally, the idea of good business. They want to get more paying customers in general by developing the quality. Best quality can only be reached if the weakest link has been taken into account.

The increase in the number of low floor buses is a result of many things. The Ministry of Transport and Communications has supported this idea in many ways and also financed the purchase of such equipment for certain time in order to facilitate the transport of the elderly and the disabled. At the same time the operators found this kind of bus as a new, good-quality product. The low floor bus gives an enterprise a new image and attracts new customers. According to the surveys taken place in Finland, the low floor buses have been met with pleasure, particularly among aged travellers and those moving with children. This does not, however, mean that the low floor bus of the first generation would be perfect. There is still something to improve, for example the location of seats and handrails.

It may sound conflicting, but from the viewpoint of aged travellers it has been fortunate that several parties have started to pay more attention to the cost efficiency of transport operations. It has been the elderly who have gained advantage from new applications.

Cost effectiveness
So, quality is one key word when you discuss with the operators. Cost effectiveness is another key word.

The cost efficiency has increased by the low floor bussystem and new service routes. In cities transport operators have realised that the low floor buses can, among other things, reduce the time spent at stops. In the state administration the costs for the special transport with taxi have been put under a magnifying glass.

Service routes and demand responsive systems
The introduction of totally new public transport modes in Finland, i.e. service routes and demand responsive service, is related just to the marketing of this idea - new cost efficiency. The emphasis on economy and new technology has, for one reason or another, been able to change a lot.

Service routes are now in use in several regions. Initially service routes are a Swedish idea. The idea is the following: Vehicles, routes and services are designed to serve extremely well the elderly and other persons with reduced mobility, for example those moving with prams. Service routes, however, can be used by anyone. Therefore, in Finland they are regarded as part of ordinary public transport. The vehicle used for this purpose is generally a
small low floor bus. The driver has been trained for this task and can assist travellers, for example to carry their bags. The route is designed so that the bus stops at places which are the most important for the elderly, i.e. residential areas where several elderly live, city centres and at health centres. Some service routes can deviate from their routes if needed, for example to leave a traveller at his home door.

In last years also new demand responsive applications that are even more flexible than service routes have been initiated in Finland. Under the guidance of the Ministry of Transport and Communications new technology was studied European-wide under the so-called Sampo project. The special feature of these experiments in Finland is that bus and taxi operators have participated in them. In other countries experiments were limited in the domain of bus transport. These new demand responsive services are now used in different parts of Finland. In practice, the system operates so that a customer orders by telephone a small low floor bus or a shared taxi either to a stop or home. He or she calls to the Travel Dispatch Centre (TDC) in the same manner as he/she is used to call an ordinary taxi. The travel dispatch centre is able to route and locate a car and to send it to a right address. If a traveller is disabled or needs some help to carry the bags the driver can assists him the same way as in service routes. Since the service is a part of normal public transport and open for everybody the customer shares the journey with others, for example with schoolchildren or those going to work.

Service routes and demand responsive services have recently been studied in Finland. The results are interesting. Above all, the elderly seem to have gained from these services. It is the elderly whose mobility chances have been the worst, because municipalities have not been willing or able to arrange special taxi services. Those who have problems with their mobility but who cannot be regarded as severely disabled. These new services have been the only chance of moving for many elderly. They seem to appreciate these new services very much. These services have increased their mobility chances and - what is very important- also their possibilities to make acquaintance with new people of their own age group and other permanent bus travellers, and thus given new contents of life. These new services have clearly increased the life quality of the elderly.

The research made by Professor Ruoppilas group concerned the city of Jyväskylä. At the moment the research was conducted, there were no service routes in use. However, Jyväskylä was one of the first cities in Finland which introduced the service routes. I have personally made acquaintance with them. The bus was crowded by the most cheerful elderly people who convinced me for several times that the introduction of the bus was the best thing that has happened in Jyväskylä for many years.

It is also interesting that several demand responsive services have more and more started to attempt also young drivers to leave their cars at home and travel to work by bus.

These new services can be seen as a big step towards a more user-friendly public transport system. However, the challenge of the ageing of the
population requires much more to be done.

In order to convince the elderly that public transport is a good choice the work has to be continued to improve the quality and accessibility of public transport in all transport modes. It is not enough that bus and taxi transport within municipalities is developed. It is not enough that new services within municipalities are developed. There should also be some kind of door to door services even for the long distance transport- better feeder transport systems, better information and ticketing systems etc.

And to create these services standards are needed. For example, in Finland, we talk a lot of the idea of travel centres. The travel centres are designed in order to facilitate shifting from one vehicle of public transport mode to another. The idea of a transport terminal that combines various transport modes is supportable in every respect. In order to get the real benefit for the elderly, designers must have exact standards and information of the facilitates needed. In the case of travel centres in Finland at least both the mandatory requirements for accessible buildings and the guidelines for travel centre design should be followed.

Need for basic support of mobility

More information about ageing is required. In the transport sector only the removal of level differences and the idea of low floor are really more extensively understood. It is realised that ageing makes it more difficult to go up the stairs. But there are, however, other factors related to ageing. For example, maintaining the balance may be difficult. Therefore, good handrails are important in buses. A person with reduced mobility is not able to go long distances without resting-places. Floors should not be slippery. The weakening of sight requires better lightening and clearer guidance. One should keep in mind that information must be given in various forms, due to the different needs. At the moment different real-time information systems are developed all over Europe. They can make a journey more pleasant for travellers who have no sight problems. The mobility of persons whose hearing has got worse is facilitated with information boards and monitors. However, one-sided development of information (especially if no attention has been paid to the size and colour) based only on sight is a big problem to persons whose sight is weaker. The significance and further development of announcements, portable devices and personal assistance should not be forgotten.

Recent studies in Finland have demonstrated that both the young and the elderly passengers wish to receive information in several different forms. All passengers value the human factor and, in general, personal service is appreciated. At least the biggest public transport terminals should have information points providing personal customer service and guidance. It shall be noticed that providing passenger information does not only mean the traditional distribution of information on timetables and prizes but also the quality of the services that is available.

General remarks

Finally one can never point out enough the idea of travel chain. One has to
realise the travelling as a concrete travel chain from the point of view of the traveller. All parts of the travelling chain should be in good condition, accessible and safe so that an elderly or otherwise uncertain person would choose public transport—home environment, streets, bus stops, vehicles (getting on and off as well as travelling), stations etc.

I think that the research results from Jyväskylä reflect the fact that the representatives of the older generations who have lived through the war years, have been even too modest. It has been too easy to ignore them. However, it is not at all certain that they can be ignored in the future. New generations with high education and accustomed to a certain standard of travelling will probably not become as modest as the former generations.
DILEMMAS IN THE INTEGRATION OF ELDERLY TRANSPORT. REFLECTIONS ON THE DEVELOPMENT OF ADAPTED TRANSPORT IN THE NETHERLANDS

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1. INTEGRATION AS A SOCIETAL GOAL

Social integration is a self-evident goal of modern societies. By creating a great deal of openness, of interaction and exchange between segments of society, development is likely to be more harmonious. There is a delicate and always redefined balance between individual and group identity on the one hand and equality, often seen as an essential element of equity, on the other hand.

Demographic processes, both geographical (migration) and biological (ageing) in character, require continuous action with regard to integration. Cultural changes add complexity. In a way these are inherent in migration as well as in ageing: people coming from different (distant) cultures or grown up in a changed culture.

For the elderly there is a danger of disintegration. Not primarily because they have difficulty in following cultural change but above all because their ability to execute daily activities tends to decrease. It implies that their contribution to social life and to the economy is affected and that even independent life will become difficult, which makes them an economic burden. It underlines the importance of policies to maintain the integration of elderly in society, especially when life expectancy is increasing and the birth rate is modest.

2. TRANSPORT AS A MEANS FOR INTEGRATION

Nowadays transport is essential for real participation in activities, for inclusion into social networks, notwithstanding the growing opportunities for telecommunication.

Motorisation, 'automobilisation' has become a dominant feature in individual transport. The ageing people of the present are accustomed to independent car use, not only the male but increasingly the female as well. A decreasing physical or mental ability to drive a car constitutes a danger for disintegration, forcing the user to reduce his action time and space and his
trip frequency. He may have considerable difficulty to change to other means of transport, partly because the options have suffered from general car use, partly because he is (no longer) accustomed to these, partly because they are not adapted to his needs.

3. POLICIES TO KEEP THE ELDERLY (AUTO)MOBILE

There are different strategies to maintain daily mobility. These may be directed towards improving driving abilities (the one extreme) or towards providing protected and accompanied transport, the other extreme: maximum independence versus maximum care.

The possibilities between these extremes are roughly as follows:
- providing driving support systems
- adapting the driving environment, i.e. simplifying the road system
- adapting the infrastructure for other individual means of transport like walking and cycling
- improving access to public transport
- bringing public transport closer
- individualising public transport

One might ask which strategy is the right one. No doubt it has to be a combined strategy. Given the fact that many elderly people are car owners, the first strategy is important: it enables them to maintain their normal behaviour. Improving the opportunities for other kinds of 'automobility' (cycling and walking) provides the elderly with better alternative independent transport modes. For a considerable number of people and especially for longer distances public transport is necessary though.

4. INTEGRATION AS A GOAL IN PUBLIC TRANSPORT

4.1 Access

Public transport has an explicit function for social integration, but it pursues an active integration policy as well. The concept 'public' has in fact two meanings: for the general public and provided or at least regulated by government. Regulation, especially of the service offered (the connections and departures, but fares as well) is a consequence of the function ascribed to it, economically, socially, spatially and (most recently) environmentally.

The branch became unprofitable from the sixties onwards by competition from the motor car. Social motives were important for subsidising it since. Public transport serves as an alternative for those without access to private means of transport, psychically, physically and especially financially. In Germany it is called a 'Daseinsfürsorge', an existential (and therefore essential) provision. It is the primary reason to maintain a minimal level of service, disregarding low passenger numbers.

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In the Netherlands the social dimension was acknowledged during the seventies. The problem was presented elaborately in de Boer 1976 and 1978 e.g. A National Standard (NVS) guaranteed a minimum service on deeply rural lines, the first ones to be withdrawn. The areas concerned are likely to lose other services (like local shops) too. Therefore the community bus was introduced, a volunteer driven line bus connecting small communities with regional centres. This standardised type of public transport is still operative in about a hundred projects. The NVS fell victim to deregulation in the nineties.

Several efforts were made to penetrate deeper into the countryside by professional public transport. Demand responsive services were thought to be the solution. Taxi share experiments, with concepts called ‘bustaxi’ (early eighties) and ‘teletaxi’ (early nineties) were hardly or not successful. It is the explanation why the quest for ‘supplementary public transport’ (in fact door to door transport) by organisations of the elderly and handicapped was lost. Demand responsive line buses, the ‘ringbus’ in English (fixed routes, stops and departure times) were more successful. Nowadays these are operated by cheaper sub-contractors, local taxi firms using mini buses, and called ‘taxiliners’.

4.2 Accessible vehicles

Public transport does not imply automatically physically accessible transport, adapted to the needs of elderly, frail and handicapped people. With regard to vehicles, operators traditionally seem to be mechanically oriented rather than passenger oriented, regarding the organisation of transport sooner as engineering than as marketing. In the case of floor level of buses it meant that mechanical parts were put underneath as much as possible, resulting in vehicles that were highly inaccessible: one really had to climb into them.

Recent decades have witnessed several efforts to introduce more accessible vehicles: wheelchair lifts in trains, kneeling buses, low floor vehicles, the latter ones being important for the elderly in general.

Much energy of interest groups was spent on enforcing the introduction of buses with kneeling devices. They failed to. A demand for lifts in trains led to experiments on a new type of train, the ‘Regiohopper’ or ‘Buffalo’ on one line (Zwolle - Emmen). Later on other trains of the same type were not provided with lifts, and yet these where provided with wheelchair toilets.

Low floor buses were the subject of other local experiments. These yielded positive results, because the low floor enables passengers to get faster into and out of the bus. The innovation is gradually introduced throughout the country. It is likely to be the standard within 10 years.

Most of these buses have a kneeling device and a movable riding plank as well.

4.3 Coming closer with better vehicles; strategies
Following the Swedish concept service routes were introduced in several towns, partly on an experimental basis. For a modest town like Hoogeveen (appr. 30,000 inhabitants) the service routes constitute the only local transit, connecting destinations important for the elderly like old age homes, the hospital and the shopping centre with the railway station. A dense network is served by low floor Danish DAB buses. The interior is more or less standard provided by the factory. Once, when the author took a Hoogeveen service bus, it even had a Danish first aid box titled 'Første Hjelp' in stead of 'Eerste Hulp' in Dutch. Drivers are instructed to give help to passengers who have difficulty in getting on and off board and with seating. They are supposed to depart only when everyone is seated.

In Sweden the concept was quite a success, not only because it brought public transport in neighbourhoods which had no service before, but certainly too because disabled people preferred it above the stigmatising individual special transport services. Therefore it the service routes proved to be efficient.

In the Netherlands the concept spread only slowly until 1994, probably because of better public transport and certainly because there were only modest individual services.

By its nature a service route can offer only a low transport velocity, unless it connects the neighbourhood served and for instance the town centre as an express bus. If not, it is no competition for any kind of private transport, not even for the bicycle. People with limited abilities to participate in traffic (parents with small children included) are the likely users. It implies that the degree of integration is only modest.

### 4.4 Integrating special transport services

The lack of access to private means of transport and the inappropriateness of public transport gave birth to all kinds of special transport for the disabled (like wheelchair minibuses), elderly, pupils and even women.

General inventories of these phenomena are lacking, but the present author has been extensively engaged in matters of accessibility of schools and in efforts to integrate special services into public transport, which make it possible to depict the situation with rough strokes.

Examples of the first are the reorganisation of pupil transport in one of the Dutch provinces [de Boer 1985] and the design of rules for the 'closability' of primary schools [de Boer c.s. 1987], both including manuals. An overview in English of earlier studies can be found in [de Boer 1990-I].

The matter of integration was investigated in studies for the national transport and physical plans, including an elaboration of these with a regional government [de Boer c.s. 1987], [de Boer 1990], [de Boer 1991].

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The inventories made for the author’s studies showed that pupil transport was by far the most important form of special transport, in spite of the fact that country school traditionally are protected. Special education expanded enormously after about 1960, especially with schools for children having behavioural problems (in regional centres) and with very specialised schools like those for children having hearing difficulties (without being entirely deaf), which are to be found in large urban centres. This transport is mostly organised on a collective basis, i.e. pupils of different schools are transported in the same vehicle. Primary schools sometimes have there own minibuses in order to attract more pupils to their school.

Transport for the elderly can take different shapes too. To normal public transport they are attracted by means of a 50% fare reduction. Taxi operators often are offering reduced fares too. Special collective services usually were volunteer based and intended more or less explicitly for less able if not disabled elderly of modest means. Old age homes, nowadays housing people with serious health or mobility problems, sometimes have their own vehicles.

Special services for the disabled irrespective of age were quite rare. The disabled often got an individual provision, either material (like an adapted car) or financial: a taxi budget or simply an allowance. Again institutions for the disabled often organised their own transport, having vehicles too.

The Second National Transport Plan of 1989 proclaimed the ‘integration of public and special transports’ without much quantitative knowledge of the second phenomenon. The Fourth National Physical Plan of some years later chose the ‘mobility option’ for the countryside: the only way to do something for the accessibility of facilities and services was thought to be improving public transport, which by lack of additional means would have to be done through integration with special transports.

The possibilities for real integration were studied intensively in a small region, the south-eastern part of the Province of Groningen. The ideal is integration of both financial means and passengers, to create the most efficient solution. The study showed however, that this was by no means simple. The financial means came from different sources. Minibuses were financed by national foundations, by regional government or by local initiative. Drivers were often staff members of institutions without a formal task in transport or volunteers, driving without a fee. Integration was therefore hardly possible; the means would disappear. One could not imagine taking the provisions be it cars or money, from the disabled. Anyhow, the means involved seemed to be restricted.

The only way to bring about a substantial integration was creating a public transport being able to fulfil the needs of the users. This is easiest for pupil transport, operating on the same regular basis as traditional public transport. Moreover at least the collective transport was financed by local government and therefore relatively easy to be integrated. Yet in the project it did not lead to an integrated transport system of any substance. Most of the pupils of special schools needed door to door transport, which could not be provided
by lack of public transport funds and/or of an operator prepared to take the risk.

In one village, the government centre of a municipality, there was the felt need for a village volunteer minibus for multiple purposes. The bus was provided by regional government. The operating and replacement cost could be covered by letting the multibus take over local pupil transport financed by the municipality. The drivers proved to have difficulties with the few pupils of special schools. Just the same they had difficulties with the transport of elderly to a day treatment centre, elderly that are barely able to take care of themselves any more. They wanted to provide door to door public transport. They were at least embarrassed with this type of passenger and so probably were the few elderly citizens they served.

5. INTEGRATION AS A GOAL IN SPECIAL TRANSPORT

5.1 The general attitude: ideals and economy

The importance of integration and the contribution of transport have been treated in the first sections of this paper. Here we will address the question of aspirations in special transport itself to integrate into public transport.

In general one might say that those who are responsible for this type of transport wish their clients to be integrated as much as possible, taking care of their own business and therefore travelling by public transport as much as possible.

Pupil transport for instance is organised for children who are unable to travel by normal public line transport either because it does not satisfactorily connect their residential area with the school location or because they cannot use it without company. Accompaniment (or a small vehicle) is necessary for children who are defenceless or aggressive, not knowing where to go or being easily distracted from it. The other ones do go by public transport, since the school wants them to be integrated in normal life; going to a special school creates a degree of isolation in itself. The municipality, having to pay ever more for the expensive special transport, while under public pressure to economise, will wholeheartedly support the use of public transport, which its modest fares, thanks to the regional subventions.

Institutions like pensioners homes are most likely to find their transport a financial burden, because the ever increasing need for care per inhabitant makes these even more understaffed than they used to be.

Transport that is intended to make the institution more attractive or that is operating on a volunteer base, will be less easily integrated. For the institutions the segregated transport is attractive, because it can be conspicuous and distinguish the institution form other ones with which it has to compete. Integration may be cheaper but implies the loss of its additional value. Volunteers often render services with a specific ideal of target group in mind. If they have to transport just anyone for whatever purpose they will no
longer participate. Replacing volunteers with professional drivers may meet with resistance too, both from the drivers and the clients. The volunteer drivers often get both a social satisfaction and a financial one from this activity. Some clients may feel more comfortable with familiar drivers from their own social environment than with a professional driver who might be not too fond of the often tiring and time consuming passengers of special transport.

5.2 A revolution caused by European law: the WVG

Until 1994 disabled people could get a transport provision more easily if they were under 65 years of age, than later. In that case their financial circumstances had to be more difficult. Those having a provision could keep it until death. After an appeal to the European court this practice was rejected as age discrimination.

Under the new WVG law (Wet Voorzieningen Gehandicapten = Law Provisions Disabled) the elderly disabled have been given the same rights. The responsibility for execution of the law and the available financial means were given to local government, with the advice to organise collective transport, preferably public in character. The reason for this change of policy from an individual to a collective provision was a financial one: the number of clients was estimated to be doubled, whereas the fund were sooner reduced. The change was justified by the fact that the basis for a provision is the client's inability to use existing public transport.

All of a sudden a number of responsibilities and financial means were in one hand: the policies for accessibility of essential services, the policy concerning the elderly, the means for pupil transport and disabled transport and, in the case of larger towns, even those for public transport.

There were numerous problems though: the painful task to take the individual provision away from the old clients, the fact that mobility patterns sooner are regional than local (implying either co-operation with neighbouring municipalities or a continuing but reduced fee for the clients) and the uncertainty about the transport services to be offered and, not the least problem, the degree of integration to be chosen.

The reactions of the municipalities, which did not receive any professional support in spite of an often absolute lack of local expertise, were fascinatingly diverse. Quite a few decided to wait for the cat to jump and to continue giving individual financial provisions, sometimes even on the old level, expecting the number of new clients to be modest. Other ones gladly accepted the offer of some regional transport operators to create a (sometimes public) door-to-door system for much less than the estimated maximum affordable individual provision. Surprisingly large numbers of municipalities created some system of their own design, hardly ever integrating modest previous initiatives. In some places regional bodies of municipalities tried to create well designed and durable systems, integrated into normal public transport. For the long distance a taxi-company created by Dutch Rail offered a taxi-train-taxi transport chain for door-to-door transport. The process of change is continuing still, some operators going out of
business, some systems being withdrawn or reduced, other systems being introduced or expanded. More information is to be found in several of the author’s publications [de Boer c.s. 1995-II], [de Boer c.s. 1998-I], [de Boer 1998-II].

6. CONCLUDING: DILEMMAS IN INTEGRATION

The bewildering change with which the old clients were confronted will not be treated here. For the elderly progress was in many places impressive, and not only for the disabled amongst them, because frequently the systems created can be used by all elderly.

There many uncertainties still in organising collective transport. These have to do partly with adequacy, partly with cost-effectiveness and partly with possible counterproductive impacts of integration. Of course there is the problem too that age is only a vague indicator of health, mobility- and financial problems.

- Adequacy: what should be provided in terms of service area and period, directness of journeys (door-to-door without changing or less?), departure frequency and travel time, vehicle adaptations, information and fare. One might say that a service route is the minimum: fixed route, fixed stops, fixed departure times but in a dense network, with adapted vehicles and attention for the individual passenger, and normal (concessionary) fares. Access to regional networks might be called an additional condition.

- Cost-effectiveness: what is essential given restricted means? A public door-to-door system to be used predominantly by disabled and elderly, operating only during the period in which important activities are in function, so at least from 9.00h a.m. to 18.00h p.m., with fares somewhere between normal public transport and the taxi and certainly no reduced fares for the elderly.

- Counterproductiveness: the elderly invading systems not primarily intended for use by them or, to the contrary overwhelmed by a majority of other users that are hardly compatible with them. Normal line transport, with its quality of relatively high travel speed might be affected by slow and indecisive passengers. Door-to-door systems used by youngsters to go either to school (in bad weather) or to the disco might become either overburdened or hostile for the target groups.

The solution might be found in mixed solutions like:
- special services for the elderly only during rush hour
- special services for socially problematic youngsters during rush hour and at night
- differentiated fares to distract not target groups from over using the system
In fact it means that integration in transport is made subordinate to the superior goal of social integration. Transport systems for the elderly should not distract them from participation.

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29.

SEAMLESS TRAVELLING FOR THE ELDERLY

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1. INTRODUCTION

A great many elderly cannot meet the demands of mobility made by society. Besides, it is estimated that 25% of the Dutch population will be over 65 years of age in 2040. Therefore, increased mobility of the elderly is both a societal aim and an aim that is formulated by the elderly themselves. Freedom of movement for the elderly should prevent social isolation and dependency. A demand-responsive personal transport system can improve the mobility of the elderly and thus increase their participation in economic, social, and cultural activities.

This paper presents theoretical foundations of travel services together with some analyses that have been made with a demand-responsive shared taxi system, the OV-Tax Zoetermeer in the Netherlands.

The discussion presented here is part of the PhD research project 'Design of personal travel services' which belongs to the multidisciplinary TRAIL research programme Seamless Multimodal Mobility.

2. THE ELDERLY

2.1 Elderly and mobility

Everyone in our society sometimes has problems with their mobility - mobility defined as the possibility of a person to reach and access all kinds of activity places. The elderly belong to a group that have significantly more trouble with their mobility than others. This is the result of various factors (Tacken, 2015).
Seamless travelling for the elderly

First, having a driver's license and therefore the availability of a car is no common use for today's elderly. And not having a car implies that long-distance travelling will be more complicated. As ‘transport captives’, many elderly depend primarily on public transport and their friends or family for the fulfilment of their travel demands.

Secondly, the physical and psychological constitution of the elderly can act as major constraints on the travel possibilities - constraints, which include the lack of (enough) endurance, fear to travel alone, and forgetfulness.

And thirdly, the financial and/or household situation can act as a constraint. Elderly with little financial means simply cannot afford a lot of travelling. And living together with a less mobile person will have a large impact on the household’s travel behaviour.

2.2 Changed mobility circumstances for the elderly

Increasing mobility possibilities for people and the changing spatial organisation of society have changed trip patterns of people quite drastically during the last decades (IVVS, 1998). The separation of activities has increased the necessity of travelling.

This description implies both a time and a space dimension. Many activities are concentrated in time (labour, education), which is often referred to as 'the synchronisation of activities'. The eight-to-five-working day has resulted in a fixed time structure of behaviour patterns. The trip patterns of people follow this time structure closely, which results in the daily peak and off-peak hours on the transport network.

This temporal and spatial organisation of society primarily affects workers, students, and scholars. However, people outside these groups, like the elderly, are affected as well. In fact, the preferred activity and travel patterns of the elderly are conditioned to a large extent by these societal structures.

2.3 Social participation aim

Many elderly cannot meet the demands of mobility made by society. On one hand, the action space of the elderly - action space defined as the spatial unit of activity places, which a person or a group of persons has visited in a certain period of time (Dijst, 1995) - decreases growing older and older (Claessens en Van Esch, 1989). On the other hand, social developments like the deconcentration of activities ask for an increased mobility of people in general.

Therefore, the increase of the mobility of the elderly is both a societal aim and an aim that is formulated by the elderly themselves (Stoppelenburg en Tacken, 1995). Freedom of movement should prevent social isolation and dependency. Research in the Netherlands (SCP, 1997) has shown that the participating of the elderly in out-of-the-house activities primarily depends on good travel facilities, and less on the health or income of the elderly. The elderly want to participate in the simple daily events of life (shopping, visiting friends, etc.) as much and as long as possible without the help of others.
Part 3: (Public) Transport and new Technologies

(family, neighbours).

3. TRENDS, THREATS, AND TREASURES

3.1 Privatisation and market economy

The car is the most important transport modality for the elderly (table 2.1). But as mentioned in the previous chapter, the higher their age, the more problems they meet in using their cars. Public transport can fulfil the existing travel desire and therefore is an important transport alternative for the elderly. However, the sector of public transport is confronted with two major organisational changes: the privatisation of public transport companies, and the introduction of the market economy.

<table>
<thead>
<tr>
<th>Age</th>
<th>car driver</th>
<th>car passenger</th>
<th>public transport</th>
<th>bicycle, moped</th>
<th>by foot</th>
<th>other</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-64 year</td>
<td>37%</td>
<td>15%</td>
<td>4%</td>
<td>23%</td>
<td>19%</td>
<td>1%</td>
<td>100%</td>
</tr>
<tr>
<td>65-74 year</td>
<td>30%</td>
<td>15%</td>
<td>9%</td>
<td>22%</td>
<td>23%</td>
<td>1%</td>
<td>100%</td>
</tr>
<tr>
<td>≥75 year</td>
<td>20%</td>
<td>17%</td>
<td>12%</td>
<td>17%</td>
<td>33%</td>
<td>2%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*table 2.1 The use of the main modality of transport (Tacken, 1993)*

Public transport companies become responsible for their own performance in terms of cost-effectiveness. Sooner or later, therefore, these transport suppliers will cancel non-profitable collective public transport lines: services which have a low travel demand, but which especially the elderly could use. It can be assumed that fixed transport services can only survive where travel demand is high.

3.2 Deconcentration in time and space of societal activities and processes

The trend of suppliers focusing on a limited number of (profitable) fixed transport services is accompanied by different trends of growing diffusion and variability in consumer's travel preferences: a deconcentration of activity and trip patterns of the individual travellers.

Information and communication technology makes the world time- and footloose. The associated demand of transport changes at the same time: more diffuse (criss-cross patterns) and more multi-preferent (IVVS, 1998).

Especially the trend of the growing diffusion in consumer's preferences will benefit from a more individual, target group oriented approach of the mobility problem. Therefore, transport should be seen as a product, offered by both public and private suppliers. Of course, the clients, the individual travellers, have a decisive vote in what the transport product should look like.

Looking at the 'mobility problem' in this way, the elderly become a separate segment of the large transport market, for whom services can be supplied completely adapted to the specific situation of the elderly (comfort, costs, etc.).
3.3 Travel service approach

The idea of a travel service is characterised by the presence of at least two persons: a transport demander and a transport supplier. Before we distinguish all kinds of services it is wise to define the concept of a transport demander. A transport demander is a person or a group of persons who have decided to travel together (Egeter, Van Binsbergen, 1996).

The first distinction that can be made within the set of different services are the private services versus the business services (figure 2.1). In the set of private services no market system is involved. When a group of neighbours decide to travel together or to share the use of a car, the trips made can be identified as private services between the neighbours. When one person fulfils his desire for travel by making a trip all alone in a private vehicle it is said that 'the transport demander provides himself with a travel service'.

![figure 2.1 Travel services](image)

A transport demander can also look at the transport market for an external service provider, who can fulfil his travel demand. Collective means of transport search for an optimum service level which is related to implicit travel demands. The explicit travel desire from an individual transport demander ('I want to travel from origin A to destination B at a particular point of time X') is only known by the transport demander himself; certainly not by the collective transport provider. These kinds of services are fixed during a rather long period of time. Long before a transport demander decides to look at the transport market for a service provider, these kinds of services have already been decided on.

The second kind of business services, the demand-responsive services, refer to explicit travel demands and have a time-space flexibility. This service...
is a tailor-made product and takes into account the (personal) wishes of the client. Flexibility can be found in the type of used equipment, the routes, the stops, and the point of travel time. The next chapter discusses the demand-responsive transport systems in more detail.

4. RESEARCH OBJECTIVES

4.1 Demand-responsive personal transport

A demand-responsive travel service is defined as the non-private supply of a travel service directly referring to an explicit demand of a client, the transport demander.

A travel service in its broadest sense is a service referring to any kind of travel desire in its broadest sense. To fill in this vague description we distinguish six relevant, different kinds of services which together cover the (whole) field of the demand-responsive travel services: the organisation service, the transport service, the logistic service, the modality service, the (supporting) information service and the (supporting) financial service (figure 3.1) (Rooij and Tacken, 1998, and Egeter and Binsbergen, 1996).

- **organisation service** - the organisation (of a part) of a client's demand for travel is not arranged by the transport demander himself. These kind of services are the framework of the personal travel services.
- **transport service** - the vehicle during the trip is not controlled by the demander of transport himself; the transport demander doesn't have to take care of the process of transport.
- **logistic service** - a vehicle is not looked after by a demander of transport himself; the transport demander doesn't have to take care of the logistic process - the allocation of vehicles and personnel to trips to be made.
Seamless travelling for the elderly

- modality service - a demander of transport can choose between different modalities of transport for his trip; because we talk about a demand-responsive system the modality service is a part of the logistic service.

- information service (specific and generic) - every distinct part within the different sets of services has its own kind of supporting information service (specific); these specific services are surrounded by an environment of general transport system information (generic).

- financial service - the pattern of cash flows between the transport demanders, the service providers, and authorities (subsidies from the government). Does the transport demander have to pay in advance or after the trip has been made, or does he get a bill every month? Does he have to pay with cash money, with coupons, or can he do it electronically? The overlapping zones of the sets of the different services have to be seen as 'more services at the same time'. All kinds of combinations of the presented services can be found at the Dutch transport market (Rooij and Tacken, 1998).

4.2 Research question

It is assumed that the introduction of demand-responsive systems will change the activity and/or trip patterns of people. It is assumed that people will travel more and/or different.

People will travel more - measured in person kilometres - because there is a new opportunity to travel. And as history has shown many times, new supply creates new demand. And people will travel differently in terms of route, modality, and/or point of time, because the new system offers new alternatives to travel from origin A to destination B.

The research question can be defined as:

How do both the short-term and the long-term spatial behaviour of the elderly change with the introduction of a demand-responsive transport system?

4.3 Travel choices

Travellers make several decisions related to their activity and trip patterns. These interdependent behavioural choices can be categorised in four main groups (figure 3.2) (Bovy, Schoemaker, Binsbergen, 1993):

1. activity choices;
2. location choices;
3. mobility choices;
4. trip choices.

It is assumed that every individual pursues a specific kind of lifestyle. Among other things lifestyle determines choices of education and profession. To satisfy the desire of lifestyle, a person develops an preferred activity pattern, a personally composed entity of various preferred activities: work, education, sports, social and recreational activities, holidays, etc. Lifestyle and activity pattern are thought to be very stable characteristics of a person. They are
the framework for the more changeable behavioural patterns like the choices of locations and the choices of mobility.

The *choices of locations* - like where to live, where to work, where to go to school, etc. - are set for a rather long period in terms of years. The choices of locations are not only influenced by the individual activity-trip desires, but also by the personal travel possibilities. Choices of locations are the spatial and temporal framework for the daily activity and trip choices.

*Choices of mobility* - like getting a driver's license, buying a car or a public transport season ticket - define the trip behaviour for a rather long period of time, because of the high initial expenses related to these kinds of choices. Choices of location and mobility are long-term investments and of strategic significance for the daily activity and trip behaviour.

![Diagram showing the relationship between lifestyle, activity pattern, choices of locations, choices of mobility, daily activities, and individual trip choices.]

The *daily activity choices* play a major role in a person's choice behaviour, because these activities eventually satisfy the needs. Some activities have a rather constant pattern (in time and space) - like work and education - others can vary from day to day - like shopping, visiting friends, etc.

It is widely understood that travelling is a necessary derivative from these activities. But it should not be forgotten that choices of activity depend to a certain extent on the possibilities for a person to travel. And these possibilities depend on the long-term choices of locations and mobility.

*Daily trip choices* concern the short-term decisions about modality of transport, point of travel time, route, etc. Decisions about trips are conditioned by the activity pattern, the location pattern, and the mobility situation.

5. **TRANSPORT WITH A FUTURE FOR THE ELDERLY?**

A research project on the functioning of the OV-Tax Zoetermeer in the Netherlands
5.1 New travel possibilities for the disabled

In 1994, new regulations on facilities for the Disabled were brought into operation in the Netherlands. From that moment on, local governments have become responsible for all kinds of facilities (like for example transport) for the disabled. Nowadays, they receive a limited budget from the national government which they can allocate at their own insight.

With respect to transport policies, many local governments have decided to introduce new means of collective transport to help a larger group of persons with limited financial means. A lot of Dutch municipalities have demand-responsive shared taxi systems, sometimes only available for the disabled, sometimes also available for other people of the municipality.

In Zoetermeer, a Dutch city between Rotterdam and The Hague (figure 4.1) with about 100,000 inhabitants, we got the opportunity to study the functioning of a demand-responsive shared taxi system. Information about the trips and the passholders was available for analysis. Extra information could be gathered by interviews with the passengers during a period of three weeks. Information came available on the alternative transport modes, on trip motives, and on the types of destinations.

The shared taxi system has been developed for the whole local population of the city of Zoetermeer, but the system is used most by the elderly. Handicapped people make only a small contribution to the total number of people using the system.

Figure 4.1 The city of Zoetermeer

5.2 Characteristics of the OV-Tax Zoetermeer

Although anyone can make use of the OV-tax, formally we have to think of the system as a closed system, because a pass of DFL. 10,- is needed to make use of the OV-Tax. Some further system characteristics are:

- the taxibuses (all with equipment for the transport of wheelchairs) only ride
within the borders of the municipality of Zoetermeer (intra-urban trips)
• the taxi-buses ride between 09.00 AM and 23.00 PM
• the call centre where the trip demands are allocated, is open between
08.00 AM and 23.00 PM
• the trip has to be ordered at least one hour in advance
• a maximum waiting time of 15 minutes before and/or after the desired
departure time has to be taken into account
• in the taxibus you have to pay with coupons (DFI. 3.50), available at
certain points of sale in the city

Related to figure 3.1 where all kinds of travel services were
identified, the OV-Tax Zoetermeer can be defined as the
combination of a organisation, a transport, and a logistic
service.

5.3 Why using the OV-Tax?

70% Of the trips are made by people over 60. The average age of the
travellers is 67. It appears from the inquiry that 77% of the travellers is
female.
The travellers were asked what they were going to do at the place of
destination. About 50% of the trips with a different destination than the own
house, is made for visiting friends and acquaintances. Facilities for health
care and recreational facilities are two other relevant destinations. The OV-
Tax is not used a lot for shopping. Both the citycentre and the local shopping
centres are situated near the stations of the Zoetermeer intra-urban train.
The largtes target group travels with the OV-Tax because of a physical
handicap (table 5.1). But also the comfort this kind of transport offers (door-
to-door), the relatively low costs (compared the a normal taxi), and the
absence of an alternative mode of transport, motivate people to choose the
OV-Tax for travelling. The weather conditions and (social) safety do not
count heavily. The safety becomes more important, when attention is given
to the point of time for travelling. The feeling of unsafety on the streets, near
stopping points, or in the regular public transport is bigger in the evening.
People who travel with the OV-Tax after 20.00 PM mention unsafety quite a
lot (36%).

<table>
<thead>
<tr>
<th>Reason of use</th>
<th>n = 164</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical constraints</td>
<td>42%</td>
</tr>
<tr>
<td>Costs</td>
<td>23%</td>
</tr>
<tr>
<td>Comfort</td>
<td>29%</td>
</tr>
<tr>
<td>no alternative mode of transport available</td>
<td>22%</td>
</tr>
<tr>
<td>Safety</td>
<td>9%</td>
</tr>
<tr>
<td>The limitations of other modes of transport</td>
<td>8%</td>
</tr>
<tr>
<td>Weather conditions</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>10%</td>
</tr>
</tbody>
</table>

*table 4.1 Reasons of the use of the OV-Tax (%)*
5.4 The OV-Tax seen as a transport alternative

Travellers were asked how a trip (with the same destination) used to be made, before the introduction of the OV-Tax (table 5.2). It appears that the OV-Tax is an alternative for motorised transport modes: the taxi (44%), the car, as passenger (37%), and the bus (27%). The bus for the elderly and the train do not feel a lot of competition from the OV-Tax, nor do the slower modes of transport. Also car drivers are not attracted by the shared taxi system.

<table>
<thead>
<tr>
<th>Mode of transport</th>
<th>n = 438</th>
</tr>
</thead>
<tbody>
<tr>
<td>car, as driver</td>
<td>9%</td>
</tr>
<tr>
<td>car, as passenger</td>
<td>37%</td>
</tr>
<tr>
<td>bus for the elderly</td>
<td>9%</td>
</tr>
<tr>
<td>Bus</td>
<td>27%</td>
</tr>
<tr>
<td>sprinter/train</td>
<td>9%</td>
</tr>
<tr>
<td>Taxi</td>
<td>44%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>8%</td>
</tr>
<tr>
<td>by foot</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>9%</td>
</tr>
</tbody>
</table>

Table 5.2 Mode of transport before the introduction of the OV-Tax to equal destinations

5.5 Changes in trip and activity patterns

We have seen that the travellers of the OV-Tax primarily are transport captives: the people who are dependent on others for travelling. The question is whether the OV-Tax, an enlargements of the travel possibilities, has lead to different trip patterns or/and activity patterns. Do people now go to new or other destinations?

It appears that 34% of the travellers go to a completely new activity and (therefore) a new destination. For the same activity, the use of the OV-Tax seldom (only 5%) leads to the choice of a new destination.

Some differences can be found when the point of time of travelling is considered. From those people who used to travel to the same destinations, 28% travelled with the OV-Tax at a different point of time (at least half an hour difference). The OV-Tax has increased the trip scheduling flexibility of the users.

5.6 Conclusions on the OV-Tax system and the change to CityTax Zoetermeer

The OV-Tax has ideal characteristics for the less mobile people of society as a complementary public transport system in the margins of time and space. The system is primarily used by the elderly, although its availability for the whole population of Zoetermeer. The image of the system (taxibuses all with equipment for wheelchairs, payment of the trip with coupons not available in the taxibus, the passes) has made the (unformally open) system to "an elderly system".

To get rid of the existing prejudices of the OV-Tax being an system for elderly, the concept of the shared taxi system was changed quite recently to
the ‘new’ CityTax Zoetermeer: the equipment has been expanded with ‘normal’ taxis, costs are still very low (pass: DFI. 5,- and every trip costs DFI. 3,50) and now can be paid to the driver, a client gets a telephone call 5 minutes before the taxi(bus) arrives and the possible travel times have been expanded to 06.30 - 00.30 during the week, on Saturdays from 07.30 and on Sundays from 08.30.

The change from the OV-Tax into the CityTax slightly changed the service characteristics of the system: the system is still a combination of a organisation, transport and logistic service, but the financial service and the information service (5 minutes service) can be considered as quite interesting improvements for the travellers. Also the new option for the service supplier to use different kinds of vehicles (taxi’s, taxibuses, wheelchair buses) can be seen as an expansion of the service structure.

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A REVIEW OF OLDER DRIVERS’ PERCEPTION OF AND PERFORMANCE WITH ADVANCED TRANSPORTATION TELEMATICS (ATT)\textsuperscript{4}

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1. INTRODUCTION

What works for older drivers will work for the rest of the driving public, and, conversely, an ITS system that fails to serve the older driver will leave a large and increasing segment of the driving public at risk (Hancock, Parasuramen, & Byrne, 1995, p. 359).

Advanced transport telematics (ATT, Europe) and intelligent transportation systems (ITS, North America) are the fusion of advances in telecommunications, automotive electronics, and computing. They have the potential to increase older driver mobility and safety. The societal goals of these initiatives are to decrease accidents, congestion, and pollution. A number of assumptions underlie the research and development of ATT products for older drivers. Older drivers are most likely to benefit and suffer the effects of poorly designed ITS technologies (Perel, 1998; Stamatiadis, 1994; Warnes, et al., 1993). Older drivers are faced with driving environments (vehicles and roadways) that are undergoing rapid technological changes. Vehicle advances such as power steering and ABS may help the older driver although drivers may negate the safety benefits of these systems by driving less prudently (see, e.g., OECD, 1990). In-vehicle information systems and increases may overload the older driver in the complexity of the urban driving environment. Many are unfamiliar and uncomfortable with rapid change, especially in technology. They were not brought up in the computer age and may be distressed when required to operate machines and interpret displays of the high-tech variety. Some embrace and experiment with new technologies. Ideally, an ATT system would increase older driver mobility and safety. Pragmatically, the impact of ATT in-vehicle systems on older driver safety and mobility, given available empirical evidence, is uncertain. Therefore, ATT systems must be developed and properly evaluated so that drivers achieve their goals safely.

\textsuperscript{4} A more extensive treatment of the issues discussed in this chapter can be found in Caird, et al., (1998). Also see http://www.acs.ucalgary.ca/~erg/its/tc.htm for additional information about older drivers, ITS/ATT, and transportation ergonomics.
With the projected increases in older drivers on the road—especially women—(Cerelli, 1989; 1994; Eberhard, 1996; NHTSA, 1989; Transportation Research Board, 1988), many more older drivers will be dependent upon their automobile in the future to shop for food, visit the doctor, and socialize with friends. For example, between 1983 and 1990, an increased reliance on driving, over other forms of transportation, was found in both rural and urban areas (U.S., FHWA National Personnel Transportation survey, cited in Eberhard, 1996). Present and future older drivers, with lifelong habitual patterns of automobile use, are not likely to easily give up driving to use public transit or other transportation alternatives especially in North America with its long distances and less extensive public transportation. Larger cities tend to be designed such that access to essential needs (i.e., food, clothing, medicine, and social contact) can only be met by driving. In rural settings, public transit is often not feasible because lack of demand, logistics, and expense preclude it. In addition, individuals tend to prefer driving for a variety of reasons. These include the ease of getting into a car, being able to go somewhere at any time, and being able to run a number of errands consecutively. Restrictions to mobility that come from age-related declines in driving capability or policy-related restrictions to licenses will constrain the lifestyles that the elderly can live (see, e.g., Sivak, et al., 1995). Therefore, the maintenance of independent and meaningful lifestyles, which are supported by driving, will require a wide array of policy, service, infrastructure, and technical solutions. ATT's are technical solutions. A number of studies are reviewed to highlight issues that older drivers encounter when using these systems and related technologies.

2. EVALUATIONS OF RELATED TECHNOLOGIES

2.1 Automated Teller Machines (ATM)

While new technologies are finding their way into our society more and more in recent years (e.g., computers, banking machines, smart cards), it may be assumed that older people will adjust quickly to their use. However, there is evidence that new devices are not readily understood or easily used by older adults. A good example of technology use by the elderly is the automatic teller machine (ATM). Rogers, et al. (1996) examined ATM users in four age groups (<35, 35-54, 55-64, and 65+) and found that subjects 55 and older preferred to deal with people and were less likely to use an ATM, as compared with younger subjects. In addition, older subjects felt less comfortable than young ones using the machines. The most frequent difficulty encountered by older users was seeing the screen. In another study (Rogers, et al., 1996), older adults (aged 61 - 81) were given one of four instructional programs for teaching ATM use. The assessment included performance on four ATM tasks across several blocks of trials. Successful performance ranged from 48 to 89% for the first six blocks of trials. Average performance after a 24-hour period, for the four teaching methods, varied from about 25 to 57%, suggesting a good deal of difficulty in remembering the correct procedures for ATM use. The most successful training method was found to be the use of hands-on experience and specific practice with
critical task components. Initial fear of technology, legibility of display information and the need for specific training are recurrent difficulties that older driver experience using many ATT technologies.

2.2 Mobile Phones

For devices that require division of attention, an interaction of age and task complexity is generally predicted, that is, increases in age will produce greater decrements in performance on one or both tasks (Kortelling, 1994; Ponds, et al., 1988). One new technology that demands driver attention in much the same way as will other proposed ITS applications is the mobile or in-car phone. Driving while using the phone requires the driver to do several tasks at the same time. It has been shown that using a phone while driving can increase the chances of an accident by up to 4.8 times (Redelmeier & Tibshirani, 1997). The primary factor in the link between phone use and accidents would appear to be reduction in driver attention to the events on the roadway. Absorption of attention may come from manipulating a device (e.g., dialling a phone number) or talking on the phone. Conversations can vary from talking about the weather to heated arguments about business deals. More intense discussions may divert attention from the tasks of driving. 'Hands free' phones do not necessarily prevent drivers from being absorbed in conversations.

It is important to consider the extent to which drivers might compensate for the increased risk associated with in-car phone use, for example by reducing speed or increasing headway. In a simulator study of the effects of phone use on driver behaviour in a car following situation Alm and Nilsson (1995) found an increase in choice reaction times and shorter minimum headways while using a phone. In addition, elderly drivers had a greater increase in reaction time while phoning than did younger ones. Drivers' mental workload, measured with the NASA-TLX, increased with the phoning task. The impact of phone use on reaction time was greater for the older drivers. In addition, drivers did not compensate for the added demands of the phoning task by increasing headway. The negative impact of existing in-vehicle technology (i.e., the in-car phone), and the apparent failure of drivers to compensate for the diversion of attention resulting from its use, raise the very real possibility that drivers, especially older ones, will have difficulty performing the driving task safely when new ITS devices are introduced into vehicles.

3. OLDER DRIVER EVALUATIONS OF ATT APPLICATIONS

3.1 Perceptions of ATT

Sixsmith (1990) examined the expectations of older drivers as they relate ATT's. These represented route guidance, anti-collision devices, radio data systems, awareness monitors and breakdown detection devices. A series of six focus groups of older drivers (age 52 - 79) discussed driving performance
and ATT's. Among the major driving difficulties experienced by drivers were navigational problems, night driving, and declining competencies (e.g., reaction time, perception).

The results indicated that women were more reluctant than men to accept new technologies. Some participants felt that new technology would increase safety and some thought that it was the answer to all their problems. Others were wary of new technology, especially at the driver-machine interface. The five technologies discussed provoked mixed reaction (and there were no apparent gender differences). When asked whether new technologies would give them increased confidence in situations where they had been reluctant to drive (e.g., driving in central London, or at night), the responses were generally negative. These older drivers did not see the new devices as the solution to their problems. They tended to feel that the ATT's would be of more benefit to younger drivers and business people. Negative comments were made of any systems that would startle them (e.g., warnings) or demand more of their attention. "People felt that driving is dangerous enough today without extra problems imposed by [ATT's] that may be poorly designed, or at least poorly adapted for elderly drivers, especially when such devices are not necessary" (Sixsmith, 1990, p. 44). On the basis of this limited study, there may be reason to believe that new technologies are not the solution to many of the difficulties encountered by older drivers on today's roadways. The participants were sceptical of the value of systems that would present additional warning signals and more information with which they must cope.

Radio data systems, which provide up-to-date information on road conditions, weather, etc., were met with enthusiasm. Any device capable of making the vehicle more reliable (e.g., breakdown detection, emergency alert) was especially appreciated by female drivers. These older drivers, in general, were reluctant to give up control of the vehicle (e.g., as with anti-collision devices), and many saw them as potentially replacing proper driver attention to roadway hazards. While this study gathered only subjective evaluations of specific new technologies, it serves to make us aware of some of the potential concerns of the older driver.

### 3.2 Performance Evaluations of ATT

Within EDDIT (Elderly and Disabled Drivers Information Telematics), which is a project of DRIVE II, six ATT applications (i.e., route guidance, traffic information, emergency alert, reversing aid, night vision, and collision warning) were tested to determine whether older driver mobility was improved or safety compromised (Oxley & Mitchell, 1995; Oxley, 1996). For each system approximately 30 elderly drivers, 10 each within the age ranges of 65 – 69, 70 – 79, and 80+, were sampled. Males and females were approximately balanced within each age range and drivers had to have held their license for five years and still be driving. An overview of the applications and how they were tested is shown in Table 1.

| Table 1. Overview of EDDIT ATT Devices Evaluated. Adapted from | 266 |
Navigation systems that required significant attention caused drivers to reduce speed and steer off-course. As the complexity of route guidance increased, basic driving task performance declined, and more so for older than younger drivers. The authors concluded that collision warning and reversing aids, for a variety of reasons, might have little impact on improving mobility. In contrast, vision enhancement systems and emergency alert with AVL (Automatic Vehicle Location, Mayday) systems are likely to improve older driver mobility and personnel safety, respectively. Vision enhancement systems (VES) (both ultraviolet, UVES and infrared, IVES) seemed to improve the visibility at night of pedestrians and roadway guidance features. Subjective perceptions of VES indicate that older drivers find the system easy to use (UVES–100%) and they may choose to drive at new times (73%–UVES, 60%–IVES). Emergency alert, which provides vehicle location information to a central dispatch centre, was also viewed favourably. Overall, some systems have promise and others require further development and evaluation.

3.3 Navigation Systems

Barham, et al. (1994) examined the benefits and safety implications of route guidance systems for 35 elderly drivers (65+) by having them drive a predetermined route, once with and once without Travelpilot; a route guidance system. Four separate measures were taken while they were engaged in following the prescribed route: 1) estimation of length of time spent looking at the Travelpilot was made by a researcher sitting in the back seat of the car; 2) an experienced driver assessor observed the participants driving technique; 3) pre- and post-questionnaires about the navigation

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**Evaluation Procedure**

<table>
<thead>
<tr>
<th>ATT Device</th>
<th>Specific Scenario</th>
<th>Evaluation Procedure</th>
<th>N</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Driving Sim.</td>
<td>Test Track</td>
</tr>
<tr>
<td>Collision warning</td>
<td>Right turn (U.K.) across oncoming traffic from a major to a minor road</td>
<td>x</td>
<td></td>
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<tr>
<td>Reversing aid</td>
<td>Eight back-up manoeuvres, with and without reversing aid</td>
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<td>x</td>
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<tr>
<td>Route guidance</td>
<td>Routes in urban and suburban regions</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Traffic information</td>
<td>Highways near Lyon (France)</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Emergency alert</td>
<td>Public road around Cranfield (U.K.)</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Night vision</td>
<td>Prescribed test track route (Sweden and U.K.)</td>
<td></td>
<td>x</td>
</tr>
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</table>
device were administered; 4) mental workload was assessed before and after using NASA-TLX.

No differences were found on assessed ratings of performance by the assessors, although only overall scores are presented. Assessor subscores such as for steering, braking, anticipation, positioning and so on were not reported. There is no reporting of whether the design of the study was between or within or whether drivers performed with the Travelpilot and then without or whether counterbalancing was performed. All participants were members of the Guild of Experienced Motorists, which may not have been indicative of performance of ordinary older drivers. Total time, while driving, looking at Travelpilot was 7.5% of all glances. Males made longer looks (M = 0.73 s) than females (M = 0.63 s). Potential relationship between a measure of working memory and glance frequency (but not glance length), that is, more looks might mean that those with worse memory might need to look back at the display to acquire or refresh a piece of information. The Travelpilot was rated as easy to use. No safety-related problems were found—except when faced with "the dual task of driving and following the route guidance systems instructions". Having a route guidance system of some type might change their driving habits by going to new places or getting out more often.

While investigating navigation systems, Cambell, et al. (1995) reported that older drivers (55 - 85) found the features of TravTek (a specific navigation system) more difficult to learn to use, and less functional than did a group of younger drivers. There was some indication that the initial reticence to use a system such as TravTek diminished as older drivers gained more experience with it. Thus, initial perceptions of ITS products are likely affected by fear of technology. Until they have adequate experience, the elderly, in general, are reluctant to use technology.

In a second study, older drivers (aged 55–76), interacted with navigation information that was either 100% or 77% accurate. They were not able to use the more accurate information as efficiently as a younger group of drivers (aged 18-54). A third study, where a delay was introduced between the presentation of a message and recall of it, also produced performance decrements by the elderly group. These two studies highlight the working memory limitations of older drivers. Working memory (WM) is related to the number of times that a driver needs to look at or re-acquire information (e.g., a guidance display) (Oxley & Mitchell, 1995). Thus, older drivers with worse WM are likely to need to look at a display more often than drivers with better WM.

### 3.4 Vision Enhancement Systems (VES)

Infrared (IVES) and ultraviolet (UVES) vision enhancement systems appear to be promising technologies to increase older driver mobility (Mitchell, 1997; Oxley & Mitchell, 1995). The purpose of a vision enhancement system is to enhance the driver's ability to see hazardous objects (e.g., guardrails and other vehicles) and the roadway (e.g., edgelines), especially during low
visibility conditions (i.e., thick fog, rain, snow, and nighttime). In IVES, thermal energy differences between objects in the traffic environment are displayed on the windshield. For example, a pedestrian has a thermal signature that is different from the traffic environment background. To date, an adequate sample of older drivers has not evaluated IVES. UVES uses ultraviolet vehicle headlamps to illuminate the roadway with radiation, which is then reflected back to the driver. Older drivers loss of visual capability (see, e.g., Kline & Scialfa, 1997) may be aided with these systems.

Stähl, et al. (1994) tested an UV headlight system for Volvo, developed by Ultralux AB. Thirty-one older drivers, who were either employees or retirees of Volvo, were approximately divided into 3 age groups: 65-69, 70-74 and 75+. All drove on a test track twice, once with standard low beam headlamps and once with UV headlamps. The results showed that visibility for both roadway structures and pedestrians increased for all age groups with the UV headlamps. The difference in the distance at which roadway structures and pedestrians were visible was largest for the youngest group (65-69 years). When asked to judge forward visibility provided by the two types of headlamps, all age groups chose the UV headlamps as providing more visibility than the low beam headlamps. Stähl, et al. (1994) also asked the participants to rate perceived levels of glare with the UV headlamps. When seen through the rear-view mirror they produced more glare than ordinary low beam headlamps. Participants also judged glare by standing on the roadway as pedestrians. They reported less glare with the UV headlamps than with ordinary low beam headlamps. The inconsistency between more UV mirror glare, but less glare for pedestrians was not addressed. The results from the older sample were compared to a group of younger drivers (26-60 years) from a prior experiment. In most cases, the older drivers responded more favourably towards the UV headlamps than did the younger drivers. Additional testing of UVES and IVES is needed.

4. SUMMARY AND CONCLUSIONS

ATT systems offer the potential to increase the mobility and safety of future older drivers. However, these systems are not the only options available (see, e.g., Evans, 1991; Waller, 1985). Research is still needed to determine the degree to which in-vehicle ATT's can offset declines due to ageing processes (NHTSA, 1989). Producing age-related effects with ATT devices that require certain capabilities is dependent on imposed task and driving conditions. More difficult task demands and driving conditions are more likely to produce age differences. However, the relationships between driving performance with these systems and safety (i.e., accidents) has yet to be determined. In the future, age and gender may not necessarily be a good predictor as to who might use an ATT application or how they might perform with it.

ATT products may produce compensatory effects by drivers, such as speeding which nullify the safety gains obtained (see, e.g., OECD, 1990). Appropriate and inappropriate behaviour compensation in older drivers has had minimal research attention. ATT's must, at the minimum, keep pre-
existing levels of safety constant. What may increase the mobility of the majority of transportation users could impinge on maintaining the mobility of older drivers. The effects of an ATT on a population of drivers are not uniform. While some may enjoy benefits of travelling to their destinations faster, others may find the increased speed and information complexity of driving inhibits their desire to travel.

ATT systems evaluated by older drivers have a number of common difficulties that need to be addressed by designers (also, see, Caird, et al., 1998; Nicolle & Stapleton, 1995). The division of attention of older drivers between ATT applications and the attentional demands of traffic, roadway geometry, signs and signals should be minimised. Devices that require extensive manipulation (e.g., dialling a number on a mobile phone) or absorb attention (e.g., having an argument on the mobile phone) are likely to adversely impact older drivers. For example, the allocation of attention to information in a head-up display may cause elderly drivers to miss important events such as pedestrians in the roadway (Caird & Chugh, 1997).

Fear of using technology, difficulty seeing displayed information and lack of effective training are significant barriers to large-scale acceptance of ITS applications by older drivers. Therefore, ease of use, adequate legibility, and minimal training are essential user requirements for ATT applications. Systematised training and support may help older drivers to accept and effectively use ATT systems. Information presented to older drivers is likely to be used less efficiently and is likely to decay sooner than for younger drivers (Granda, et al., 1997).

Many evaluations to date (e.g., EDDIT, Oxley & Mitchell, 1995) have emphasised older driver mobility as the important dimension of evaluation. Older drivers are typically asked whether a particular device, in their opinion, would increase the likelihood that they would drive more in particular situations with the device after some experience with it. Vision enhancement systems and systems that increased the perception of safety and security, such as automatic vehicle location (AVL), were perceived by older drivers as having the potential to increase mobility. Asking drivers their preference for and impression of a device may or may not be congruent with their performance with the same device. An in-vehicle application, for example, may be perceived as adding mobility and/or safety when it may not in practice (see, e.g., Andre & Wickens, 1995). Therefore, the principle of convergent empirical evidence from performance and preference is paramount. Conducting multiple studies to obtain convergent safety and mobility evidence on particular ATT systems will require the co-ordinated efforts of multiple governments (e.g., Commission on European Communities, Federal Highway Administration, U.S., and Transport Canada) and standards committees (e.g., International Organisation for Standardisation, ISO; Society of Automotive Engineers, SAE).

An example of a promising application with limited evaluation data on it is the emergency alert or mayday system which transmits the status and/or location of a vehicle that is malfunctioning or has had an accident to a dispatch centre (see, e.g., Oxley & Mitchell, 1995; Sixsmith, 1990). Mayday
systems have the potential to speed the delivery of emergency medical services in rural areas. The National Highway Transportation Safety Administration (NHTSA) noted that 93% more rural accidents result in deaths than do urban crashes (NHTSA, 1996). The timely delivery of emergency medical services (EMS) has been identified as one of the primary reasons that fatal traffic accidents have declined in industrial nations over the past forty years (Evans, 1991). Once in an accident, an older driver is three times more likely to die than a younger driver is (Evans, 1988). If mayday systems can reduce EMS response time to accidents, older drivers will benefit.

5. ACKNOWLEDGMENTS

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6. REFERENCES


A Review of Older Drivers' Perception of and Performance with Advanced Transportation Telematics


Part 3: (Public) Transport and new Technologies


ENHANCING THIRD-AGERS’ MOBILITY THROUGH THE USE OF HUMAN-POWERED VEHICLES

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1. INTRODUCTION

The 20th century is the 'motor age'. Cars are part of normal life for a majority of people as drivers or passengers. Transport planning and urban transport policy have tended to focus on vehicle travel rather than other modes such as cycling and walking. The car has come to be such a dominant part of the urban scene in industrialised countries that it is easy for us to forget that, in the world as a whole, the total number of bicycles, around 800 million, outweighs the number of cars owned by two to one. Moreover, as Marcia Lowe from the Worldwatch Institute has pointed out, global production of bikes each year exceeds car manufacturing by about three to one. Bicycles in Asia alone transport more people than do all of the world’s cars (McClintock, 1992).

Cycling accounts for less than 2% of trips in the UK, compared to 10% in Sweden, 11% in Germany, 15% in Switzerland and 18% in Denmark. Cycle use in the UK has been declining as a form of transport in recent years. This contrasts with some of the European neighbours where deliberate programmes for action have successfully increased the share of trips by cycle (Department of Transport, UK, 1996).

In some developed and developing countries, the cycle is an important means of transport. Taking the ecological and health benefits into consideration, cycling could be an inviting alternative to car dominated transport for everyone. Much of the considerable potential for cycling is derived from the existing journey patterns of other modes. According to the UK Department of Transport (1993), 72% of all trips are less than five miles in length; half are less than 2 miles.

Cycling could be a better choice in local transport for older adults. However, the vehicles have to be thoughtfully designed by taking into account the loss in physiological effectiveness due to the ageing process. This prompted the School of Design Research at University of Central England and the Centre for Applied Gerontology at University of Birmingham to initiate research into the Third-Agers’ attitude toward cycling for local transport. The results of the
research should lead to the development of guidelines for future human-powered vehicle design for the ageing population.

1.1 Definition and demography of Third-Agers

The world's population grew at an annual rate of 1.7% during the period 1990-1995, but at present the population aged over 65 is increasing by some 2.7% annually. Of a world total of 355 million people over 65 in 1993, more than 200 million are in the developing world, where they make up 4.6% of the population, with more than 150 million in developed countries, where the proportion is 12.6%. Although Europe, Japan and the USA currently have the 'oldest' populations, the most rapid changes are being seen in the developing world, with predicted increases in some countries of up to 400% in people aged over 65 during the next 30 years (World Health Organisation, 1998).

Definition of Third-Agers

In the belief that birthdays are poor indicators of social attitudes or health, most titles in the field of social gerontology eschew them as much as possible. It is becoming customary to use a 'status' construct for such studies, dependent upon where a person is located in the social life cycle. The usual frame of reference for this is as follows:

- the First Age is the age of childhood and socialisation;
- the Second Age is the age of paid work and family-raising;
- the Third Age is the age of active, independent life beyond work and parenting;
- the Fourth Age is the age of eventual dependence (Midwinter, 1991).

Third-Agers in the United Kingdom

In the UK, people belonging to the age group of 50-74 years have been classified as Third-Agers and their population changes during the next two decades are given in Figure 1.

1.2 The problems in mobility among the Third-Agers

Maximum mobility is important for people of all ages. The mobility of older people, which affects their access to facilities that they need to use, may decrease with age. Slowing down means that roads have to be crossed with care and that vehicles have to be thoughtfully designed. The mobility needs of older people therefore should be taken fully into account in transport design and land-use planning.

The need to get about is essential for daily life, and also takes advantage of increased leisure time. The National Travel Survey 1991-93 found that men aged 60 or over travelled 24% fewer, and women aged 60 or over 48% fewer miles per year than the population as a whole, and made significantly fewer social and recreational trips than the overall population. Both public and private services, such as hospitals and shopping centres, are increasingly concentrated in large, sometimes inaccessible sites. This has further increased the importance of mobility (Age Concern, 1994).
Many of the transport difficulties faced by people stem from the fact that transport policy in Britain in the last few decades has been largely determined by the rapid increase in car ownership. Location of shops and services has likewise been determined by the policy view that the car as a means of access has become the norm (Department of Transport, UK, 1993).

In 1994-95, only 9.9% of single pensioner households (mainly dependent on state pensions and living alone) had a car. The combination of lack of access to a car, difficulty in using public transport because of the increased likelihood of disability, inaccessible buses and trains (high steps, poor seating, poor positioning of grab rails etc.), and inaccessible necessary services means that older people are both more likely to have difficulty walking and yet more likely to depend on walking as a means of getting about (Age Concern, 1996).

**Walking**

Walking is the most universal and ubiquitous method of personal transport. The ability to get about is essential for daily life, and takes advantage of increased leisure time. Older people are more likely to depend on walking as a means of getting about. Although the incidence of disability increases with age, 87% of all people aged 65 and over were able to go out of the house and walk down the road on their own (Martin, 1988).

Besides being able to walk, older people deserve to be able to use all modes of transport that are available for other age groups. While both public and private services, such as hospitals and shopping centres, are increasingly concentrated in large, sometimes inaccessible sites, the importance of vehicle transport is obvious. Unless constrained by social, environmental or psychological barriers, most older people can continue to enjoy life by access to vehicle transport. Barriers include: high cost, inaccessible public transport, an inaccessible private vehicle, and an unfriendly environment.
Car availability
Among people in the Second Age, the most important determinant of mobility is car availability, which in turn is very closely related to social class, income, and sex. Ageing adds further dimensions to these differences in mobility.

Health and personal capabilities decline with age. Driving a car becomes more dangerous; climbing into a bus becomes more difficult; hills, steps, ramps, and road crossings become more difficult when walking. Access to car driving depends upon ability to operate a car and deal with road conditions. A car which runs at a speed of 30 (or usually more) miles an hour demands rapid reactions which older people cannot always easily fulfil.

Retirement from work brings a reduction in income. Further reductions in real income may occur if an older person is relying on a pension which does not keep pace with the increase in prices. In these circumstances it is difficult to maintain and run a car or to replace it when its life expires. It also becomes expensive to travel by bus unless concessionary fares are available. It should be emphasised that this decline in mobility does not necessarily mean a decline in the number of journeys, for this is determined more by needs. The more likely results of declining mobility are shorter journeys and greater effort (Robson, 1982).

Public transport services
Access to public transport depends upon the cost and availability of services, particularly in rural areas. The existence of pensioners' bus passes and other concessionary schemes reduces the impact of fare increases on many retired people. 93% of pensioners in 1989/91 lived in areas where concessionary travel fares were available (Department of Transport, 1993).

In some parts of the country, bus services can be infrequent and unreliable. In rural areas, facilities are far less likely to be within walking distance - nearly a third of households did not have a bus stop within 6 minutes' walk (Department of Transport, 1993).

According to the UK Department of Transport (1996), the existing journey patterns show that 72% of all journeys are less than 5 miles in length; half are less than 2 miles. A journey of 2 miles is hardly easy on foot for older people, especially with load carrying, but driving for a distance of 2 miles can be considered as an indulgence in terms of energy-efficiency and difficulty of parking.

To enable Third-Agers to remain independent and enjoy a reasonable quality of life, those without a car should be able to use all modes of public transport and be more able to take control of their own transport decisions.

Is there something in between walking and driving a car? Cycling could be a better choice for local trips, and combined with public transport, can offer a door to door alternative for longer trips.

Cycling can offer door to door trips with moderate velocity which enables Third-Agers to take full control of the vehicle, could be a better choice of local transport for them. However, the physical ability of older adults, which affects the use of facilities that they need, may decrease with age. Slowing down means that roads have to be crossed with care and that vehicles have to be thoughtfully designed.
2. METHODOLOGY

To enable the Third-Agers to remain mobile independently and enjoy a reasonable quality of life, they should be able to take control of their own transport decisions. This investigation will explore older adults’ experience in driving and their attitude toward cycling including daily transport needs. A questionnaire was developed by the School of Design Research at the University of Central England in consultation with specialists in the Centre for Applied Gerontology at the University of Birmingham. The questionnaire contained 22 questions with 110 decisions for each respondent, and was divided into four subjects: mobility patterns, car driving, cycling and personal information.

Questionnaires were sent out from the Centre for Applied Gerontology to 300 members selected at random from the Thousand Elders panel (Nayak, 1995). The members of the panel are people aged 55 years and over who live independently in the community and come from various socio-economic backgrounds. Two hundred and fifty-one completed questionnaires from the Thousand Elders were received and were analysed using the Statistical Package for Social Sciences (SPSS).

2.1 Age of the survey respondents

The age distribution of the survey respondents is given below (Table 1).

Table 1: Age groups in the investigation.

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Number of respondents</th>
<th>Percentage sample</th>
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<tr>
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<tr>
<td>Total</td>
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The results of the investigation include:
- mobility patterns which consist of frequency of using a car, using public transport, walking and cycling,
- use of cars and problems when driving a car,
- use of cycles, and difficulties of dealing with the environment when cycling as a means of local transport.

2.2 Mobility patterns

Among the variety of transport used for daily life, the survey respondents tend to walk and use a car more than other types of transport (Figure 2).
Enhancing Third-Agers' Mobility through the Use of Human-Powered Vehicles

Figure 2: Types of transport used for daily life of the survey respondents in the last 6 months.

Driving a car
The survey respondents are not only devoted to driving (77.4%), but also drove frequently. Among 192 respondents, 98.1% of them did drive weekly or more often. 62.2% of males and 43.8% of females actually drove daily. This does not imply that Third-Agers drive a car without difficulties. The problems that elderly people experienced will be discussed in the other findings of this investigation.

Being a passenger in a car driven by someone you know
In the last 6 months, 78.1% of the respondents in the investigation rode in a car driven by someone he/she knew. Frequency of riding in a car among these correspondents was fairly equally distributed from daily to less than once a month.

Travelling by public transport (bus or rail)
Half of the respondents had used public transport - either bus or train - in the last 6 months. 52.8% of them used the bus weekly or more often, while 66.1% of them used the train less than once a month. Females tended to use the bus more than males did.

According to Age Concern (1994), only 3% of people aged 50-74 travel by train once a week or more, while 63% never or rarely do so. 91% of people over 74 use the train twice yearly or less.

Travelling by taxi
39.0% of the respondents had used a taxi in the last 6 months. However, most of them did not use taxis frequently; 78.4% of them used taxis less than once a month.

The taxi provides an accessible transport service for those Third-Agers who do not have the use of a car, and cannot use public transport. For those who have access to cars and public transport, a taxi can be seen as an occasional supplement to the transport available to them.

Cycling
17.1% of the respondents had cycled in the last 6 months. Frequency of cycling among these correspondents is equally distributed from daily to less than once a month. Compared to other types of transport Third-Agers used, cycling was relatively less frequently used.

Walking (more than half a mile)

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People walk for many reasons; going to work, for business, leisure, health or domestic purposes. Walking (more than half a mile) was the most popular method (84.7%) of transport among the survey respondents. 37.7% of the valid cases walked daily and 94.1% weekly.

According to the Department of Transport (1996), walking along the public highway accounts for 29% of our journeys, including 82% of journeys less than a mile. In mileage terms, it accounted for 3% of distance travelled. Furthermore, most trips by vehicle - be it a bus, car or tram - involve walking at both ends.

Frequency of use of transport
Among the survey respondents, of those who drove a car in the last 6 months, 55.2% drove daily; 98.4% drove weekly or more frequently. Of those who walked, 37.7% of them walk daily and 94.1% of them walked weekly or more frequently. Surprisingly, of those who used cycles in the last 6 months, 18.6% of them cycled daily and 58.2% cycled weekly or more frequently (Figure 3).

Figure 3: Transport used weekly or more frequently.
2.3 Problems of driving a car

Figure 4: Problems of driving a car.

The survey results showed that the biggest problem when driving a car was 'Night driving' (77.8%), followed by 'Too expensive' (64.2%), 'Getting in and out of a car' (62.1%); 'Parking a car' (50.6%) and 'Clear vision' (48.1). Nevertheless 'Keeping car speed with the traffic flow', 'Driving in a traffic jam' and 'Keeping a car in complete control' were insignificant in the response (Figure 4).

Low income

All transport, except perhaps walking has a cost, and its use can therefore be limited by low income. Among the survey respondents, 64.2% of the cases declared that it was too expensive to run a car. Other sources of information have the corresponding conclusion:

In 1993, 62% of pensioners received an occupational pension. Half of these received a pension of £38.60 a week or less. Certain groups, such as single women over 75, are less likely to have an occupational pension, and, if they do, the amount is less than average. Only a limited number of pensioners at present enjoy substantial occupational pensions (Age Concern, 1996).

Low income reduces access to all modes of transport, but the most significant impact is on car ownership. The 1993 Family Expenditure Survey found that:

- Only 46.9% of pensioner couples and 10.6% of single pensioner households mainly dependent on state pensions had a car, compared to 68.6% of all households (Central Statistical Office, 1993).
- This comparatively low level of car ownership may in part be due to the relatively recent growth in mass car ownership and to the fact that fewer older women have learnt to drive. Nonetheless, low income is likely to be the major factor.

Other road users' attitude

Not only do elderly people care about what others think of their driving. However, the physical ability of older adults, which affects the use of facilities that they need, may decrease with age. 59.3% of the cases felt that it is a
problem facing unfriendly attitudes of other road users. The attitude of other road users is another barrier for elderly people to remain as drivers. Factors concern reduced sensory ability and an associated slowing in 'central processing' leading to poorer perception and judgement. Reduced 'channel capacity' (limiting the amount of information which can be handled at one time) makes it increasingly difficult to perform complex manoeuvres such as efficient judging an entry into a busy roundabout and, at the same time, needing to be aware of warning and direction signs (Bull, 1992).

Clear vision and night driving
When driving a car at a speed of 30 mph or more, clear vision is definitely an important safety consideration. In the investigation, 'night driving' was the most prevalent concern of the respondents when driving a car. 77.8% of the survey respondents thought that night driving was a problem while 48.1% of them recognised that clear vision was a problem when driving a car. The difference indicated that elderly people have reduced vision in the dark. Although there is relatively little change in visual function during the early adult years, medical research has found that very noticeable changes in vision occur during the middle and later years.

The Automobile Association (Bull, 1992) sponsored a questionnaire study of the views of elderly drivers. Many of them recognised increasing difficulty in coping with traffic. They were not, however, commonly aware of difficulty at junctions though this is a more frequent site of accidents than for younger drivers. Many had made sensible modifications to driving habits- reducing night driving, for instance and planning journeys to avoid heavy traffic. Many recognised that at some time they would have to give up driving and to a large extent would rely on their family doctor to advise them when the time had come. The occasion of the routine health assessment of older patients could be a good opportunity for doctors to give such advice.

In spite of difficulties they encountered, the survey respondents were not only devoted to driving (77.4%), but also drove frequently (55.2% of them drove daily; 98.4% drove weekly or more frequently). To enable the Third-Agers to remain mobile independently and enjoy a reasonable quality of life, they should be more able to take control of their own transport decisions.

2.4 Cycle use and problems in dealing with the environment while cycling
Cycling could be a better choice in local transport for Third-Agers. However, their attitude toward cycling and the problems they experienced have to be identified to enhance future transport policy management and vehicle design.

2.4.1 People who own a cycle and have used it in the last 6 months
According to The Department of Transport (1993), only 10% of pensioner households own a cycle and cycling mileage by pensioners has halved between 1975/76 and 1989/91. However in the current investigation, 29.7% of the ageing population own a cycle and 20.9% have cycled in the last 6 months.

More elderly people own cycles today. 40.2% of males and 18.5% of females
have one or more cycles. The number of males who used a cycle in the last 6 months is double that of females.

2.4.2 Types of cycle used

61.5% of the cycles used by survey respondents were road bikes which was the most popular type of cycle. Surprisingly, 19.2% of the cycles used by respondents were mountain bikes, which are supposed to be a youngster’s choice. A mountain bike demands much pedal force and is usually ridden in an uneasy posture for the ageing population. Older people’s mountain bikes might have been bought when their owners were younger. Foldable bikes comprised 19.2% of the cycles used by survey respondents. For those who need to store or transport cycles in a narrow space, foldable bikes are alternatives. Figure 5 indicates that females are more in favour of foldable bikes than males are.

Figure 5: Use of 3 most popular types of cycle.

Purpose of cycling

Those who cycled in the last 6 months, used a cycle for leisure (86.3%) most frequently, followed by shopping (60.8%) and social purposes (31.4%). Very few of them used a cycle for sport or work (3.9%) (Figure 6). According to the Department of Transport (1993), most cycle journeys are for commuting/business (41%) or leisure (31%). On average they (Third-Agers) have more time available than younger households, and are prepared to travel longer distances to shop. They also have more money and time for making comparison. Shopping becomes more of a leisure activity than a chore (Morgan, 1992).
2.4.3 Needs of load carrying

As the ageing population usually use cycles for leisure, shopping and social reasons, 54.5% of them believed that being able to carry a load is important when cycling. On this subject, different gender and age groups agree. Meanwhile, we found that 59.3% of the survey respondents were not fully satisfied with the load carrying capacity of the bicycle.

In the investigation, the respondents gave their opinion about occasions on which they carried the greatest load. A majority of 88.6% of the respondents believed that they needed to carry a load on a shopping journey, followed by family (24.9%) and leisure (22.3%) journeys. Cyclists of other age groups used knapsacks (backpacks) for carrying loads. This does not apply to the ageing population due to difficulties in putting it on and taking it off. It would be useful to have a storage device on a cycle to meet their needs.

2.4.4 Speed of cycling and journey length

Speed of cycling

When cycling, 51.8% of the respondents believed that riding at a speed of 6 to 10 miles per hour (10 to 16 km per hour) is suitable for people of their age. This consisted of 59.4% of males and 39.1% of females. However, 46.9% of females prefer to cycle at a lower speed of 3 to 6 miles per hour which is about double the average walking speed. Only 11.4% of the respondents thought that a speed over 10 miles per hour was applicable to the ageing population (Figure 7).

Enhancing Third-Agers’ Mobility through the Use of Human-Powered Vehicles

Figure 7: Highest comfortable speed (miles per hour) of cycling.

According to Faria, IE and Cavanagh, PR (1978): The maximum steady-state energy value (for exercise durations of 10 minutes or more) for the average individual levels off at about 0.3 hp. Even this represents a much greater power output than most of us would care to maintain during touring or riding to the office. A figure around 0.1 hp is probably a more reasonable value for a bicycle ride that lasts for an hour or so which is not exhausting. At 10 miles per hour, the cyclist would have a power output of 0.13 hp, which requires more than a comfortable power output for the average individual.

Journey length
Up to 83% of the respondents thought that a journey of less than 10 miles was applicable to older people. However, 35% of females preferred to cycle within 2 miles, which is a distance covering more than 35% of the existing journeys in the UK (Figure 8).
According to the Department of Transport, the existing journey patterns show that 72% of all journeys are less than 5 miles in length; half are less than 2 miles. Hence, for local transport in either an urban or suburban area, the cycle is potentially capable of carrying elderly people to almost anywhere needed in daily life.

Figure 8: Comfortable longest journey for cycling (miles).

5 1 hp = 746 watts
2.4.5 Problems in dealing with the environment while cycling

Cycling which can offer door to door trips, could be a better choice of local transport for older adults. Most cycling takes place on the road, so it is essential that the road network is made suitable for cycling. Presuming that cycles were properly designed for older adults (including tricycle, power assistance etc., if necessary), what were the difficulties older people experienced or thought they might encounter? The results of the questionnaires showed that 'Riding on the road with motor vehicles' was the most serious concern, followed by 'Going up hills' and 'Theft' (Figure 9).

Figure 9: Problems in dealing with the environment while cycling.

Riding on the road with motor vehicles
It appeared to be the most serious concern when cycling: 94.8% of the respondents felt that it was difficult to ride a cycle on the road with motor vehicles. This result was without contrast between gender and age groups. Excessive motor vehicle speed is a major hazard for cyclists - and other road users. Greater attention must be paid to the non-traffic functions of the road. Reducing speeds and aggressive driving through engineering, education and enforcement, is crucial to creating a cycle-friendly infrastructure. Cyclists will benefit from a range of measures to encourage sustainable transport and reduce the use of private cars. Restrictions on car use are needed to improve the environment; cycling offers a practical alternative in many cases (Department of Transport, UK, 1996). Education programmes to help the ageing population (children and adults as well) to cycle more safely and to make motorists more aware of their responsibilities towards vulnerable road users are required.

Riding on designated cycle routes (segregated cycle routes and networks)
Contrary to the previous question of 'Riding on the road with motor vehicles', very few respondents (3.3%) thought that riding on designated cycle routes was a problem. However, in the question of 'Lack of cycling routes', 70.0% of the cases believed that it was true.
In order to encourage Third-Agers to use the cycle as a means of transport,
it is necessary to create a cycle-friendly environment by both increasing segregated cycle routes and using existing road networks.

**Going up and down hills**

Cycling up hills was a significant problem according to 86.2% of the respondents. Furthermore, 93.5% of females thought so. On the other hand, relatively fewer cases (14.3%) thought cycling down hills was difficult. 20.7% of female respondents reckoned cycling down hills was a problem while only 8.6% of males thought so.

Gravity has its most devastating effect when riding on hilly terrain as anyone who has pushed a heavily loaded touring bike up a steep hill and then hoped that the brakes would hold when coming down the other side can testify. When there are no steep hills, 60.3% of the respondents considered cycling as heavy work for elderly people. It makes no sense to expect Third-Agers to cycle on hilly terrain without any power assistance. A variety of cycle designs for those who live in different terrain may be the best solution.

An easily operated and smooth braking system is essential for cycling especially when going down hills, not only for safety but also for a sense of security.

**Cold and heat**

There appeared to be inconsistent points of view when dealing with cold and heat while cycling. Compared to 46.2% of the cases that thought cold was a problem when cycling, very few respondents (14.3%) considered that heat was a problem when cycling. This signifies that they do not cycle as vigorously as other younger age groups do. In this case, cold could be a major concern when cycling in low temperatures.

**Wind resistance and weather**

Second to the resistance of hilly terrain, wind resistance was considered as the main problem by cyclists; 56.7% of the respondents believed so. Weather is surely an important factor in daily life. 43.8% of the respondents thought that rain or sun made cycling difficult.

High speed cycling implies high wind resistance, which is one of the major concerns in bicycle racing. This is not of concern to elderly people, as most of them cycle at speeds under 10 miles per hour. Wind and gales is the problem. What makes wind resistance a particular problem is that it can constantly change in force? On the other hand, although air temperature may not be low, the wind-chill index must always be considered.

**Parking and theft**

Parking and theft of cycles were recognised as problems for the survey respondents; 23.8% of them considered parking to be a problem and 72.4% were concerned about theft.

**Parking**

Provision of secure cycle parking facilities should be sought in all major developments and in town centres. Town centre management action plans should include proposals for improved access, cycling facilities, publicity and promotion. Local authorities should work with employers and retailers to develop easy access and secure cycle parking in town centres, at stores and other attractions.
If cycling is to retain its inherent advantages, it is essential that cyclists are able to park at the most convenient location, usually immediately outside the venue they wish to visit. Where cycle parking provision is not conveniently placed, cyclists need to be able to attach their cycles to fixed features.

**Theft**

Cycles are an example of a commodity vulnerable to theft. They are highly mobile, exposed, high enough in value to be worth stealing, too low in value to be worth equipping with expensive security devices, frequently hard to identify and easily disguised.

Experience in the UK and in other countries demonstrates that steps can be taken to reduce theft. It is important that all possible measures to prevent theft are taken to encourage Third-Agers to take up cycling.

**Cycle registration and recovery**

Currently there is no national system in the UK for the registration of cycles, which can be valuable items and are exposed to risk of theft. A widespread drive for voluntary cycle registration could yield a significant reduction in theft. The cost of registration and marking could come to as little as £5 per cycle, especially if marketed through cycling organisations (Department of Transport, UK, 1996).

### 3. CONCLUSION

Although it is reasonable for all individuals to expect age-related changes in health and physical functioning as they grow older, individual differences are the rule. For the most part, we control our own health, and how we grow older. The body's capacity for exercise in late adulthood is influenced by the extent to which the individual has kept his or her body physically fit at earlier points in the life cycle. It is not uncommon to find that older individuals, who continue to be physically active, such as those who participate in the Senior Olympics, are healthier than many individuals who are much younger.

Traditionally the objective of traffic management has usually been to maximise capacity for motor vehicles, but this is changing. In future there will be a need to avoid motor traffic capacity considerations pre-empting the provision of cycle-friendly traffic management and design (Department of Transport, UK, 1996).

Cycling offers a widely accessible, healthy, convenient and environmentally friendly means of making local journeys, especially in urban and suburban areas. Cycling at moderate speeds enables older people to take full control of their machine and could be a better choice of local transport for Third-Agers. A clear recommendation arising from this survey is that a cycle-friendly infrastructure and thoughtfully designed human-powered vehicles can offer a better choice of local transport for Third-Agers.

### 4. REFERENCES


Enhancing Third-Agers' Mobility through the Use of Human-Powered Vehicles

Part 4
Mobility and activity: needs and barriers
32.

SUPPORTING MOBILITY OF THE ELDERLY BY MEANS OF SAFE AND COMFORTABLE CARS

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1. INTRODUCTION

The relationship between older people and their own cars can be characterised by a quotation from as long as ago as 1936:

*I do not believe that the relation between a person and a physical object, whether it be a toy, a utensil, a weapon, a dwelling-place, an ornament or a conventional unit of currency, is ever a simple affair between a person and a thing; it is always a triangular relation between at least two people and the thing. (Susan Isaacs, 1936, 70)*

Who might that second person be, the one who plays such an important role? First of all, you think of the front-seat passenger. With his or her mere presence, this person influences the social situation and thus the comfort and safety of the driver. There are also the other drivers who, with their behaviour, can make the situation of the elderly driver either more or less comfortable. The behaviour of other drivers is like a mirror that reflects the way the older drivers act and strongly influences their image of themselves. Who else could be this second person that is so important in the relationship between older drivers and their cars? Here, I am thinking above all about the designers, the ergonomics experts, who - although they are not directly present - still have indirect contact to the driver in that they have designed the vehicle. My own research aims to describe the requirements of the elderly, to use these requirements to derive guidelines for the design, and to sensitise designers to the wishes of older drivers.

My lecture will deal with the following topics:

Firstly: the behaviour of elderly drivers
Secondly: the design of car cockpits, especially displays
Thirdly: the moods and emotions of elderly drivers.

2. DRIVING BEHAVIOUR

The development of age structures and the pattern of driving-license ownership will lead to a significant increase in the number of elderly drivers, especially elderly female drivers. This development will influence accident statistics. The proportion of elderly drivers involved in accidents - which is still
small nowadays - will inevitably rise. The causes of accidents change with increasing age. The share accounted for by "inappropriate speed" is falling continuously; accidents caused by failure to give way (or yield, as they say in the USA), especially in complex urban traffic situations, will increase. It is a fact that older drivers are already over-represented in the case of accidents involving left or right turns in urban traffic. In this situation, a lot of information has to be processed all at once within a short period of time.

As field studies have shown, the driving behaviour of the elderly differs only slightly to that of young drivers. On motorways and dual carriageways, older people generally drive more slowly than young people do. Older people drive more gently; they brake and accelerate less frequently. However, the elderly display signs of insecurity at junctions, especially if these junctions have been constructed in a complex manner. They have difficulties joining the flow of traffic and getting into the right lane; they overlook traffic lights.

Older people handle driving tasks that place average demands on the driver just as well as by younger people. Difficulties arise when fast action is required.

From the point of view of method, it is not always easy in research of this kind to distinguish clearly between the effects of age and those attributable to driving experience. In a study that we commissioned, an attempt was made to achieve this (Heinbokel and Frese, 1993). On a car journey, all the driving errors of those participating in the study were observed and evaluated with error taxonomy. Examples of driving errors include:

The driver turns into a side street although turns in this direction are prohibited at this location. The driver does not notice the error.
Or: When switching lanes, the driver overlooks a vehicle on the right-hand lane. The driver of the other vehicle has to brake sharply.

On the whole, the group of elderly drivers (older than 50) made more mistakes than the group of young drivers (younger than 40). On a one-hour journey, the younger group made an average of 8 errors; the older group made an average of 13 errors. However, when the fact that the two age groups have different degrees of driving experience is taken into account, the result can definitely be viewed in relative terms. Those older drivers, who have extensive driving experience, in some cases with several classes of driving license, make the fewest mistakes. In these cases, they do not differ significantly from younger drivers. Only the older drivers who do not have this broad experience make a noticeable amount of errors.

Two important conclusions can be drawn from this result. On the one hand, it seems to be an urgent requirement to identify driving strategies that specifically help older people to deal with the demands placed on them in traffic. It is obvious that drivers with a broad background of experience have successful strategies. On the other hand, these results weaken the theory that specifically older drivers will cause an increasing number of problems in road traffic. It is more realistic to expect that the next generation of older drivers, who will have a lot of driving experience, will continue to drive safely.
Research into driving errors have shown us even more: if we analyse the process of how an error comes about and how that error is dealt with, the next step will be the ability to formulate guidelines for the design of vehicles. We know, for example, that especially older people have a fear of making mistakes when dealing with technical devices. Whereas younger people simply try things out and see what happens, older people want to avoid mistakes. The result of this is that the phase of planning action and making a decision takes a long time. The consequence for the design of technical systems is that they should be largely tolerant of errors, that is, they should leave open the possibility that you learn from your mistakes and that you can correct mistakes.

It often happens that drivers notice their own mistakes when it is too late. Here, technical assistance is required - to provide the driver with feedback at the right time and to indicate what constitutes safe behaviour. The engineering of appropriate feedback is a central design feature that has been around for quite some time. For example, an acoustic signal sounds when you forget to switch off the lights on getting out of the car.

There are numerous arguments against concentrating on avoidance of errors during design. In traffic, it is impossible to avoid all errors. In systems that do not permit error, the options for action on the part of the user are so restricted that the user is no longer able to acquire the knowledge that is necessary for complex situations. This is why a design strategy that is also based on the principles of error management has to be developed. In addition to the feedback principle, this also includes technical support during driving by means of automation. Such systems prevent the occurrence of the negative consequences of errors, for example, shifting from lane to lane unintentionally or coming to a standstill in good time.

3. DISPLAY DESIGN

The second topic I would like to deal with concerns the design of car cockpit displays that are suited to the elderly (Kebeck, Cieler, Pohlmann, 1993). So far, the basis for design guidelines has consisted almost exclusively of knowledge from the psychology of perception and the senses. For example: How can displays be designed in such a way that they do not dazzle? What typefaces guarantee good readability? What character spacing causes the fewest reading errors? The constant increase in the amount of information available in a car means, however, that proposals of this type are no longer sufficient. Design input for displays should also be based on knowledge about higher levels of information processing. To achieve this, we have introduced above all aspects of memory psychology into cognitive ergonomics. The changes that the memory undergoes in old age have so far not been afforded sufficient attention in the ergonomic design of displays in cars.

When displays are checked, three clearly distinguishable demands are made of the memory: firstly, remembering meanings, for example: What does this
symbol mean? Secondly, remembering positions, for example: Where is the fuel gauge? Thirdly, remembering states, for example: What speed was just displayed on the speedometer?

In the past few years, a large number of empirical studies have shown that the ageing memory is not subject to any general reduction in performance. As a rule, memory failure is restricted to certain clearly defined functions.

If it is known which parts of the memory change with age, the vehicle cockpit can be designed accordingly. The aim is then to compensate for memory deficits by means of ergonomic design. Older people, for example, spontaneously use fewer organisation strategies to structure and retain learning material. This increases the possibility of unsystematic memory errors. It is therefore of particular importance for retaining display positions and states in the memory to provide clear and concise display arrangements in passenger cars. The following aids to organisation can be offered for the design of displays:

- Arrangement of displays according to principles of Gestaltpsychology
- Compatibility of controls and related displays.
- Arrangement of displays according to logical criteria, for example: all warning lights in one position.

Other guidelines from the field of cognitive ergonomics from the point of view of the psychology of memory include:

- Pictograms to mark displays should be object-related and close to reality.
- Verbal markings are to be used above all when no concrete pictograms are possible.
- In the case of digital displays, appropriate engineering must ensure that the information displayed is "refreshed" at a slow rate.
- The number of displays should be reduced to a necessary minimum.
- The reduction of the amount of information can be achieved by means of integrated information displays.
- Acoustic displays place less of a burden of the processes of attention. They do not have to be read off at regular intervals.
- If possible, some displays should contain instructions. For example: *Please fill the tank!* instead of: *Contents of tank almost exhausted!*

These guidelines for display design give an indication of what factors apply to the design of the entire car. Older people are an important reference group for design recommendations. However, there should not be a special vehicle for older people; this would marginalise older drivers. A vehicle of this
type would certainly have very little chance of becoming a successful product on the automobile market.

4. MOODS AND EMOTIONS OF OLDER DRIVERS

This brings me to the third topic: the moods and emotions of older people when driving. Anyone who buys a car nowadays directs his or her attention not only to the exterior – to the product – but also inwards – to the self. On the one hand, the car has to meet certain functional requirements such as safety or variation of use; on the other hand, it should also fit the individual personality of the customer. In the 1970s and 1980s, knowledge of popular psychology became hugely widespread among the population. Hand in hand with this goes an inward reflection on the part of the customer towards the self, towards feelings, experiences, and memories. A life is planned as a personal project where the aim is no longer the satisfaction of basic needs such as eating and drinking. Instead, it is a matter of more abstract aims such as self-realisation, increasing self-esteem and of pleasant experience - all in all, the good life.

Here, products that promise the customer direct access to the desired experiences can help. This emotional provision of experience through products is also becoming increasingly important in the market for cars. Of course, driving a car is an emotionally loaded situation one way or the other. So far, it is more the negative emotions such as aggression, stress or frustration that have been investigated; positive experiences in the driving situation have hardly been investigated at all. We have started to study aspects of driving enjoyment in free interviews (Arig, 1997, Küting, 1997). What do people of different ages regard as driving enjoyment? There has not yet been a quantitative assessment, but I would like to present a few verbatim quotations from the interviews.

5. WHAT DOES DRIVING ENJOYMENT MEAN FOR YOU PERSONALLY?

Setting off on holiday, the first three or four hours, then it becomes too long. And relatively short journeys in the countryside, where I don’t get into traffic jams and where, over and above the driving, I get to see a bit of the countryside. But I think that, at my age, it is not the driving itself; for me personally, it’s more the situation I am in, where the car plays a role. I don’t like long journeys to reach a holiday destination; this is always unpleasant for me.

Did that used to be different?

Yes, it used to be different. I used to enjoy driving.

Another example:
I enjoy driving enormously when I am driving my car in an area with attractive countryside on small roads. I always say roads of the fifth level. My wife and I talk about the fifth level when I can drive at my leisure. There is no hassle, the car is calm. I am absolutely sure that if chicken runs out somewhere and I hit the brake, I will definitely not run over that chicken if at all possible. And we then feel so at home in this car that we don't have the feeling at all that there is anything particularly negative about this type of driving. And I think this is a very important thing, for example, for people of my age - and there are more and more of us. If you can help anyone to develop this feeling, that's something to be very happy about. Of course - to mention the negative side - I hardly ever drive on the motorway: I have no desire to sit in a traffic jam between Hanover and Berlin for two hours.

Compare this with the response of a younger driver when asked what driving enjoyment meant to him:

The physical value of acceleration, the motion, the speed is for me important components of driving enjoyment. The physical experience in a small, nimble car with high engine performance is more intense than in a large travelling saloon.

It is obvious that driving enjoyment has two facets as something to be experienced: on the one hand, it is relaxed, in-command gliding in lovely countryside; on the other hand, it is the spontaneous, playful mastering of changing situations.

For older people, driving enjoyment is more the relaxed gliding in pleasant surroundings. Naturally car manufacturers cannot guarantee driving enjoyment, but they can design the car in such a way that it provides the prerequisites for stress- and aggression-free driving. This includes the car interior, which offers enough space and comfort. The differences between drivers grow with age. For this reason, a car should be designed with as much variation as possible. This variability can involve quite separate areas: the setting of the seats and of the steering wheel, but also the driving dynamics. At any rate, it should not be that the driver adapts to the car, but the other way around: the car should be adapted to the wishes of the driver in the best possible way. The possibilities to achieve this today have by no means been exhausted; more research and development work is required. If you regard cars from a holistic point of view, the harmonious interplay of different sensory stimuli can be a new design objective. Especially for older customers, the car could be a place in which they choose to experience things, in which hearing, seeing, smelling and feeling provide a unique combination of stimuli.

Let me now return to the start of my lecture. The relationship between a driver and his or her car is always a triad relationship between at least two people and the car. Developmental psychology tells us that, with age, the constellation of motives and emotions that determine social behaviour changes. Whereas in mid-adulthood the need for information is an important
motive for social contacts, this moves into the background in the case of older people. Here, the emotional quality of the social encounter comes to the forefront. The result is that although social activities become less variable they become more intensive (Hasselhorn, 1997).

This means that perhaps the emotional attitude to cars and driving changes with age. At any rate, in future we have to pay more attention to the emotional processes of older drivers in our research and development work. The designer, the ergonomics expert has three areas of work (see Figure 1).

Design, lifestyle and self-image
Who am I? Who do I want to be? What is my image?

Thought and action
Relief for the driver through controls and display systems, assistance systems

Seeing, hearing and moving
IMPROVEMENT IN GETTING IN/OUT OF CAR,
better transmission of windscreens.

Figure 1: Aspects of the Concept: Driving in Old Age

My hypothesis at the close of this lecture is as follows: in designing the vehicle, the designer enters into an indirect social relationship with the driver. Older drivers can look back on a lifelong history of handling various vehicles. When cars are designed in future, not only the cognitive but also the emotional requirements of elderly customers should be taken into account.
33.

COPING WITH OUTDOOR MOBILITY DIFFICULTIES AMONG ELDERLY PERSONS

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1. INTRODUCTION

This paper discusses what coping with outdoor mobility difficulties means to older people facing such problems. We are not trying to present exact quantitative information, for example, about coping strategies used in this kind of situations but will lean on more qualitative data and examples about how the difficulties to move outdoors are handled by elderly persons.

In psychological literature, the concept of coping refers to behaviour, the purpose of which is to maintain the ability to adapt in stressful situations. Nowadays, coping is usually understood rather as handling or managing stress and/or the problematic situations causing stress, not as mastery over them (e.g. Lazarus & Folkman, 1984; Suutama 1995). Coping is seen as a process which includes, or is closely connected with, many other concepts such as anticipation, appraisal, internal and external resources and adaptation. However, most psychological studies on coping have concentrated mainly on the ways and strategies that people use when they handle stressful situations.

The ways and strategies of coping have been categorized or classified in various ways, for example, whether the strategies are focused on the problematic situation itself (problem-focused), on the stress or other emotions caused by the situation (emotion-focused), or on trying to forget or deny the problem (avoidance strategies). Or they can be classified according to the mode of behaviour, i.e. what you think (cognitive strategies), what you do (behavioural strategies) or what you feel (emotional strategies). Also, at a more specific level, many conclusions have been drawn concerning the most important coping strategies. For example, Stone et al. (1988) concluded that the most often mentioned coping strategies in studies on major life events among elderly persons were: Social support, Problem solving, Information seeking, Religiosity, Situation redefinition, Avoidance and Tension reduction.
The choice of different ways and strategies is influenced, at least, by the nature of the event and the personality of the coping individual. Ageing, as such, does not seem to have any major effects on the choice of the coping strategies (e.g. Murrell et al., 1988). The number of the different ways of coping used may decrease with increasing age, but the rejected ways seem to be those that have not been effective in previous coping situations.

2. HANDLING OUTDOOR MOBILITY DIFFICULTIES

Regarding the outdoor mobility difficulties, there are certain things that influence elderly, as well as younger persons' coping behaviour. For example, if the mobility difficulties are anticipated to be only temporary (short- or long-term), a person probably copes with them differently than if he or she believes them to be permanent. There may also be, and often is, more than one reason for the outdoor mobility difficulties. Things causing these difficulties are, for example, deteriorated health, decline in strength and abilities with normal ageing (at least in very old age), social losses, various fears, problems relative to the physical environment and weather. Similarly, difficulties in moving outdoors may have many different consequences, such as difficulties in daily activities, decreased social contacts, giving up with some activities (work, hobbies, etc.), and mood problems. Coping with outdoor mobility difficulties is often a complex and psychologically demanding process, because a person has to handle, besides the actual mobility difficulties, also their several causes and effects at the same time.

When elderly persons handle their outdoor mobility difficulties, it is probable that the same broader coping strategies are used as in other stressful or problematic situations. However, this is a quite seldom studied research problem. We have found only a few recently published articles in English where this subject was discussed, or perhaps just touched upon (Clark et al., 1996; Landreville et al., 1996; Meeks et al., 1989; Norburn et al., 1995; O'Neill, 1997; Steffens and Bergler, 1997; Swinson et al., 1992). On the basis of these articles, we can draw the conclusion that help and assistance from other persons (social support) is the most important coping strategy in outdoor mobility difficulties among elderly persons and younger adults, as well.

In the above mentioned studies, at least part of the subjects were over 60 years old. Most studies used selected samples or specific groups of subjects, such as blind or demented people, and the generalizability of their results may be questioned when it comes to the so-called normal population. However, other coping strategies revealed in these studies were: use of various equipment or devices (e.g. a walking stick, wheel chair), changes in behaviour or in life-style (stopping driving a car, decreased moving outdoors, giving up or changing hobbies, having less face-to-face contacts, etc.), medication (in phobic situations) and some kind of modifications in the (close) environment. Other interesting findings were that decrease in the number of coping strategies with increasing age was not associated with the
effectiveness of coping, and that depressive symptoms were associated with coping strategies Escape-avoidance and Accepting responsibility.

3. FINNISH FINDINGS

Questionnaire data of about 600 persons aged 55+ and living in Jyväskylä, Central Finland (see Ruoppila, Ukkonen and Suutama in this publication), showed that the older age groups with more mobility difficulties tend to avoid certain situations more than the younger groups. They avoided moving outdoors during dark hours; they avoided driving, cycling or walking in bad road conditions as well as in bad traffic conditions (rush hours, dangerous crossings, etc.); they also tended to avoid driving, cycling and walking long distances and in unfamiliar surroundings more than the younger subjects. The caution increased with increasing age. Elderly persons seemed to know quite well their own abilities and limitations and acted accordingly.

In this study, 30 subjects over 75 years of age participated also in a theme interview on the meaning of outdoor mobility, difficulties or restrictions in it and on managing these difficulties. In the interviews, many subjects emphasized the great social and other importance of outdoor mobility in their life.

"If I'm not moving around, I don't have any pals, but when I go to others they accept me warmly. I'm very pleased with having made new friends, and that way I have not suffered from loneliness. And if I can keep my present shape, I'll never just sit in my corner, I have to move." (82-year-old man)

"Mobility means contact with the outside world, you can see people and run your own business so that you don't have to ask others for help. That means quite a lot to me. I would like to run my own errands as much as possible." (80-year-old woman)

The interviewees had various, often quite individual, ways to cope with their outdoor mobility difficulties, but some commonly used strategies were also found. People often changed from one mode of mobility to another one, which proved to be easier or more suitable in their present situation. For example, giving up driving a car and beginning to use public transport or changing from cycling to walking (in some cases from walking to cycling) were mentioned. Other kinds of compensation, and that way improving the ability to move outdoors, are shown in the next quotations.

"For example, when I got asthma, I thought that my moving outdoors is all over. But then I started to swim more... Asthma has no effects on my mobility now, because swimming has helped me to conquer it. I started little by little, gradually swam more and more, and then I started water gymnastics, too." (79-year-old man)

"I do physical exercises indoors now when I can't walk. I do those exercises with my legs and arms every morning. You have to do it, if you don't want to get stiff. I've done it since I came home after the operation. It's one of the
Coping with outdoor mobility difficulties among elderly persons

good things, when you can't walk." (83-year-old woman)

Accepting the decline in abilities and possibilities for outdoor mobility in old age was quite common, as well. Giving up activities was often seen as a natural part of life in old age.

"I don't want to walk because of my knee, but I know that I should. Well, I walk to my friends, and in the city I go skipping from a store to another. But I don't like it, because it is not brisk enough. I have a stationary exercise cycle too, and I should treadle it, but the scenery doesn't much change there... On the other hand, the things you wish for become fewer with increasing age. You seem to give up things, and it doesn't even annoy you. I've been interested in choirs, I have participated in many, but because of these knees of mine I can't be bothered to go to any of them now." (78-year-old woman)

Contentment with the prevailing situation was stated in many interviews. At the same time, the interviewees were keeping up positive attitude towards life in spite of perceived or anticipated mobility difficulties.

"We'll see what comes, but if I keep my present condition, I'm very satisfied. I know that I already go downhill, and I may enter the final straight any day now, but that's life." (82-year-old man)

"Every morning I realise that at my age the next morning may be the one, when I'm not able to go anywhere. I have to be ready for it and take a stand that I wouldn't become depressed or bitter for what happened to me." (80-year-old woman)

As in practically all coping studies, help and support from other persons, especially from one's own children, was seen as a very important way to handle difficulties and stressful situations.

"At the moment, I cannot be afraid of anything. If there won't be any accidents, everything will go on as usually... Luckily, I have a child living quite near, who can help me if something happens. And you can get other kind of help too, if you need, I believe so. As far as children live nearby, I feel secure." (83-year-old woman)

Social relations and changes in them, especially concerning family members, may have many kinds of influences on people's everyday living. They affect also outdoor mobility, which is revealed in the next fragment of an interview.

Question: "Has your circle of friends changed lately?"
Answer: "Yes, clearly, the circle of friends is decreasing and those who are left are losing their strength. You can say that loneliness is growing around us too."

Q: "Has this affected your outdoor mobility?"
A: "Not really, because after my husband and I stopped walking together I have not had any other walking companion. I have walked alone after that."

Q: "How have you got along with these changes?"
A: "Well, it has caused me some pain that we cannot move outdoors together anymore, but such is life."
Q: "Have these changes had the kind of effects that you cannot make certain trips anymore?"

A: "I sure can't go out as much as I did a year ago. The situation at home changes it. I have to consider carefully, when I can go and how long I can stay away." (80-year-old woman)

The interviews also revealed that for this group of people it was most difficult to cope with those outdoor mobility difficulties which were connected with social losses such as death of spouse, other close relatives or friends. Another interesting finding was that stopping driving seemed to be quite easy for some persons, but very difficult to some others. Generally, the majority of the interviewees held positive attitudes towards their situation at the moment and optimistic views of the future. It must be pointed out that most of the subjects participating in the theme interview had good functional abilities; somewhat less positive and optimistic attitudes (e.g. depressiveness, passive resignation) may be expected among persons with poor functional capacity (cf. Suutama, 1995).

4. DISCUSSION

The choice of the ways of coping depends partly on the reason for outdoor mobility difficulties; whether it is, for example, reduced locomotion, failure of eyesight, social losses, fears, weather conditions, or a combination of various matters. The difficulties, as well as reasons behind them, may be regarded either as losses, threats or challenges (see e.g. McCrae, 1984), which influences the individual's appraisal of the situation and his or her resources and ways to cope with that situation.

On the basis of the information given by the studies mentioned above, as well as other data (Suutama 1995), it is concluded that the adopted ways and strategies of coping are quite individual even if some common features are also found in them among elderly persons. Most of the independently living elderly persons are well able to cope with their outdoor mobility difficulties and other problematic situations. They solve their problems alone or with close persons, and help, assistance and emotional social support are sought and usually found when needed. However, negative outcomes, such as getting depressed, are also possible if help is not found, if mental burden gets too heavy (e.g., in case of successive losses) or when the adopted ways of coping are unsuccessful.

5. REFERENCES


Note: The quotations from the theme interviews were taken from an unfinished Finnish manuscript by Jouko Laaksonen, Isto Ruoppila and Timo Suutama and translated by Timo Suutama.
1. INTRODUCTION

In consumption studies one interesting approach is to study how new products such as technological innovations emerge in the mass market. The pioneering groups can either be the young adults with new consumption habits, needs and desires or the wealthy middle-aged people with better economic resources.

Sometimes the new lifestyles or cultural objects appear to remain age-related or dependent on the stage in life-course. Sometimes they gradually break through and change the whole society.

I have been studying how the car-ownership and driving have become an essential part of everyday life among the middle-aged and elderly Finns in past two decades. Which background variables explain the pace of change? To what extent the new driving cohorts take their place in age-system? How do they give up driving and a part of their autonomic mobility? When do they still consider buying new cars?

As the basic source material I have data from the large household studies gathered by the Statistics Finland from 1976 to 1994.

2. THE AIM AND THE METHOD

It seems that those cohorts that learnt to use cars as transportation means and as an important part of their everyday life are not going to give up driving easily. As they still are relatively young, it is obvious that the amount of old-age drivers will increase significantly in the future. During the last two decades the skill of car driving has become common among young and middle-aged women. This will have a long-term impact on the autonomy and mobility of the old-age households of tomorrow.

Consumption can happen on an individual level and on household level. In the following text all figures represent the consumption on household level. I could have used the concept of family too, but it has some weaknesses. Family refers to huge variation of functions, social and emotional bonds,
norms and presumptions. In modern welfare state these remain and it has become very important to define in unequivocal way what a family is and who the members of it are. It can be said that as our daily life has diversified, the strongest common factors of the family are found in the field of consumption. The other reason to avoid the word ‘family’ is that actually the average size of Finnish household is today slightly more than two inhabitants and the size will continue to drop during the next few decades. The proportion of people living alone is steadily increasing and the usual norm of family with both parents and one or more children will be only a shortening phase in some life.

Actual buying decisions are made in different kinds of situations and routines, that can consist a varying amount and different forms of communication, negotiation and agreement. Sometimes it is a question of struggle, what purchases is important or necessary. Usually the set of priorities is built and reproduced in a more silent way and it is not always a question of power or authority. Thus individual family members are the actors behind the purchasing and owning situations, but the action happens in an environment of dependencies. That is why I have found it natural to have household as the basic unit. Households of different age can not be compared with each other because their size and formation are different. I have divided all the money consumed by the amount of OECD consumption units belonging to the same household. The first person in the household gets a value of one. The next adults get the value of 0,7 and the children 0,5 each. The operation is quite mechanical but it is the most useful and systematic method available.

The age of the household in the following figures is the age of the adult person in the household with the biggest income. Usually it is a male. In the youngest age group the proportion of women is bigger because the position in the working life is not stable and more people live alone. In the oldest age groups the amount of men is very small because they die younger.

In the original household study the information of goods bought is gathered considering a very short period of time. Then the amount of money spent is multiplied to represent the situation during one year. This system works best with goods that are bought on a regular basis. With cars the numbers can be quite misleading and significance tests tend to produce very weak results. The variances are not valid either. The statistical mean of the group is not affected by this method and it can be used to illustrate the situation in whole population.

3. BUYING A NEW CAR

In 1976 buying a car constituted 36 percent of all traffic costs. (Maintaining one costs slightly less.) There was a peak in the costs of car buying in the age group of people older than 25 but less than 30 years. No significant changes occurred in the older cohorts before the age of 60. After that the drop was dramatically. People in their sixties did spend some money on cars. But there were very few cases, where a person older than 70 bought one.
Nine years later there still was a recognisable change around the age of 60, but the drop was no more dramatic. It seems that the persons born after 1925 and before 1935 bought fewer cars than the ones born later. The basic difference from the year 1976 is that the 60-year-old people did not take their place in the age-system of car buying to the same extent than their predecessors. It was also the first appearance of the people over 70 spending a substantial amount of money in buying vehicles.

With ageing the households have a tendency to change their needs and habits. In car-driving this means that the average amount of kilometres diminishes. That is why their cars last longer and ageing households
acquiring a new car in their sixties can have a relatively long time ahead of them to remain car owners. Car buying can be the last major investment they are going to do while still in working life. So from the timing of the car buying it is not possible to estimate how long they are going to remain drivers, because normally they can trust that the car lasts their life. Although the changes in timing tells a lot about the attitude towards driving, the set of priority in consuming preferences and the financial resources of a certain age group.

The growing trend of people over 60 buying cars continued in 1990. The most significant change happened in the youngest age group. Traditionally the young people have very seldom been able to buy a car. Now their position in the market had developed remarkably.

Figure 3. Money spent on buying a car by households of different age per OECD consumption unit in 1990 (100% average)

In 1990 nearly 140 000 new vehicles were registered in Finland. In 1994 the amount was 67 000. The reason for this was the economic recession in the beginning of the decade. In 1994 many people chose to keep on driving with their old cars or delayed the car acquiring instead of buying immediately a new one. The economic situation changed the age system of car-buying profoundly. Unemployment hit the youngest generations quite badly and this is the first time that the 25-29 old ones were not the most important car-buying age group, but a marginal one. Those who still could afford to invest in cars were the middle-aged or older households. In the first half of the decade buying new cars dropped so much that the amount of all registered motor vehicles slightly decreased. The total traffic performance decreased too, especially in the public roads. On the other hand traffic in the streets and private roads kept on increasing, which reflects the decentralising tendency in the structure of Finnish towns.
Part 4: Mobility and activity: needs and barriers

Figure 4. Money spent on buying a car by households of different age per OECD consumption unit in 1994 (100% average)

The household study of the 1994 was made with a smaller sample of cases than the previous ones, but the results are supported by other findings. Although the results reflect to some extent the economic situations and different age groups are affected differently by it, a continuous trend can be seen. The major conclusion is that in 18 years the point where people no more buy cars has moved further in the life cycle.

The meaning and the importance of the change are facts that depend on how we interpret them. There is no absolute measure, whether a trend is weak or strong or a change is fast or slow. It is always a comparison to change in some other fields of consumption, change in a some previous time or change compared to what we would have expected.

It is apparent that car-ownership has some elements of a typical cohort phenomenon. To some extent it is interwoven with age-related variables such as position in society and in life cycle. The pace of transition suggests that we have not yet reached the limits of the motorising.

4. USING THE CAR

Car buying is a huge investment, whose timing and frequency are strongly influenced by the current economical situation and the future prospects. People should have saved money in advance or they have to take a loan, which requires a certain trust on future earnings. More stable phenomenon is the amount of kilometres driven by people. It can be measured for instance by investigating how much money is spent on gasoline. As expected the numbers show essentially the same but significantly more stable change.
In 1976 the quantity of driving diminished by age. After that the shape of the consuming curve changed and a new peak emerged. At first it was a moderate one and was placed at the age of 45-49. Gradually its importance has gained weight and in 1994 it was the 50-54 year old households that spent most money on gasoline. The conclusion is that the change in car owning is not a pure expression of people with increased economical resources to invest some of it on newer cars. They also drive more than the comparable age group before them.

5. CONCLUSION

It seems inevitable that in future we will have a growing number of older people in traffic with their own motor vehicles. The phenomena of car driving and car owning are not simply about traffic or an answer to question how to move from one place to another. The rapid change in age-structure of driving suggests that it has also psychological and social meanings whose importance can not be neglected. The possibility and ability to drive have become essential parts of personality, self-image, freedom, self-expression and autonomy for many people. The driving experience and enjoyment of it are factors that can not wholly be substituted by providing other means of transport.

There is a strong tendency and will to continue driving in old age, which means an increased risk to be part in traffic accidents. What conclusions
should be drawn about it, is always a political question. Risk levels can be estimated, but to what extent are they acceptable can not be answered by scientific methods. Modern societies are about defining risks, calculating them and deciding, what to do to them. Political power in this situation means the ability to define the agenda, the way we talk about risks, how we define them, and the values we put against each other. People in their late middle ages do have relatively strong economical and political power and the proposition of them is still increasing. Thus there is a strong potential that can be used to lobby the ‘positive’ sides of driving such as mobility and autonomy. The ‘negative’ elements of it such as danger to self and other people can be softened for instance by trying to define the health in a way, where the ability to fulfil ones personal subjective needs is important. The scientific study and knowledge can provide information on what are the reasons and consequences, but the question to on what condition and to what extent car driving can maintain its growing importance and status will remain a political one.
35.

OWNING AND DRIVING A CAR AMONG ELDERLY PEOPLE – AN INTERNATIONAL COMPARISON

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German Centre for Research on Ageing (DZFA) at the University of Heidelberg, Germany

1. INTRODUCTION

In West European industrial countries the preferred means of individual transportation is the car. In many cases, especially in rural areas, a car is an important prerequisite for taking care of daily necessities, keeping up social relationships and taking part in leisure activities (Gelau, Metker & Tränkle, 1993). When people grow older the importance of owning and driving a car as a means to lead an active and independent life can be further stressed by changes in their physical condition (Mollenkopf, Marcellini & Ruoppila, 1996). On the other hand, the significance of having the possibility to drive a car can be greater than just a means to get where you want. In research, there is a growing recognition of the psychological connotations that the possession of a valid driving licence and the possibility to drive a car can have to an older person. Studies have shown that a valid driving licence and driving can give an elderly person the feeling that he or she is still an active and competent member of the social world (Eisenhandler, 1990; Persson, 1993). A recent study by Marottoli et al. (1997) further supports these findings, as driving cessation was found to be independently associated with increased depressive symptoms.

The increasing number of aging people as well as the increase in the number of aging drivers in the western countries has been widely acknowledged. Studies on the driving behaviour on elderly population have indicated that the number of kilometres driven per year decrease with age (Gelau et al. 1993), but that the frequencies of car driving seem to be less affected by age (Gelau et al. 1993; Pfafferot, 1994). Most of the elderly drivers also want to continue driving as long as possible (Gelau, Metker,
Schröder & Tränkle, 1994). It has also been noted, that the number of elderly female drivers will most likely increase as there are more female licence holders in the successive cohorts (Hakamies-Blomqvist, 1994; Pfafferot, 1994).

Although many factors about the driving patterns have already been studied, no comparative studies have been conducted across countries. Due to cultural as well as legislative differences the development may not be as uniform as often assumed. This presentation seeks to investigate the owning and driving of a car among persons 55 and older in three different European countries.

2. MATERIAL AND METHODS

The study is a part of the international COST A5 project, Ageing and Technology, Keeping the Elderly Mobile: Technology to Meet their Outdoor Mobility Needs. The subjects in the study are persons born in 1940 or earlier (i.e. 55 years and older) from Finland, Germany and Italy. The material was gathered in the autumn 1995 from four middle-sized towns, one in Italy, one in Finland and two in Germany (one from the former East Germany, one from the former West Germany). The samples were drawn from the population register of each Municipal Registration Office as they were at the beginning of the study. The interviewees were selected using stratification by age (55-74 and 75+), sex and living area (centre, intermediate and outskirts parts of the town). These variables accounted for 12 subcategories of the elderly. Table 1 shows the number of persons interviewed in each location. In Finland (Jyväskylä) altogether 618 persons were interviewed, in Germany 804 (Chemnitz 400, Mannheim 404), and in Italy (Ancona) 600.

Table 1. Description of the localities (absolute numbers)

<table>
<thead>
<tr>
<th>City area</th>
<th>Finland</th>
<th>Germany</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55-74</td>
<td>75+</td>
<td>55-74</td>
</tr>
<tr>
<td>Centre</td>
<td>M 51</td>
<td>W 57</td>
<td>M 56</td>
</tr>
<tr>
<td>Intermediate</td>
<td>48  52</td>
<td>49  54</td>
<td>76  74</td>
</tr>
<tr>
<td>Outskirts</td>
<td>59  48</td>
<td>48  51</td>
<td>78  75</td>
</tr>
<tr>
<td>Total</td>
<td>158  157</td>
<td>152  151</td>
<td>210  202</td>
</tr>
</tbody>
</table>

M = men, W = women

The interviews were conducted at the subjects' homes using a standardized questionnaire. The core of the questionnaire was identical in all the locations. The questionnaire was designed to cover all the most important components, which can influence outdoor mobility (for more details, see Ruoppila, Ukkonen, Suutama in this publication). In Finland the participation rate was 66% of the original sample, while the respective percentages in Germany were Chemnitz 63% and Mannheim 52%, and in Italy 71%. Subsequent to the interviews the respondents wrote down in a diary of outdoor mobility the
Part 4: Mobility and activity: needs and barriers

circumstances of the trips they made during one day (Italy) or three days (Finland and Germany). In this article, however, only the material from the questionnaire will be utilized.

Statistical significance was tested with $\chi^2$ test, One-way and simple factorial ANOVA. When the criteria of normality was not met, non-parametric Kruskal-Wallis Test was used. Statistical analyses were carried out using the SPSS 7.0 software.

3. RESULTS

Table 2 presents the percentages of persons living in households equipped with a car. The figures are presented for six different age groups, by sex and country. In each location there were more men than women living in households equipped with a car ($\chi^2; p<.001$). The biggest differences between the sexes were at the ages 60 to 79 years in Finland and 65 to 79 years in Germany and Italy. In the younger age groups both men and women were often living in households equipped with a car and in the oldest age group the difference between the sexes was equated by the fact that also male subjects were more often living in households without a car. Only in Italy, in the age group of 80 years and older, there were more women than men living in households equipped with a car.

With increasing age fewer subjects were living in households with a car. This trend was most visible in Finland and in Germany, the differences between the age groups being significant for both sexes in each location ($\chi^2; p<.001$). The highest percentages of persons living in households with a car was in Italy 67%, in Finland and Germany 47%; ($\chi^2; p<.001$).

Table 2. Car in household by age and and sex in Finland, Germany and in Italy (%)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>55-59</th>
<th>60-64</th>
<th>65-69</th>
<th>70-74</th>
<th>75-79</th>
<th>80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>77</td>
<td>85</td>
<td>82</td>
<td>58</td>
<td>46</td>
<td>37</td>
</tr>
<tr>
<td>Women</td>
<td>61</td>
<td>54</td>
<td>54</td>
<td>34</td>
<td>21</td>
<td>15</td>
</tr>
<tr>
<td>Germany</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>83</td>
<td>80</td>
<td>70</td>
<td>50</td>
<td>59</td>
<td>28</td>
</tr>
<tr>
<td>Women</td>
<td>83</td>
<td>72</td>
<td>48</td>
<td>27</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>97</td>
<td>90</td>
<td>95</td>
<td>82</td>
<td>75</td>
<td>47</td>
</tr>
<tr>
<td>Women</td>
<td>86</td>
<td>80</td>
<td>64</td>
<td>55</td>
<td>41</td>
<td>52</td>
</tr>
</tbody>
</table>

When studying the average number of cars per household, the same trend is seen; more cars being available in the younger age group and male subjects' households (Table 3). The most striking finding is the high average number of cars found in Italy, also in the female households and in the older age groups. Age, sex and country all had their own significant (ANOVA; p<.001) effect on the averages, but there was no interaction.
Owning and driving a car among elderly people – an international comparison

Table 3. Average number of cars in household by age and sex in Finland, Germany and Italy

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Finland</th>
<th>Germany</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>55-74</td>
<td>0.9</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>75+</td>
<td>0.4</td>
<td>0.2</td>
<td>0.5</td>
</tr>
</tbody>
</table>

The higher average in Italy can be explained with the differences in housing between the countries. In the Italian sample it was more common for the subjects to live in a household with their children or children and their families. However, as also the average for the younger male group was higher, other cultural factors like the higher dominance of car as a means of conveyance can also explain the results.

Table 4 presents the percentages of persons possessing a valid driving licence. Possession of a driving licence was again more common among male than female subjects, and in the younger groups. The differences between the age groups for both sexes in each location were significant ($\chi^2$; $p<.001$). Altogether 41% of the subjects in Finland, 46% in Germany and 36% in Italy had a valid driving licence, the differences between the countries being significant ($\chi^2$; $p<.01$). The shares of elderly females possessing a valid driving licence seems to imply variations in the pace of increase in the elderly female drivers depending on the country. For example, in the age group of 55-59 years more than half of the female subjects in the Finnish and German samples had a valid driving licence, whereas in the Italian sample this share was less than one third.

Table 4. Possession of a driving licence by age and sex in Finland, Germany and Italy (%)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Finland</th>
<th>Germany</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>55-59</td>
<td>85</td>
<td>68</td>
<td>83</td>
</tr>
<tr>
<td>60-64</td>
<td>88</td>
<td>62</td>
<td>86</td>
</tr>
<tr>
<td>65-69</td>
<td>81</td>
<td>26</td>
<td>73</td>
</tr>
<tr>
<td>70-74</td>
<td>55</td>
<td>5</td>
<td>63</td>
</tr>
<tr>
<td>75-79</td>
<td>49</td>
<td>7</td>
<td>68</td>
</tr>
<tr>
<td>80+</td>
<td>38</td>
<td>5</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 5 presents the frequencies of car driving by age and sex in all the locations.

In all the samples there were much more male than female drivers and the frequency of driving was higher among men, most of them driving daily or almost every day, or at least 1-2 times per week.

In Finland the question of car usage frequency was asked from all the persons possessing a valid driving licence, in Germany and in Italy from the persons with a car in household. As the selection is different, the number of
female respondents in this question was higher in Germany and in Italy. Due to selection it can be argued that the figures of the Finnish women better represent the group of active car users. In addition, in Finland a medical screening system for licensing is in use.

Table 5. Frequency of car driving by age and sex in Finland, Germany and Italy (%)

<table>
<thead>
<tr>
<th></th>
<th>Finland 55-74</th>
<th>Finland 75+</th>
<th>Germany 55-74</th>
<th>Germany 75+</th>
<th>Italy 55-74</th>
<th>Italy 75+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily or almost every day</td>
<td>M 74</td>
<td>W 38</td>
<td>M 52</td>
<td>W 25</td>
<td>M 65</td>
<td>W 18</td>
</tr>
<tr>
<td>1-2 times per week</td>
<td>M 18</td>
<td>W 20</td>
<td>M 28</td>
<td>W 25</td>
<td>M 22</td>
<td>W 11</td>
</tr>
<tr>
<td>Less often</td>
<td>M 7</td>
<td>W 21</td>
<td>M 8</td>
<td>W 25</td>
<td>M 7</td>
<td>W 10</td>
</tr>
<tr>
<td>Never</td>
<td>M 2</td>
<td>W 21</td>
<td>M 13</td>
<td>W 25</td>
<td>M 6</td>
<td>W 60</td>
</tr>
<tr>
<td>N</td>
<td>122</td>
<td>56</td>
<td>64</td>
<td>8</td>
<td>151</td>
<td>115</td>
</tr>
</tbody>
</table>

M=men, W= women

To have a closer look at the driving frequencies, Table 6 illustrates the male respondents’ age variations in the group driving a car daily or almost daily. As there were so few female drivers, these results are presented only regarding the male respondents. In all the locations the frequency of car driving was lower in the older age cohorts. With respect to daily or almost daily driving the difference between the countries was significant ($\chi^2; p<.01$), highest percentages in the frequencies being in Finland. The higher percentage in the Finnish sample in the age group of 70-74 can probably be connected to the driving licence legislation. In Finland the driving licence expires at the age of 70 unless renewed. It can be argued that the drivers with low frequencies of driving are more likely to give up driving. Thus among the remaining car drivers there may be more drivers with higher driving frequencies.

Table 6. Male subjects driving a car daily or almost every day in different age groups in Finland, Germany and Italy (%)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>55-59</th>
<th>60-64</th>
<th>65-69</th>
<th>70-74</th>
<th>75-79</th>
<th>80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>79</td>
<td>74</td>
<td>66</td>
<td>72</td>
<td>51</td>
<td>34</td>
</tr>
<tr>
<td>Germany</td>
<td>77</td>
<td>71</td>
<td>53</td>
<td>55</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>Italy</td>
<td>76</td>
<td>68</td>
<td>58</td>
<td>29</td>
<td>29</td>
<td>20</td>
</tr>
</tbody>
</table>

In table 7 are shown the percentages of male subjects driving less than 5000 km per year. The figure of 5000 km per year has been chosen to represent a limit for small amount of driving. In the older age groups, the number of persons driving less than 5000 km per year was higher in all the locations. The difference between the countries was significant ($\chi^2; p<.001$). Subjects
in Finland driving most often more than 5000 km per year. The effect of Finnish legislation can also be observed in this table. The drop in the percentage of the group 70-74 years can be related to the fact that the persons with few kilometres per year have let their driving licence expire.

Table 7. Male subjects driving less than 5000 km per year in different age groups in Finland, Germany and Italy (%)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>55-59</th>
<th>60-64</th>
<th>65-69</th>
<th>70-74</th>
<th>75-79</th>
<th>80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>9</td>
<td>13</td>
<td>18</td>
<td>6</td>
<td>37</td>
<td>41</td>
</tr>
<tr>
<td>Germany</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>13</td>
<td>46</td>
<td>63</td>
</tr>
<tr>
<td>Italy</td>
<td>14</td>
<td>39</td>
<td>44</td>
<td>74</td>
<td>62</td>
<td>73</td>
</tr>
</tbody>
</table>

4. DISCUSSION

The long-known fact that having a car and a driving licence is more typical of men and especially younger men than of women and older persons proved true also for this data (e.g. Pfafferot, 1994). The frequency of car driving and the number of kilometres driven proved also in this study to be lower in the older age groups (Gelau et al. 1993; Pfafferot, 1994). As the western society is still in great deal characterized by private car traffic, this trend may reflect older persons poorer possibilities to stay mobile (Mollenkopf, et al. 1996). As mobility is one of the key factors in leading an independent life, mobility problems can have a negative impact on the quality of life of older people (Rothe, 1993). Previous studies have shown that the possibility to use a car is connected with better mobility satisfaction (Mollenkopf & Flaschentäger, 1997; Ukkonen, Ruoppila, Suutama and Lintunen, 1998).

This material showed an increasing share of female licence holders and car drivers in the younger age groups, which suggests that the number of elderly female drivers will be rising in the future (Hakamies-Blomqvist, 1994; Pfafferot, 1994). According to these results it can be argued that this development may take place with varying pace depending on the cultural context. Results from this study imply that this development may be faster in Finland and in Germany than in Italy.

As a comparative study this study showed again the importance of considering the cultural factors when interpreting the results. In this material, for example, the differing housing structure in Italy can be seen to explain part of the results. Car ownership was more common and the average number of cars per household was higher in Italy, where the average number of persons in the household was higher than in Finland and in Germany. Car ownership has also before been shown to vary according to the number of persons living in the household, less cars being available in one person households (Mollenkopf et al. 1996).

In a similar manner some of the Finnish findings for car usage frequencies and kilometres driven could be explained by the driving licence legislation. This is in accordance with previous findings by Hakamies-Blomqvist and Wahlström (1996), who found out that 70-years old men who let their licence expire most often reasoned their decision by their health situation and by
having stopped driving. Persons who continued driving, on the other hand, had more often a car available. In Finland, from the age 45 onwards, the license holder must pass a vision check-up in every five years. An optician or a physician can do this. At the age of 60, and every five years thereafter, the license holder must pass a medical review covering general health status and vision. At the age of 70, if not renewed in time, the licence expires. The Finnish driving licence legislation has been changed according to the European Union standards in the beginning of year 1998. Previous to this persons over 45 needed to have a medical check-up in every five years. In Germany no renewal procedures are in use, in Italy a driving licence is renewed in ten-year intervals up to age 50, after that in every five years up to age 70, after that for three years at a time. In this study the differences between the former East and West Germany were not analysed. In other studies, the availability of private cars has proved lower in the eastern region than in the former West Germany (Mollenkopf & Flaschentäger, 1996, 1997). There are, however, also big differences between young and old age groups. Since the German unity the east-west differences in private motorization have started to level off, especially among the younger age groups and families with children. The results support the previous findings on future trends concerning elderly people’s car owning and driving. Yet, there were also differences between the three locations studied. This shows the importance of cautiousness in drawing any broad conclusions from studies conducted in separate cultures. It should also be remembered that as the findings in this study are cross-sectional results, this material provides no basis for saying anything certain about the future trends of car usage among the elderly.

Acknowledgements: The Academy of Finland, the Ministry of Transport and Communication, the City of Jyväskylä and the Department of Psychology, University of Jyväskylä have financially and by other means supported this study.

5. REFERENCES


Owning and driving a car among elderly people – an international comparison

varför slutar äldre körkortsinnehavare köra bil? (When, how and why do older holders of driver license stop driving a car? A survey of 70 years old Finnish license holders). Reports from the Department of Psychology A 48, Helsinki: University of Helsinki.


RELATIONS BETWEEN OUTDOOR MOBILITY BEHAVIOUR, PERCEPTION OF MOBILITY AND STATE OF HEALTH

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1. ELDERLY DRIVERS IN GERMANY

As in many other industrial countries the demographic trend shows an increasing number of elderly people in Germany. According to the estimations of the Statistisches Bundesamt (1991, p.23) the proportion of the over 60-year-old-people in Germany will grow from 23.7% in the year 2000 up to 34.1% in 2025. Furthermore the proportion of people in the group of elderly population owning a driving licence grows, too. For example: 86% of the today’s 35-44 year old people living in western Germany have a driving-licence, but only 14.3% of the more than 79 year old people. Although there are less driving-licence owners in eastern Germany, the general trend is similar: 73.2% of the 35 to 44 year old people have a driving-licence but only 8.9% of the more than 79 year old ones (Hautzinger and Tassaux 1995, p.31). Therefore the proportional development of elderly drivers will increase much stronger than the general development of the proportion of elderly people in society.

In Germany the proportional part of elderly people is increasing especially in the living areas around the big cities (BMFug 1993). This development is caused by the mass of houses built of ones own in the areas around the bigger cities since World War II. You often find a lack of shops, services and cultural offers in these residential areas, so that mobility gets an important function for an active and satisfactory life for people living there. Caused by the lack of public transport service in these suburban living areas the private car is the most used mobility vehicle.

As many studies show elderly drivers get more and more difficulties in solving driving tasks which are typical for inner-city traffic: deciding under pressure of time and solving complex problems (Brouwer 1994; Ellinghaus, Schlag, Steinbrecher 1990; Metker, Gelau, Tränkle 1994). So elderly drivers themselves don't like driving in inner-city traffic. Moreover they are in danger of having an accident there. Consequently many elderly people don't drive in...
such situations, which often causes social isolation and heavy losses in quality of life.

2. EMPIRICAL STUDIES OF ANBINDUNG

The research project ANBINDUNG6 (traffic and transport psychology as well as gerontology) wants to determine the mobility perception and uses of elderly drivers who live nearby bigger cities, searches for the needs for alternatives and supplements to the private car and tests the chances and specific problems of the combination of public and private transport. Furthermore, the relation between mobility, health and quality of life is focussed on.

Databases of this report are the first and second empirical steps of ANBINDUNG (a third one will be done in Summer 1998). The empirical investigations search for information about elderly drivers who live in suburban areas around bigger cities.

203 over-60-year-old active drivers are asked in the first step in summer 1996 (99 persons living around Cologne, 104 around Dresden). The test subjects are drawn by articles about our intention in public press, by disseminators (elderly being active in communal politics), by flyers and personal information. After having made sure that the interested person fits to our target group by telephone screening a first interview is done: it contains exploration about their individual importance of mobility and actual habits in holiday trips. The interview is followed by a user-introduction to the mobility diary. The diary contains a detailed record of the mobility habits over the period of one week (purposes, aims, choice in means of transport, passed distances and time); moreover specific experiences during their ways are documented. Afterwards a second interview is done which asks e.g. for unsatisfied mobility needs and causes of mobility deficits.

The age of the participants of our study is 60-88 years (middle age is 68,5 years), all persons are retired and active drivers. Nearly a quarter of the interviewees is feminine, which is caused by the lower density of feminine driving-licence-owners in the group of elderly people.

15 month later, in late summer 1997, 103 of the 203 persons are investigated again. Apart from a subtly differentiated questionnaire (about mobility, health and quality of life) a journey to the next City (Dresden or Cologne) is done together with the interviewer and a cameraman. On this way private and public transport are combined, the journey (especially the change of the different modes of transport) is documented on video. The videotape serves two purposes: firstly it is discussed with the elderly drivers directly after coming back to their home (perception of elements of the journey, discussion of special critical incidents), secondly it is analysed afterwards in a standardised way (number of mistakes, personal strain and sureness in action during the different phases of action).

6 The acronym ANBINDUNG goes for „Anforderungen Älterer an eine benutzergerechte Vernetzung individueller und gemeinschaftlich genutzter Verkehrsmittel“. The research project is sponsored by the German Bundesministerium für Familie, Senioren, Frauen und Jugend; Fkz 314-1720-318/1.

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### 3. MOBILITY HABITS

As in the German representative studies *System repräsentativer Verkehrsbefragung (SrV)* and *kontinuierliche Verkehrserhebung (KONTIV)* in our study a way is defined by its purpose (example: if a person goes to the merchant first, from there to the doctor, afterwards directly to some friends and in the end back home again we have got four ways outside the house). According to the mobility diary in the first empirical step the elderly drivers do between 6 and 52 ways during the documented week, which leads to an average number of 27.2 ways. The elderly pass distances between 20.3 and 1456 kilometres during the week to do these ways (mean 246 kilometres).

<table>
<thead>
<tr>
<th>empirical step</th>
<th>methods</th>
<th>contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>may-July 1996:</td>
<td>1. interview</td>
<td>• Individual importance of mobility</td>
</tr>
<tr>
<td>first empirical step</td>
<td>over seven days:</td>
<td>• habits in travelling</td>
</tr>
<tr>
<td></td>
<td>mobility diary</td>
<td>• mobility habits</td>
</tr>
<tr>
<td></td>
<td>one week later:</td>
<td>• perception of mobility (special events)</td>
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<td></td>
<td>2. interview</td>
<td>• unsatisfied mobility needs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• valuation of modes of transport</td>
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<tr>
<td></td>
<td></td>
<td>• knowledge about public transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• need for information about public transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• status of health</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• social life-situation</td>
</tr>
<tr>
<td>september-october</td>
<td>questionnaire</td>
<td>• longitudinal section: mobility</td>
</tr>
<tr>
<td>1997:</td>
<td>interview</td>
<td>• life and health situation (partial longitudinal section)</td>
</tr>
<tr>
<td>second empirical step</td>
<td>accompanied observation</td>
<td>• planning and doing the journey to the city</td>
</tr>
<tr>
<td></td>
<td>discussion</td>
<td>• discussion and analysis of the video: coping and perception of the situation</td>
</tr>
<tr>
<td></td>
<td>seven weeks later:</td>
<td>• consequences of the investigation concerning habits</td>
</tr>
<tr>
<td></td>
<td>questioning by telephone</td>
<td>and perception of mobility</td>
</tr>
</tbody>
</table>

Fig. 1: Process of the empirical steps
Fig. 2: Choice of mode of transport

As figure 2 shows, nearly two of three ways are done by car. Conclusion, the private car gets an important function to serve the mobility needs of the investigated elderly drivers living in suburban areas around bigger cities. Going by feet often means (besides going to nearer destinations as well as just strolling around) to reach the public transport, other vehicles, or the destination from the vehicle. According to the mobility diary the bicycle is used much more often by the elderly drivers than public transport. This indicates that public transport actually doesn't take an important function to solve the mobility problems of elderly drivers who live around bigger cities.

Asked for their habits in travelling in the first empirical step, the elderly who are questioned in both empirical steps say to do 2.33 travels per year on average. 15 month later they say to do 2.08 travels. According to Wilcoxon this difference is significant (p<.05). The same effect can be made out looking at their details given about their amount of car driving kilometres per year: it is reduced from an average of 12224 km to 9919 km per year (p<.001).

4. PERCEPTION OF MOBILITY

In the second empirical step of ANBINDUNG the elderly drivers are observed while travelling from their home to the next city (Dresden or Cologne) by using a combined mode of transport. This combination is defined as using an individual plus a public mode of transport on the way to the city. In 68.9% of the 103 observed travels the individual mode of transport is the private car, in 26.2% of the cases they go by feet, and in 4.9% they reach the public mode of transport by bicycle. 31% of the public transport are busses, 33% trams. The other elderly drivers go by train. The video-supported observation leads to information about the special needs of the elderly, their strategies to cope with the mobility tasks, and their perception of the travel.
In order to analyse the observation afterwards; the video is divided into six different sequences or mobility tasks:

1. **Parking:** The first sequence starts with the orientation to the parking room for the individual vehicle (here: only if car or bicycle is used) and ends with leaving this vehicle. The act of orientation in general and special problems as to find a parking lot or the anxiety of vandalism come into focus.

2. **Way to the station:** In the second sequence the way to the railway station or bus stop by feet is looked at. Interesting aspects here are crossing roads, coping with footpaths in bad conditions (holes in the floor, slopes).

3. **Way to public transport:** The next task to be focused on is the way to the public transport in the railway station: going along stairs or in tunnels.

4. **Timetable/Orientation:** The following section of the videotape concerns the orientation in the station and on the timetable. Aspects as the size of the letters, the layout and the effect of personal advice are important.

5. **Ticketing:** At fifth the act of ticketing - a very critical phase of mobility in public transport - is focused on. We look at their strategies to cope with the ticket vending machines (sometimes with defects) and in contrast to that with the personal vendation.

6. **Getting in and in public transport:** The last sequence to be looked at is the entry into the public transport till taking seat. Besides difficulties to get in, the operation with the doors, the orientation in the public transport, as well as problems because of movements of the vehicle before taking seat are looked at.

Although the succession of the sequences changes, splitting the action into these six sequences could be done exactly over all accompanied observations. So it is used as a basis for the standardised analysis of the videos afterwards. Two independent raters (who didn’t participate in the observation before) scale the action for each sequence along the dimensions rank of strain, rank of sureness in action (from 1 = no strain/very sure to 5 = being overtaxed/losing control) and number of mistakes in the action. Moreover, they rank the perception of the whole journey for each participant.
Relations between outdoor mobility behaviour, perception of mobility and state of health

Fig. 3: Video analysis: mean ratings of the sequences of action during the combined travel to the city

As can be seen in figure 3, orientation/timetable and ticketing are the most critical incidents during the travel. But also the task of parking can be very strainful, whereas the footways and the entrance into the public transport - apart from special cases where the situation doesn't fit to the capacities of the elderly - seems to be arranged in an acceptable way in those cases.

5. HEALTH

The status of health is asked in different ways. Once the elderly were asked to rate their own status of health from 1 (perfect) to 5 (very bad). In the first empirical step 14.6% of the elderly (who are investigated in both steps) named no restrictions (perfect), 4.9% of them in the second step. The average valuation changed from 2.19 to 2.33 Wilcoxon (p < .05). Although (according to these results) their status of health became worse, the situation seems to be quite good: neither in the first nor in the second empirical step did anyone scale his own status of health very bad. The relatively good status of health of the investigated elderly drivers is confirmed by the other ways of asking for their health:

Different standardised questionnaires are used to get differentiated information about their status of health: the physical and psychological power

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is asked by a questionnaire of Arnold & Lang (1991), the "activities of daily living" - a questionnaire to investigate the autonomy in daily living as well as the cognitive enforcement by asking for functional and social activities - from Oswald & Fleischmann (1995), and the Nottingham Health Profile (by Kohlmann et al. 1997) to get information about their quality of life according to health.

In figure 4 strain and sureness in action during the accompanied observation, the perception of the whole journey and the general satisfaction with mobility to the different results about the status of health are shown in correlation. To get a better view over this synopsis, only the correlations above .2 are put down.

6. DEPENDENCIES BETWEEN MOBILITY AND HEALTH

<table>
<thead>
<tr>
<th></th>
<th>Self-assessment of health</th>
<th>Physical power</th>
<th>Psychological power</th>
<th>Activities of daily living</th>
<th>Nhp</th>
<th>nhp</th>
<th>nhp</th>
<th>nhp</th>
<th>nhp</th>
<th>nhp</th>
<th>nhp</th>
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</thead>
<tbody>
<tr>
<td>su: parking</td>
<td></td>
<td>.219</td>
<td>.330*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>str: parking</td>
<td></td>
<td>.328**</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>str: way to station</td>
<td>.332**</td>
<td>.409**</td>
<td>.230*</td>
<td></td>
<td>.330**</td>
<td></td>
<td></td>
<td></td>
<td>.297**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>su: orientation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.205</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>su: ticketing</td>
<td></td>
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<td></td>
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<tr>
<td>str: ticketing</td>
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<tr>
<td>su: way to pub.trans.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.374*</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>str: way to pub.trans.</td>
<td>.280</td>
<td>.496**</td>
<td>.295</td>
<td>.225</td>
<td>.209</td>
<td>.430**</td>
<td>.347*</td>
<td>.371*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>su: (go) in pub.trans.</td>
<td>.229*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>str: (go) in pub.trans.</td>
<td>.345**</td>
<td>.407**</td>
<td>.205</td>
<td></td>
<td>.329**</td>
<td>.322**</td>
<td></td>
<td>.362*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percep- tion of journey</td>
<td>.211*</td>
<td>.307**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>general satisfaction with mob.</td>
<td>.375**</td>
<td>.485**</td>
<td>.275**</td>
<td>.260**</td>
<td>.197*</td>
<td>.305**</td>
<td>.350**</td>
<td>.293**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

su = sureness in action, str = strain in action, * = significance p < .05, ** = significance p < .01

Fig. 4: Perception of mobility (accompanied observation) and health

As can be seen, to solve the parking task personal characteristics like psychological power and autonomy are important. In contrast to that, to solve movement tasks (footways to the station, to the public transport and getting in public transport) the elderly need physical power, which is similar to the
subjective understanding of health (self-assessment of health). The results of the Nottingham Health Profile concerning personal mobility, partly emotional constitution, pain and sleeplessness also correlate with footways.

Although the process of ticketing seems to be the most complicated task during the accompanied observation (see fig. 3) no significant correlation to the status of health could be found.

Apart from the Nottingham Health Profile concerning emotions and isolation each aspect of health correlates significantly with the self-assessment of general satisfaction with the individual situation of mobility. Conclusion, different aspects of health are important to solve the different tasks during the way, but nearly all of them are important for a satisfying mobility situation. It does not help for satisfaction to get a part of mobility tasks solved easily. Only if all of them can be solved in an adequate way, the mobility situation becomes satisfactory.

According to the mobility habits in daily living (investigated by the mobility diary in the first empirical step), correlations could only be found to self-assessment of health and the physical power (see figure 5).

<table>
<thead>
<tr>
<th>Self-assessment of health</th>
<th>physical power</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilometres per week</td>
<td>.296**</td>
</tr>
<tr>
<td>outdoor ways per week</td>
<td></td>
</tr>
<tr>
<td>percentage of car use</td>
<td>-.197*</td>
</tr>
<tr>
<td>percentage of bicycle use</td>
<td>.284**</td>
</tr>
<tr>
<td>percentage of public transport use</td>
<td>.217*</td>
</tr>
<tr>
<td>trips per year</td>
<td>.205*</td>
</tr>
</tbody>
</table>

• significance p < 5%; ** significance p < 1%

Fig. 5: mobility uses and health

The physical health seems to be an indicator for the quantity of mobility (kilometres per week and trips per year). To get an impression about the influences of health on the choice of mode of transport figure 6 needs to be looked at.

According to these results (see fig.6) the correlation between health and transport modes is not linear. Whereas people with a very good self-assessment of health often use a car, the ones who are quite bad in their health also do so. To look at the alternatives of the private car, it’s just the other way around. A reason for this could be, that persons with a very good status of health have a higher quantity of mobility: according to the mobility diary elderly with no healthy restrictions do 34,2 ways per week outside the house, persons of bad healthy conditions 22,4 ways. So healthy people use
their car to solve the high amount of mobility whereas persons in bad health conditions need their car to cope with mobility because they have less physical power.

The correlation between health and car-use is significant ($p < .05$)

**Fig. 6: Self-assessment of health and choice of mode of transport**

7. **DISCUSSION**

For the elderly drivers who live around bigger cities the private car is the most important mobility vehicle. Although the amount of mobility goes back, the central function of the private car continues to exist - especially if the status of health gets worse. In this case on subjective perspective, the car sometimes becomes the only possibility to stay mobile. But also driving a car becomes more and more difficult which leads to an unsatisfactory mobility situation.

The engineering orientated innovations in public transport to reduce the physical affordances for the users with no doubt are very helpful for persons with a reduced physical power, but do not solve the obstacles of the investigated group of elderly car drivers, who are on average quite healthy. They have problems to cope with the "new situation" using public transport, for example orientation and ticketing.
In order to reduce the dependency of private car in higher age, public transport has to become an attractive alternative to the private car, so those car drivers sometimes use it instead of their own car. Doing so they learn to cope with the special tasks of using public transport. To become more attractive for car drivers not technical oriented solutions, but simplifying concepts, which include for example personal advice at the station, seems to be helpful.

8. REFERENCES


1. INTRODUCTION

With increasing age, leisure activities have become more and more important because after retirement other activities linked to social roles (as worker, parent and other) tend to diminish (Bengston V.L. 1973; Blawz S., 1973, Rosow I., 1974).

Many leisure activities imply to go outdoor, to move in living spaces and to deal with traffic environment. For this reason the capacity of outdoor mobility is an important prerequisite for having a good quality of leisure time (Mollenkopf et al., 1997).

This work analyses the outdoor mobility in leisure activities in order to understand if the most important obstacles are linked to physical conditions or to cultural factors.

We used the data set of “Outdoor Mobility Survey” (Mollenkopf and Marcellini, 1997), which was carried out in the last months of 1995, on 2022 subjects in three European countries (Germany, Finland and Italy) with different cultural, economic and social conditions. The towns where the survey was carried out were: Mannheim (West Germany) 404 persons, Chemnitz (East Germany) 400 persons, Jyväskylä (Finland) 618 persons, and Ancona (Italy) 600 persons.

The random sample was stratified in each country by age, sex and living area.

Interviewers administered a structured questionnaire in order to collect data concerning housing conditions, living area, health conditions, transportation behaviour, social relationship, cultural background, leisure time, and economic conditions.
Leisure activities and outdoor mobility: cultural and physical obstacles

<table>
<thead>
<tr>
<th>Activity</th>
<th>Germany</th>
<th>Italy</th>
<th>Finland</th>
<th>Pearson Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting friends or relatives in someone's home</td>
<td>76</td>
<td>63</td>
<td>85</td>
<td>77.56*</td>
</tr>
<tr>
<td>Going to a café, restaurant or bar</td>
<td>41</td>
<td>15</td>
<td>34</td>
<td>114.85*</td>
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<tr>
<td>Making small trips or journeys</td>
<td>49</td>
<td>18</td>
<td>69</td>
<td>322.84*</td>
</tr>
<tr>
<td>Hiking, riding a bicycle</td>
<td>33</td>
<td>4</td>
<td>42</td>
<td>248.89*</td>
</tr>
<tr>
<td>Going out for a walk</td>
<td>74</td>
<td>59</td>
<td>88</td>
<td>132.34*</td>
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<td>Actively pursuing sports</td>
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<td>6</td>
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<td>Watching sporting events (not on TV)</td>
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<td>5</td>
<td>19</td>
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<td>52</td>
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<td>Library</td>
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<td>1</td>
<td>52</td>
<td>591.06*</td>
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<tr>
<td>Taking courses (arts and crafts, etc.)</td>
<td>6</td>
<td>2</td>
<td>21</td>
<td>148.10*</td>
</tr>
<tr>
<td>Religious events, attending church</td>
<td>21</td>
<td>41</td>
<td>49</td>
<td>130.93*</td>
</tr>
<tr>
<td>Activities in clubs or associations</td>
<td>12</td>
<td>8</td>
<td>43</td>
<td>295.03*</td>
</tr>
<tr>
<td>Activities for retired people</td>
<td>17</td>
<td>8</td>
<td>30</td>
<td>102.95*</td>
</tr>
<tr>
<td>Fishing</td>
<td>2</td>
<td>3</td>
<td>29</td>
<td>324.58*</td>
</tr>
</tbody>
</table>

Note: * significant for p<.0001

2. OUTDOOR LEISURE ACTIVITIES

2.1 Level of outdoor leisure activities in the three countries

We focused our analyses on outdoor leisure activities, that is leisure activities that imply going out of home, moving in living area and dealing with daily traffic. The percentage of older people engaged in outdoor leisure activities in the three countries is shown in the Table 1.

A lot of significant differences were found among the three countries. In Finland the outdoor leisure activities are more diffused than in the other two countries. In fact the percentage of Finnish respondents engaged in outdoor leisure activities is always the highest, with exception of two activities (“Going to a café, restaurant or bar” and “Actively pursuing sports”) which are more performed in Germany. In the Italian sample, the percentage of respondents, which claim to do outdoor leisure activities, is the lowest for almost all kinds of activities (except three). Therefore the level of outdoor mobility linked to leisure activities is very 334
different among the three countries: we found the highest level in Finland, a medium level in Germany and the lowest level in Italy.

2.2 Health conditions and outdoor leisure activities

Now we are going to analyse health conditions, because they are an important prerequisite to do outdoor leisure activities. Health conditions are the main obstacle in outdoor activities claimed by persons in all countries. This fact underlines the importance of physical obstacles, but the prevalence of health injuries and chronic illnesses didn’t explain the differences in level of outdoor leisure activities because health conditions were better in Italy. Table 2 shows health injuries and chronic illnesses, which impair outdoor mobility as resulted by, self-report.

Table 2 Health injuries and chronic illnesses, which impair outdoor mobility in the three countries

<table>
<thead>
<tr>
<th></th>
<th>GERMANY</th>
<th>ITALY</th>
<th>FINLAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>No impairments</td>
<td>31</td>
<td>42</td>
<td>31</td>
</tr>
<tr>
<td>Temporary impairments</td>
<td>24</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>Constant impairments</td>
<td>45</td>
<td>31</td>
<td>49</td>
</tr>
</tbody>
</table>

Pearson Chi-Square= 46.08  significant for p<.0001

We can note that respondents without health problems are significantly greater in Italy than in the other two countries, and persons with constant problems are significantly lesser in Italy than in Finland and Germany. It’s interesting to see if the differences in outdoors leisure activities among the three countries exist in all groups of respondents with different health conditions or exist only in one or two groups. Table 3 shows outdoor leisure activities by health conditions in the three countries.
Leisure activities and outdoor mobility: cultural and physical obstacles

Table 3: Outdoor leisure activities by health conditions in the three countries

<table>
<thead>
<tr>
<th>NO IMPAIRMENTS</th>
<th>TEMPORARY IMPAIRMENTS</th>
<th>CONSTANT IMPAIRMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G</td>
<td>I</td>
</tr>
<tr>
<td>Meeting friends or relatives</td>
<td>79</td>
<td>62</td>
</tr>
<tr>
<td>Going to a café, restaurant or bar</td>
<td>55</td>
<td>21</td>
</tr>
<tr>
<td>Making small trips or journeys</td>
<td>60</td>
<td>27</td>
</tr>
<tr>
<td>Hiking, riding a bicycle</td>
<td>44</td>
<td>7</td>
</tr>
<tr>
<td>Going out for a walk</td>
<td>82</td>
<td>65</td>
</tr>
<tr>
<td>Actively pursuing sports</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Watching sporting events (not on TV)</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Theatre, opera, Concerts and movies</td>
<td>38</td>
<td>9</td>
</tr>
<tr>
<td>Library</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Taking courses (arts and crafts, etc.)</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Religious events, attending church</td>
<td>24</td>
<td>40</td>
</tr>
<tr>
<td>Activities in clubs or associations</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>Activities for retired people</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>Fishing</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: significant for p<.0001

In all three groups of respondents with different health conditions we found the same differences in outdoor leisure activities among the three countries. This means that the different level of outdoor leisure activities in the three countries is independent from health conditions.

2.3 Capacity of mobility and outdoor leisure activities

Now we are going to analyse the capacity of mobility, assessed by self-report, in order to see if this variable can explain the differences among the three countries. The capacity of mobility was defined as possibility to get where you want by car, cycle or on foot. It has to underline that the capacity of mobility, even if it's based on health conditions, is different from health conditions mentioned above because it implies many others abilities (in fact the correlation between health conditions and capacity of mobility was .66). The capacity of mobility, assessed on a five-point scale, didn't show the same pattern of differences among the three countries as resulted for outdoor leisure activities. The capacity of mobility in the three countries is presented in Table 4.
Table 4: Capacity of mobility assessed by self-report in the three countries

<table>
<thead>
<tr>
<th>CAPACITY OF MOB</th>
<th>GERMANY</th>
<th>ITALY</th>
<th>FINLAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>7</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Poor</td>
<td>14</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Fair</td>
<td>40</td>
<td>34</td>
<td>47</td>
</tr>
<tr>
<td>Good</td>
<td>31</td>
<td>31</td>
<td>28.</td>
</tr>
<tr>
<td>Excellent</td>
<td>8</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Pearson Chi-Square = 39.13  significant for p<.0001

The percentage of people with excellent or good mobility is slightly greater in Italy than in the other two countries, which have about the same percentage. Persons with poor and very poor mobility are slightly lesser in Finland than the other two countries, which have about the same percentage.

Of course capacity of mobility is an important prerequisite for outdoors leisure activities. So it's interesting to analyse the differences in outdoor leisure activities within each level of capacity of mobility. In this way we would see if the differences in outdoor leisure activities among three countries remain constant in all groups with different capacity of mobility. To simplify this analysis we grouped the five levels of capacity of mobility into three levels. Table 5 shows the outdoor leisure activities by capacity of mobility in the three countries.
Table 5: Outdoor leisure activities by capacity of mobility in the three countries

<table>
<thead>
<tr>
<th></th>
<th>POOR/VERY POOR MOBILITY</th>
<th>FAIR MOBILITY</th>
<th>GOOD/EXCELLENT MOBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G</td>
<td>I</td>
<td>F</td>
</tr>
<tr>
<td>Meeting friends or relatives</td>
<td>61</td>
<td>62</td>
<td>75</td>
</tr>
<tr>
<td>Going to a café, restaurant or bar</td>
<td>25</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>Making small trips or journeys</td>
<td>24</td>
<td>6</td>
<td>45</td>
</tr>
<tr>
<td>Hiking, riding a bicycle</td>
<td>12</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Going out for a walk</td>
<td>51</td>
<td>48</td>
<td>73</td>
</tr>
<tr>
<td>Actively pursuing sports</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Watching sporting events (not on TV)</td>
<td>2</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Theatre, opera, concerts and movies</td>
<td>11</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>Library</td>
<td>6</td>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td>Taking courses (arts and crafts, etc.)</td>
<td>2</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Religious events, attending church</td>
<td>18</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td>Activities in clubs or associations</td>
<td>3</td>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>Activities for retired people</td>
<td>14</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>Fishing</td>
<td>1</td>
<td>1</td>
<td>18</td>
</tr>
</tbody>
</table>

Note:  ns = not significant  
* significant for p<.0001

Also in this case, we found the same differences in level of outdoor activities among the three countries. In fact the percentage of Finnish respondents who claim to do outdoor leisure activities is the highest for almost all kind of activities. The percentage of Italian respondents engaged in the outdoor leisure activities is often the lowest, even if the differences with German respondents tends to diminish in the lowest level of mobility. Generally this findings means that the differences in outdoors leisure activities among the three countries are independent from capacity of mobility.

2.4 Wish to do more outdoor leisure activities

We also analysed the wish to do more outdoor leisure activities claimed by respondents. We expected that a low level of outdoor leisure activities was linked to a high level of unsatisfied need to do it, and therefore to high wish to increasing it. We thought to find relevant differences among the three countries as consequence of the different levels of outdoor leisure activities above mentioned, but some small differences not statistically significant was
found among the three countries. Therefore the wish to increase outdoor leisure activities must be considered not different among the three countries. The country with the lowest level of outdoor leisure activities (that is Italy) hasn’t a greater need of increasing these kinds of activities. It’s important to underline that in Finland and Germany, even though people make more outdoor activities than in Italy, there was a strong need to increase outdoor activities, especially in Germany. This means that probably in the three countries there is a different socio-cultural background with different needs and expectation systems.

2.5 Outdoor leisure activities and gender roles

Other cultural obstacles in outdoor leisure activities, might be those linked to gender role. We are going to analyse the percentage of males and females engaged in outdoor leisure activities in the three countries in order to see if there were some differences between two gender roles. These percentages are shown in Table 6.

Table 6: Outdoor leisure activities by sex in the three countries

<table>
<thead>
<tr>
<th>Activity</th>
<th>M</th>
<th>F</th>
<th>p</th>
<th>M</th>
<th>F</th>
<th>p</th>
<th>M</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting friends or relatives</td>
<td>75</td>
<td>77</td>
<td>ns</td>
<td>62</td>
<td>64</td>
<td>ns</td>
<td>83</td>
<td>87</td>
<td>ns</td>
</tr>
<tr>
<td>Going to a café, restaurant or bar</td>
<td>41</td>
<td>41</td>
<td>ns</td>
<td>21</td>
<td>9</td>
<td>***</td>
<td>33</td>
<td>34</td>
<td>ns</td>
</tr>
<tr>
<td>Making small trips or journeys</td>
<td>52</td>
<td>45</td>
<td>ns</td>
<td>20</td>
<td>16</td>
<td>ns</td>
<td>68</td>
<td>70</td>
<td>ns</td>
</tr>
<tr>
<td>Hiking, riding a bicycle</td>
<td>40</td>
<td>25</td>
<td>***</td>
<td>6</td>
<td>2</td>
<td>**</td>
<td>52</td>
<td>31</td>
<td>***</td>
</tr>
<tr>
<td>Going out for a walk</td>
<td>72</td>
<td>76</td>
<td>ns</td>
<td>66</td>
<td>53</td>
<td>**</td>
<td>89</td>
<td>88</td>
<td>ns</td>
</tr>
<tr>
<td>Actively pursuing sports</td>
<td>11</td>
<td>12</td>
<td>ns</td>
<td>8</td>
<td>4</td>
<td>*</td>
<td>8</td>
<td>3</td>
<td>**</td>
</tr>
<tr>
<td>Watching sporting events (not on TV)</td>
<td>11</td>
<td>4</td>
<td>***</td>
<td>10</td>
<td>0</td>
<td>***</td>
<td>27</td>
<td>12</td>
<td>***</td>
</tr>
<tr>
<td>Theatre, opera, concerts and movies</td>
<td>25</td>
<td>28</td>
<td>ns</td>
<td>5</td>
<td>5</td>
<td>ns</td>
<td>44</td>
<td>59</td>
<td>***</td>
</tr>
<tr>
<td>Going to library</td>
<td>10</td>
<td>8</td>
<td>ns</td>
<td>1</td>
<td>1</td>
<td>ns</td>
<td>49</td>
<td>55</td>
<td>ns</td>
</tr>
<tr>
<td>Taking courses (arts and crafts, etc.)</td>
<td>6</td>
<td>6</td>
<td>ns</td>
<td>2</td>
<td>1</td>
<td>ns</td>
<td>18</td>
<td>24</td>
<td>ns</td>
</tr>
<tr>
<td>Religious events, attending church</td>
<td>18</td>
<td>24</td>
<td>*</td>
<td>32</td>
<td>49</td>
<td>***</td>
<td>41</td>
<td>57</td>
<td>***</td>
</tr>
<tr>
<td>Activities in clubs or associations</td>
<td>12</td>
<td>11</td>
<td>ns</td>
<td>13</td>
<td>3</td>
<td>***</td>
<td>46</td>
<td>41</td>
<td>ns</td>
</tr>
<tr>
<td>Activities for retired people</td>
<td>15</td>
<td>19</td>
<td>ns</td>
<td>8</td>
<td>7</td>
<td>ns</td>
<td>26</td>
<td>35</td>
<td>*</td>
</tr>
<tr>
<td>Fishing</td>
<td>3</td>
<td>1</td>
<td>ns</td>
<td>6</td>
<td>0</td>
<td>***</td>
<td>45</td>
<td>13</td>
<td>***</td>
</tr>
</tbody>
</table>

Note:  
ns = not significant  
* significant for p<.05  
** significant for p<.01  
*** significant for p<.001
Leisure activities and outdoor mobility: cultural and physical obstacles

The differences between male and females are greater in Italy, but are present also in Germany and Finland. Data show that in Italy more males than females, with the exception of "religious events" perform many outdoor activities. This happens even if health conditions and capacity of mobility are not so different between males and females. In German these kinds of differences are less diffused, and there were few differences between males and females. In Finland the situation is different, because some activities are performed especially by males, and other especially by females. These differences among the three countries confirm the importance of cross-cultural differences. We can suppose these differences are probably linked to different expectations associated to gender role, and therefore too different kind of activities by which each person tries to find self-realisation.

3. CONCLUSIONS

Generally, even if health conditions and capacity of mobility are two important prerequisites for outdoor leisure activities, the differences among the three countries in these activities didn't result linked to health conditions and capacity of mobility. So these differences might be linked to cross-cultural characteristics which imply different needs and expectations systems, probably due to greater diffusion of "healthy ageing culture" in the countries of north Europe. Another aspect of cross-cultural differences among the three countries is that linked to gender role. Different expectations associated to gender role is an important factor which can affect the kind of leisure activities performed by females and males, and which can restrict the range of activities done, as resulted especially in Italy. Finally, in this work we found that cultural factors might play an important role in restricting outdoor mobility: this implies that to keep the elderly mobile it has to remove some cultural barriers which affect needs and expectations concerning possibilities of moving.

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A SUSTAINABLE MOBILITY FOR AGED PEDESTRIANS: AN EXAMPLE OF APPLIED RESEARCH. REQUIREMENTS AND OUTDOOR SPACES DESIGN IN PIETRA PAPA, ROME

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1. INTRODUCTION

Here are reported some of the most important issues of the interdisciplinary university research “Urban rehabilitation and pedestrian mobility”; this research is in co-ordination with other ones from different Countries, within the COST Program (European Framework for Cooperation in the Field of Scientific and Technical research) Action C6: “Town and infrastructure planning for safety and urban quality for pedestrians”.

Suitable techniques, technologies and methods for planning have been investigated targeting an improvement of life and urban environment quality, mainly based on an increase of pedestrians safety and thence on a regain of the outdoor urban spaces in agreement with the most vulnerable users requirements.

The feasibility of a city “ground” functional and environmental transformation has been studied, according to two directions: the first one concerning a broad pedestrianization features, limits and possibilities; the second one regarding traffic calming and pedestrian zones prescriptions, and connected innovative techniques implementation, following the example coming from different European Countries.

As case study has been selected Pietra Papa, at Viale Marconi, a south east roman semi central area, built in the '60s, because of its negative features (typical characteristics of many italian suburban areas): a very high physical and performance decay, architectural or environmental valuable features absence, public utilities and facilities lack, no meeting points.

The rehabilitation design has been mainly directed towards a removal of everything that can be seen as an obstacle to the discover and to the enhancement of the area hidden potentialities, and to the creation of new
morphological and social “poles”; these can be considered as revitalising elements for a place without differentiated urban spaces, and whose fruition and environmental lookout have been deeply damaged by private cars massive use.

Overcoming this negative set means starting an environmental and building upgrading process for urban areas on their whole, aiming at re-balancing vehicles and people mobility, by a design of new pedestrian devoted public areas hosting various activities, and, in this way, obtaining the “pedestrian size city” goal.

Spaces such as usual streets, but not only, ought to be studied: indeed, empty urban public and private places as squares, courtyards and entrance halls could be considered those available to host pedestrian movement and rest, in a calm and safe atmosphere, far from traffic jam; to allow dwellers who are forced to go on foot, such as aged people and children, to get again affordable city use conditions.

According to these statements, in order to fulfil the users spaces requirements, two attraction poles have been identified in the area: the schools system and the Tiber riverside area, as origin and destination of a main pedestrian path, meant for housing the main places for social gatherings and urban activities.

But why the research group insisted in promoting walking?

For a long time, european cultural tradition has set walking as the favourite mode of transport: indeed urban spaces, till the beginning of this century, were shaped according to this slow speed way of motion and to related social relationships springing from it. Nowadays mobility requirements of private cars rule on the planning and design practice of urban outdoor spaces, stealing room, previously dedicated to the former favourite way of transport. Slow speed movers as pedestrians and riders, in this way have been pushed to minor, unsuitable spaces, lessening urban life vitality and relationships.

Besides that, most of the nowadays urban spaces, being designed not for real people but for an “average” pattern of users, are not able to meet dwellers common requirements: in this way, only few city users can enjoy these spaces without problems; moreover, such an unsuitableness makes these spaces useless, and most of people “handicapped people”.. One of the most negative aspect of the matter, is that elders who have some physical hindrance are, in this way, compelled to stay at home; their own world is thence formed by the four walls they live in and the only chance to see what happen outside is given by TV programs. The consequence of this is a very sad form of segregation.

Making cities pedestrian-friendly is currently one of the priority target of the new sustainable mobility pattern. Under this point of view, pedestrians must be considered as main actors on the urban scene, and it is therefore proper to re-shape suitable urban spaces for their renewed role.

In order to achieve this goal, a new basic requirement must be met for what concerns mobility topics: more, wider, safer pedestrian space, by a progressive private cars traffic reduction and by speed limits control; removing traffic means more pedestrian dedicated space, new ways to use it, pleasure to walk in an enliven city, positive appraisal of the surrounding urban environment. This kind of urban rehabilitation makes the city again a “place” and so it can create the dweller’s identification process, pushing
people to guard it and to improve directly its quality, and bettering indirectly his own qualitative life model.

By the analysis of such statement, we understand that it is worth to start focusing on some factors which are basic for the action success. It is clear that to set a new kind of urban space, the measures for any kind of car traffic exclusion and urban design and decoration improvements are not enough; it is necessary to re-create the events variety that characterizes "centres", the landmarks alternation, those features constituting the "places" that polarise social life: spatial spots, forms, colours, perspectives and views that can be appreciated at pedestrians scale.

2. THE RESEARCH METHODOLOGY

After the different experiences coming from various Countries, it has come out that, for a successful suburban areas rehabilitation, it is important to focus contemporarily, on one hand, on traffic control and calming devices to obtain pedestrians safety, and on the other hand, on suitable measures to make pedestrians spaces not only useful but also enjoyable by different kinds of users, and in particular by the most vulnerable ones.

A design methodology, characterized by analysis and selection consecutive phases, has been used in order to define re-organisation possibilities and to foresee achievable quality levels. The comparison between users requirements and places performances makes possible to find out the interventions to make spaces fit for the desired purposes; an analysis of the well-known technical solutions allows to seek after the alternative ones and then to sift them in order to define their compatibility level, and to estimate,
and to guarantee their suitability, looking for the global environment quality control.

According to the research design methodology, first comes the receptivity analysis: it describes urban spaces current status, considering in particular mobility, services and environmental structure. By these data, it is possible to predict scenarios for pedestrian and vehicular mobility, and parking, city "ground" level transformations, and new possible services locations. The development and the further deep investigation of these hypotheses have been articulated by two different analysis moments: the desirability one and the opportunity one, i.e. the limits and the possibilities set by current, cultural and architectural, rules and valuations.

3. THE DESIRABILITY ANALYSIS

To validate the change, in the district renewal process, dwellers life patterns and behaviours, wishes and rising needs, must be considered; as people is formed by different kind of users categories, it is also worth to focus on them, so to define the activities they perform and then the respective, different, related requirements, in order to put them into a ranking list.

Since some kinds of users requirements could come into conflict with those by other ones, it is necessary to define and to study the different users categories one by one, in order to outline their different exigencies compatibility degree, and then the different measures to satisfy them, and finally to determinate the achievable satisfaction global level. The objective definition is very relevant: indeed, it is evident the importance of fixing the achievable goal. Two directions can be set: on one hand, reach relative "optimum" for all the users, because it is quite impossible to satisfy at the
same time and completely every requirement; on the other hand, to structure urban spaces to make them usable and enjoyable by different users.

In our study case planning, among the different pedestrians users categories, the so-called vulnerable users have been taken into consideration, mainly children and aged people. Many reasons can make them as "elective" users: in our study area, aged people are many (as the presence of two elders meeting centres demonstrates) and children too, because there are many schools. The big number of elderly confirms the western world population trend due to the almost "zero-birth rate", and to the increasing of human life average length. Unfortunately, city structure and its current quality levels are still not able to promote the overcoming of unfavourable conditions in which these vulnerable users live, and so to favour their attitude towards walking.

Dr. Rossella Squarcia, psychologist, contributed during the research first phase by direct observations, interviews, questionnaires, on the base also of different well-acknowledged theories in the specific field. According to the modern american scientific literature on the topic, she underlines that elderly can face years passing by in two different ways. On one hand, they are involved in a progressive reduction of personal functions that leads to a day by day back drawing seclusion not only from social activities, but also from all the cognitive and emotional related aspects. On the other hand, even if facing to the biological decay, they try keeping on work their personal abilities. Between these two statements, maybe there is a third way to look at the problem: the way to afford oldness is the result of personal characteristics and past behaviours, but stressing events, such as retirements, mourohs, illness, moving, distance from children, can deeply influence it.

A prevention from ageing worsening factors and acceleration process can be reached by programs involving elders in the productive, social and cultural life: a very useful way to keep their functions on and to enhance also their self-esteem.

The investigations results, elaborated by the psychologist, confirmed these theories. Even if bearing out the district thousands faults, the interviewed elders state that they like it the way it is, for many reasons: the ugliness, the decay, the lack of services and of green areas are weak reasons in comparison to the strong "familiarity" and "nostalgia" feelings, due to their long stay in the district. Anyway, moving out, "unrooting", would be a shocking experience; elderly, indeed, don't like changes and it is difficult for them to get benefit from new conditions; they prefer a situation that guarantees stability, behaviours repetition.

The applicative phase of the research has led to an "Intervention proposal for the realization of a safety system for the pedestrian mobility at Pietra Papa, Rome", coordination by Prof. arch. Lucia Martincigh, working group: Prof. arch. Lucia Martincigh, arch. Maria Vittoria Corazza, Alessandra Tosone; collaborators: arch.i Ugo Bevilacqua, Arnaldo Marino; CAD designer: arch. Laura Feliciani; consultants: prof.arch.Giorgio Boega (use of materials); prof.arch.Francesco Bianchi, arch.Oscar Santilli (urban lighting); prof.ing.Stefano Gori, ing.Stefano Carrese (vehicular mobility); arch. Patricia Ferro (environmental aspects), dott.Rosella Squarcia (psychological aspects); participants: Arch.i Marco Candiani (cartographical basis elaborations), Franco Fabrizi (researches and spot investigations), ing. Claudio Napoleone (hydraulic arrangement), Luca Urbani (road construction), Chiara Villani (visual problems).

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7 The applicative phase of the research has led to an "Intervention proposal for the realization of a safety system for the pedestrian mobility at Pietra Papa, Rome", coordination by Prof. arch. Lucia Martincigh, working group: Prof. arch. Lucia Martincigh, arch. Maria Vittoria Corazza, Alessandra Tosone; collaborators: arch.i Ugo Bevilacqua, Arnaldo Marino; CAD designer: arch. Laura Feliciani; consultants: prof. arch. Giorgio Boega (use of materials); prof. arch. Francesco Bianchi, arch. Oscar Santilli (urban lighting); prof. ing. Stefano Gori, ing. Stefano Carrese (vehicular mobility); arch. Patricia Ferro (environmental aspects), dott. Rosella Squarcia (psychological aspects); participants: Arch. i Marco Candiani (cartographical basis elaborations), Franco Fabrizi (researches and spot investigations), ing. Claudio Napoleone (hydraulic arrangement), Luca Urbani (road construction), Chiara Villani (visual problems).

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The opinions and the requirements of this kind of users, stress that the area features are no more suitable to their need, outlining faults and consequently paying attention to potentialities, that are worth to be considered and enhanced to satisfy them.

Another unfortunate factor brings together people categories under 20 and over 55/60 years of age: elderly, as well as children, are involved in road accidents, sometimes fatal too. For this, it is possible to suppose a reason for their inadequate behaviour, due to manifold different variables, as physical, biological, psychological, social ones.

Danger from traffic is dramatically felt by elderly because of their slower times of decision and reaction, because of their diminished visual perception and delay in estimating speed, but above all, because they are aware, in case of accidents, of the long-lasting consequences they should afford, not only under the healthy point of view but also under the economical one. This pushes also aged people often to create their own everyday special path, in which they avoid walking through traffic or crowded places, crossing streets, or unsafe and not secure spaces. Aged people overall perception of safety also includes security problems against violence, especially during the darkness hours.

A part of everyday activities takes usually place out of home: so aged people is compelled to go out to make shopping, to take their pets out, to visit friends, to go to the doctor and so on. Researches have shown that the walking amount is strictly related to social and economic factors, besides to the environmental influences, such as weather and traffic for instance, especially for what concerns the most vulnerable pedestrians habits. Another important matter to consider is that aged people, very often cannot drive because they have no driving licence: this make them “forced pedestrians”.

In this way, when walking conditions are bad, uncomfortable, or not safe, aged people avoid making unnecessary trips, or better they reduce their trips to the strictly necessary ones, renouncing to promenade, to visit friends, to social exchanges. Urban outdoor spaces features play an important role in this lack of opportunities: heavy traffic, or missing solutions in case of bad weather are the two most common factors that make vulnerable people stay in, self-restricting their own mobility. It means that the request for a safer and more comfortable mobility is getting higher and higher, and that, of course, this need is related to the importance of maintaining everyday activities.

The elderly common cliché represents aged people as poor, lonesome, needful old fellows, the traditional picture of a "grandpa"; on the contrary they show their will to live, their desire to have fun, to fully participate to the society life, and to feel active sharing social activities and cultural experiences. This can explain how the lack of space, of gathering places, of a park where to walk, where to stay far away from the cars and from the deafening traffic noise, is dramatically felt as a hindrance to walking, and thence to the autonomy of using spaces and to move free in the environment. The city shows its unsuitability to meet and satisfy the new exigencies of a new users class.

People express manifold requirements: among them, some are widely shared, others come from particular ways to use spaces, anyway both are worth to be deeply investigated. But, the awareness that some exigencies by some classes of users could come into conflict with others by some other users, must be always present.

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Among the several requirements, the first one to take into account is the physical and psychological safety, meant as safety of use, and then not only as safeguard from traffic dangers, but also from those inherent the use of the pedestrian space itself; in particular also security takes on importance since the fright of big city typical violence such as muggings, robbery, is felt even more dangerous because of the missing controls.

Another very important requirement to fulfil is comfort, meant as psycho-physical well-being, and therefore connected to the shape of space, to the stress of use, to facilities, to climatic and pollution effects exposure, to visibility, to lighting, and moreover to the various cultural traditions and expectations.

A continuity of safe, secure and comfortable paths is very important for aged people, in order to make for them easier to walk, to cross a street, to take the bus. For this purpose, a good sidewalks maintenance is very important: most dangerous factors are related to the bad surfaces conditions, such as presence of holes, slipperiness due to rain, to fallen leaves, not homogeneous texture and so on, but not only. Indeed, impaired or disabled people cannot easily manage steps or too hard ramps; for limping people, with or without stock, and for ill-sighted persons it is difficult to walk on inclined surfaces, and blind pedestrians need guidance based on tactile and auditory signals. It must be also stressed that very few municipalities can boast a physical environment taking care of the elderly people: they are often damaged by measures that are meant for pedestrian safety, but which in reality they are not, because based on an average, more mobile pedestrian pattern. An example of that is the green at traffic lights: often, its lasting time is too short to allow people with mobility problems to cross large urban roads by an adequate protection.

Besides these two basic requirements, a third one is worth to be investigated: the quality of the urban environment; this is very important for everybody and in particular for the elderly, because it provides them with those necessary references for their sense of direction, with the "memories" for the belonging feeling, or because it can make their difficulties worse, if hostile.

Its definition is very difficult because of the several aspect that form it; indeed, the research group trying to find out its features, noticed that this is the most difficult one to set, in comparison for instance to the others above mentioned, because it comes from the answers to a sum of exigencies that make the environment, to be recognised as "significative" element; it can shortly be expressed as the environment capability to meet dwellers requirements.

Walking, being a very low speed motion, affects also the users visual perception; indeed, it increases and changes the way to see spaces and to make use of the surrounding environment, parts of the environmental lookout are modified for what concerns their meaning and value, and in this way can also vary the intervention typology, focusing on buildings dadoes and on pedestrian space details.

4. AN INTEGRATED DESIGN APPROACH

As for safety, some aspects related to the mobility rebalance have been
A sustainable mobility for aged pedestrians: an example of applied research

depthened; since latest Italian traffic rules introduce some new aspects concern- ing the possibility to create "environmental islands" and allowing a "pedestrian network continuity", mobility planning can be focused on walking; inside these areas it becomes then possible to achieve, by various devices, some interesting results as the vehicles circulation reduction and, in theory, the cars speed control; pedestrians can, in this way, benefit of a heftier part of space, suitably dimensioned and equipped.

Great effort has been carried out, in order to enhance all the area potentialities concerning the environmental features, especially under the thermal and acoustic point of view; this has played an important role in the project proposal, since one of its priority is to allow aged people to enjoy of open spaces too, that is to use them in a comfortable way, mainly under the climatic point of view.

On the basis of roman data, the area microclimate has been studied, in order to know temperatures (peak and average values), main breezes (directions and speeds) and air humidity levels during all the seasons of the year. A special analysis has been run to find out the sun path pattern during the day, in the different seasons, in order to individuate the places with better (or worse) sun exposure, that means the coldest spaces in the winter and the hottest ones in summer.

The knowledge of breezes and sun exposures has become one of the guiding line in locating each activity, as foreseen in the project, in the most suitable space of the area, and in improving the existing microclimate by adding some useful devices, such as green elements and water. Green elements are very important, considering also the gardens poorness of the area, and they have been used widely to increase the comfort of every kind of users by their esthetical agreeableness, their shadowing and their pollution decrease effect. Among the trees indeed, deciduous ones and climbers have been used in all the rest and gathering places of the area, they have been chosen for two reasons: they allow a good sun exposure during wintertime and a good shade during summertime, useful to lessen the buildings and pavements high temperature during the summer; main species are: populus nigra, acacia baileyana, fraxinus ornus, quercus ilex, acer palmatum and so on; hedges along the streets can become an effective shield for pedestrians, (above all children and pets) against vehicles exhaust. Some hedges have been used, along a part of the main area pedestrian path, to achieve different requirements and aims; therefore a smelling specie (lavandula officinalis) has been selected in order to create, by its strong perfumes, a natural guiding line for blind people; this is an experimental study based on the latest scientific researches about natural guiding lines for blind people.

Water is another important natural element: it has been used mainly in the pedestrian devoted areas by the creation of a little water channel, that ideally springs from the Tiber, and really enter the area, slipping in it till the pedestrian core, the piazza, where it stops at a fountain.

The channel waterfilms and the fountain water veils are good devices to improve the area thermal conditions, especially by their freshness effect during summertime; besides that we consider the sound of water a useful mean to make the pedestrian area merrier.

In the general area layout, a selected part of the district has been designed so to be also at "children and elderly size", involving only those public spaces
that could be usable, according to the directions and limits imposed by the operation feasibility.

The proposal core is a pedestrian mobility system: a connective tissue holding up some urban functions. It contains spaces hosting different grades of mixed vehicular and pedestrian mobility, up to pedestrians exclusively devoted ones. All these spaces, being articulated in several categories and housing routes and rest areas can be used in different ways depending on their size, shape, location and structure.

Required outdoor activities have been studied by the ergonomic configuration, and then grouped in some spatial and functional “units”; each unit has then been located in the most suitable spaces of the area. The design of the spaces and of the equipments for each activity, are based on the users behaviours and on their activities, according to the specific anthropometrical data and ergonomic capabilities, as it can be seen by many elderly equipment: arm benches, hip supports, shopmobility points; the main goal indeed was to make all the users feel them at their best. The interventions to satisfy the requirements, have been studied taking into consideration different alternative suitable technical solutions; the choice among them has been made using some quality indicators, and some related parameters, keeping in mind the prefixed goals conformity and the reciprocal congruence.

The design proposal goals were both to remove the several area “faults” and to enhance its potentialities and hidden qualities; this allowed to reconsider the former area “identity”, i.e., on one hand its environmental feature as a river natural context due to Tiber closeness, and on the other hand, its previous marginal belonging to an “industrial revolution” historical-cultural context, represented by the “old mills” area.

As previously said, because of the area missing core, the proposal set the schools system and the Tiber riverside area as attraction poles of a main pedestrian path, a system meant to house the main places for social meetings and outdoor activities.

A central street of the area has become the main axis of this system; taking inspiration by spanish “ramblas”, it forms a “piazza”, a space where it is possible to walk, to rest or to gather together, in order to fulfil the need of socialization and so to remove the district centrality lack, complained by all the inhabitants of the area.

From this axis originates a minor cross system enclosing the school street: this area has been pedestrianized, creating a place where is possible to meet, at the same time, elders and children requirements, aiming also at stronger relationships between these two generations. This space allows schoolchildren to gather together after lessons, and parents and grandparents to wait them coming out from school, sitting on comfortable benches, screened by caducous leaves trees.

On the rear of the school there is a very quiet green area that, bound with the front one, creates a kind of dreamed “school in the garden”, where to play and stay together; this area is aimed at housing a garden, a kitchen garden and an orchard, managed by the children together with the elderly, where to make botanical and gardening experiences; this place is very important for two reasons: since many elderly spent their childhood in the countryside, this can offer the occasion to transfer their knowledge, reminding all past experiences, to the youngest generations, and so it can
represent a good chance to create contacts between young and old people. Two protected pedestrian paths and crossings join these spaces to the Tiber riverside area where the Rome Municipality plans to create a river park and sport area: an extra sport and leisure green space for the district. On a wider section of one of these path, there is a rest area called the “pergola”; it recreates the old time atmosphere allowing people to stay, in summertime, in the shadow during the day and in the breeze at night, and in wintertime, in the warm sun, and to meet, to chatter, to read newspapers or to play cards. The other path, because of its connecting role between the district and the riverside area, has been equipped also to be used as a natural and artificial guided path for the blind, presenting anyway a small, quiet corner for resting.
39.

WHAT DO STATISTICS SAY ABOUT THE SITUATION OF ELDERLY PEOPLE IN FINLAND?

Susanna Nouko-Juvonen
STAKES, National Research Centre and Development Centre for Welfare and Health

1. INTRODUCTION

The paper is divided into three parts. I first describe the present state of elderly care in Finland and tell about some future challenges. The quality and control of services intended for elderly people are current topics in the daily dialogue on a welfare state. Some of the critic is rather sharp. Secondly, I will give an account of statistics on housing conditions of elderly people and the related support services. The third part describes statistics on mobility of elderly people. In conclusion, I will try to describe how the specific theme of this conference is reflected in Finnish national statistics.

1.1 Services for elderly people as a challenge for the welfare state

Before I discuss the state of elderly care in Finland, I would like to present some indicators about our elderly population. In Finland the birth rate is expected to remain relatively low (i.e. on the same level as in last few years) in the future decades. This happens at the same time as the mean life expectancy is growing and the proportion of people aged 64 years or more is increasing. According to the population forecast made by the Statistics Finland, the number of people aged 64 years or over is predicted to grow from the appr. 717,000 persons in 1994 by appr. 60,000 persons (8.4%) by the year 2000. In 2020, the number of people aged 64 years or over is expected to be over 1.1 million, which is 374,000 (49%) more than in 2000. (Vanhuuspolitiikka vuoteen 2001, 1996)

Table 1. Population in 1990-2020

<table>
<thead>
<tr>
<th>Year</th>
<th>Population 65+</th>
<th>Population 75+</th>
<th>Population 85+</th>
<th>Total Population</th>
<th>Proportion % 65 and over</th>
<th>Proportion % 65 and over below 20 years</th>
<th>Below 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>695000</td>
<td>289000</td>
<td>58000</td>
<td>5055000</td>
<td>13.70%</td>
<td>54.10%</td>
<td>1285000</td>
</tr>
<tr>
<td>1994</td>
<td>717000</td>
<td>295000</td>
<td>63000</td>
<td>5098000</td>
<td>14.10%</td>
<td>55.00%</td>
<td>1303000</td>
</tr>
<tr>
<td>2000</td>
<td>765000</td>
<td>330000</td>
<td>76000</td>
<td>5172000</td>
<td>14.80%</td>
<td>60.20%</td>
<td>1276000</td>
</tr>
<tr>
<td>2010</td>
<td>805000</td>
<td>362000</td>
<td>95000</td>
<td>5233000</td>
<td>17.00%</td>
<td>73.50%</td>
<td>1207000</td>
</tr>
<tr>
<td>2020</td>
<td>842000</td>
<td>445000</td>
<td>104000</td>
<td>5222000</td>
<td>21.90%</td>
<td>99.40%</td>
<td>1149000</td>
</tr>
</tbody>
</table>

Source: Population forecast by Statistics Finland, 1995
What do statistics say about the situation of elderly people in Finland?

The increase in the number of people aged 75 years or more is especially significant from the point of view of welfare and health services. There were 290,300 persons aged 75 years or over in 1994, and the forecast figures for 2000 and 2020 are 334,700 and 454,300 respectively. (Figure 1). The increase is expected to be fastest among people aged 85 years or over from 1990 to 2000. After 2000 the increase will be faster in the younger age groups of persons aged 65 years or over (Figure 3).

Figure 1. Proportion of population aged 65 years or more by age, 1980 – 2020

Source: (Vanhunuspolitiikka vuoteen 2001, 1996)
There has been wide general debate about the quality of elderly care in Finland this spring. It has been said that there simply aren't enough personnel to help the elderly even with the most basic routines, such as feeding, personal hygiene, going to toilet and outdoor exercise.

The quality of institutional care varies in different regions, and even in different institutions, the same way as the supply and availability of services. The care in institutions is connected to the physical environment, patients' needs, the number and education of the personnel, funds, methods and care practices. All these factors vary between institutions, which makes it impossible to directly apply information obtained from one institution to other institutions. Also, the present state of institutional care cannot be understood without taking into consideration the changes in the service sector in general.

A thorough evaluation is needed to assess the overall state of institutional care and other elderly care in Finland.

In evaluation of this type, and when reaching for the goals of a welfare state, statistics and distribution of statistical information have a major role. Statistics are used in planning on a national, regional and municipal level.

### 1.2 Housing of elderly people and support services

In the 1990s, the aim has been to change the structure of elderly care in Finland by reducing institutional care and increasing the services provided at home, by using the available resources more efficiently, and by cutting costs. In municipalities this change has been carried out by reducing the use of services, replacing expensive services by less costly ones and by improving the practises. (Vaarama & Noro 1997). In the following I will look at the
national trends in the housing of elderly people. Table 2 displays the coverage of the main publicly funded services for the elderly. Coverage here means the relative coverage of the services among the target population. Apart from service housing and health-centres' ward departments, the coverage of services for elderly people has decreased from 1988. The decline in the coverage of elderly people's home-help services has been significant and consistent. At the same time, a structural change seems to have taken place in institutional care. Long-term specialised care has decreased radically, whereas long-term care in health-centre hospitals has moderately increased. Social administration's long-term care seems to move more and more towards housing as the long-term care in old people's homes decreases and service housing increases.

Table 2. National profile and changes (%) in main services received by elderly people in 1988, 1994 and 1995

<table>
<thead>
<tr>
<th>Service</th>
<th>1988</th>
<th>1992</th>
<th>1994</th>
<th>1995</th>
<th>88-95%</th>
<th>94-95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion (%) of 65-year-olds among all clients</td>
<td>19</td>
<td>15</td>
<td>13</td>
<td>12</td>
<td>-38</td>
<td>-8</td>
</tr>
<tr>
<td>Recipients of home help</td>
<td>15</td>
<td>19</td>
<td>14</td>
<td>14</td>
<td>-11</td>
<td>-4</td>
</tr>
<tr>
<td>Recipients of support services</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-14</td>
<td>-23</td>
</tr>
<tr>
<td>Recipients of informal care allowance</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Clients living in nursing homes</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>111</td>
<td>-6</td>
</tr>
<tr>
<td>Proportion (%) 75-year-olds among all clients</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>-26</td>
<td>-8</td>
</tr>
<tr>
<td>Clients in long-term care in old people's homes</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Clients in long-term care in health-centre hospitals</td>
<td>3</td>
<td>1</td>
<td>0.5</td>
<td>0.3</td>
<td>-60</td>
<td>-40</td>
</tr>
<tr>
<td>Long-term institutional care, total</td>
<td>17</td>
<td>13</td>
<td>13</td>
<td>12</td>
<td>-29</td>
<td>-6</td>
</tr>
</tbody>
</table>

Source: Vaarama & Noro 1997, 94

Apart from informal care allowance, the reduction of services seems to have halted in 1995 when compared to the worst years of recession (1992-1994). The most disturbing feature is that the relative reduction of home-help services continues. The families seem to participate in elderly care increasingly more without any compensation, because at the same time as there have been cuts in all public services, the relative number of recipients of informal care allowance has declined. Table 3 shows the trends in the number of recipients of the services for elderly people. The coverage of home help has decreased a noticeable 39% in relation to the increase of elderly population. Support services have not compensated for this decline. Instead, the number of home-help services' clients has decreased by 40,000 clients from 1988 to 1996. Earlier (from 1988 to 1994) the help given to each client doubled from 0.8 to 1.6 hours per week.
Table 3. Recipients of services for the elderly in a course of one year

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Home help services</td>
<td>125914</td>
<td>105639</td>
<td>87101</td>
<td>87287</td>
<td>-38627</td>
<td>-31</td>
</tr>
<tr>
<td>Support services</td>
<td>98540</td>
<td>129352</td>
<td>98703</td>
<td>99005</td>
<td>465</td>
<td>0</td>
</tr>
<tr>
<td>Clients of home help services*</td>
<td>224454</td>
<td>234991</td>
<td>185804</td>
<td>186292</td>
<td>-38162</td>
<td>-17</td>
</tr>
<tr>
<td>Informal care allowance</td>
<td>11399</td>
<td>11557</td>
<td>11307</td>
<td>12124</td>
<td>725</td>
<td>6</td>
</tr>
<tr>
<td>Housing services, 31 Dec</td>
<td>6581</td>
<td>8917</td>
<td>13949</td>
<td>15767</td>
<td>9186</td>
<td>140</td>
</tr>
<tr>
<td>Old people's home or respective, 31 Dec</td>
<td>28610</td>
<td>25913</td>
<td>22950</td>
<td>22684</td>
<td>-5962</td>
<td>-21</td>
</tr>
<tr>
<td>Proportion of long-term care in old people's home, 31 Dec</td>
<td>26592</td>
<td>23734</td>
<td>16737</td>
<td>21019</td>
<td>-5573</td>
<td>-21</td>
</tr>
<tr>
<td>Long-term care in health-centre hospital, 31 Dec</td>
<td>10104</td>
<td>12313</td>
<td>12392</td>
<td>12196</td>
<td>2092</td>
<td>21</td>
</tr>
<tr>
<td>Long-term somatic care, 31 Dec</td>
<td>2667</td>
<td>1534</td>
<td>1020</td>
<td>1185</td>
<td>-1481</td>
<td>-56</td>
</tr>
<tr>
<td>Long-term psychiatric care, 31 Dec</td>
<td>4467</td>
<td>2019</td>
<td>823</td>
<td>698</td>
<td>-3769</td>
<td>-84</td>
</tr>
</tbody>
</table>

* includes overlapping of home-help and support services.

Specialised care and long-term care in old people's homes has been reduced. The total increase of recipients of housing services and health-centre clients from 1988 to 1996 was 455 persons more than the total decrease in the number of recipients of long-term care in specialised care and old people's homes. Thus the long-term care of elderly people has not declined during the last decade. There has, however, been a profound change in the structure of institutional care and in the division of duties between institutions, which has also affected the nature of nursing and need for resources in various institutions. Also, at least some of the resources released from the long-term care in old people's homes have been used to increase short-term care, which is important for informal care and rehabilitation.

Increasing service housing has counterbalanced the reduction of care provided in old people's homes and, to some extent, also other cuts in services. When the elderly are now only rarely kept long periods of time as bedpatients in specialised care, the result has been an increase in long-term care in health-centre hospitals. The traditional institutional care has declined by 3% in relation to the elderly population. The latest statistics show that the overall reduction of the service structure has halted, since the changes from 1995 to 1996 are marginal. The service structure as a whole appears to have settled at the present level, but there are great differences between municipalities.
What do statistics say about the situation of elderly people in Finland?

The services for the elderly have gone through a major re-structuring during the last ten years. Old people's homes have been replaced by service housing, and elderly people in need of care have been moved from specialised to primary health care. The number of clients of home help has declined significantly at the same time. Outpatient services for the elderly have become more diverse, but the quantity of help provided at home has not always developed as hoped for. Several examples from municipalities reveal that the resources of home help have decreased because personnel have been transferred from home help to service housing. The reduction of home help adds to the insecurity of the elderly people living at home, and it may also lead to crowded long-term wards and longer waiting times for institutions. However, one must bear in mind that this is the national average and there are great differences in the availability of home help between municipalities. The main conclusion to be drawn from quantitative analysis is that the insufficient supply of outpatient services is a growing problem, which together with the strong reduction of long-term care leads to a widening gap between need and supply. Even though the relative quantity of Finnish long-term care is of European average and outpatient services are above the average, we now have the shortest supply of services in ten years. However, the differences in service supply and service structures have always been large between municipalities. According to surveys, these differences can only partly be explained by different service needs. The primary reasons are the municipalities' own priorities and practices. So, the home municipality largely determines what kind of outpatient services or institutional care the elderly people can expect to receive. Regional inequality is a reality in Finland in 1998. (Vaarama ym. 1998; Vaarama & Noro 1997).

2. STATISTICS RELATED TO THE MOBILITY OF ELDERLY PEOPLE

There are no permanent statistics on the mobility of elderly people in Finland (and to my knowledge neither elsewhere in Europe). The following statistics, or estimates to be more precise, are based on isolated calculations and surveys. I intend to take a closer look at the statistics on the mobility of elderly people in three parts: technical aids, public transport and residential buildings.

2.1 Availability of technical aids

There are no national statistics on the availability of technical aids in Finland, but individual surveys have been made, the latest in 1994. The survey was conducted because of an exceptionally wide public debate about how the dismantling norm guidance and the municipalities' budget cuts are going to affect the availability of technical aids. The aim was to survey the availability of technical aids, and changes in the availability in different regions of Finland in 1992 -1994. Information was
Part 4: Mobility and activity: needs and barriers

collected by means of telephone interviews from every health-centre and hospital district in the country. The availability of technical aids was evaluated in general terms, in respect of various user groups, various aids and expenditure changes.

According to the survey, technical aids have become more difficult to obtain in certain areas and in respect of some individual aids. However, the development is not similar in all health-centres or hospital districts. In other words, in some areas technical aids are easier to obtain, and in others more difficult.

According to estimates from the health-centres and hospital districts, the technical aid services correspond to the need of the clients relatively well. Technical aid services for elderly people were estimated to be 'good' or 'relatively good'.

The lowered availability of technical aids is reflected as tighter criteria for the provision of individual aids or as general restrictive rules. There is now more room for consideration, but on the other hand clear restrictions have also been issued. The restrictions have been carried out either by issuing a list of aids which will not be provided at all or by setting a sum limit and providing only aids whose value exceeds that limit. Restrictions have been set e.g. for renewal of special footwear, wigs and spectacles.

Restrictions have been focused differently in different health-centres and hospital districts. In some regions, provision of walking sticks for long-term use has been limited, in others provision of wheelchairs or batch chairs. Tighter limitations for the provision of different aids were not found more often in the same health-centres or hospitals.

There are obvious differences in the provision procedures of technical aids between health-centres and hospitals. Differences within municipalities are also emphasised by the fact that the availability of the same aids has been made easier in some health-centres and more restricted in others.

The costs for technical aids per resident are extremely varied. The quality of the aids and the efficiency of the services affect the differences in expenditure. (Appendix 1)

The law guarantees technical aid services free of charge in Finland. However, about 20 health-centres and one hospital district have charged their clients for the use of technical aids (e.g. special footwear, back braces, orthopaedic supports or wigs).

The need for technical aids is growing. The proportion of elderly population is continuously growing and elderly people in ever-poorer conditions are being nursed at home. Also, the development of technical aid technology increases benefits to be gained from the aids. In future, supporting the elderly people's outpatient care and living at home will be one of the main tasks of technical aid development. (Sillanpää, Marjamäki & Paatero 1995)

2.2 Access to public services

An essential feature of Finnish (and the European Commission) traffic and environmental planning is to take into consideration the elderly people and persons with disabilities. The aim is to make services as accessible as possible. In this context the access to services means elderly person's possibilities to utilise various services, environments and means of transport.
What do statistics say about the situation of elderly people in Finland?

I will now look at a few figures about the accessibility of public transport and residential buildings.

**Public transport**

According to a survey by the Ministry of Transport and Communications there are 250 full-size low-floor buses in Finland. There are also smaller low-floor buses, several of which operate as service buses. In long-distance train traffic, there are 14 carriages equipped with elevators and sanitary facilities suitable for persons with disabilities (the total number of long-distance trains is 61). The number of taxes suitable for people with mobility impairment is 1195. Regular taxes have 150 turning front seats.

An international survey on the access to public transport was conducted in 1995. When collecting data for the survey it became obvious that finding statistical information about the access to public transport is extremely difficult. However, the survey does enable some conclusions. There are great differences between countries in how people with mobility impairment can access public transport. The number of taxes accessible for wheelchair users has increased especially in Finland, Norway, Spain and Great Britain. The access to public transport has increased everywhere. It is also stated in the survey the attitudes towards the access to public transport vary between countries. (Vesanen-Nikitin 1995)

**Residential buildings**

There are no statistics (and to my knowledge no recent surveys, either) on how easily residential buildings are accessed. However, in 1992 there were about 50,000 staircases in residential buildings with at least three floors that didn't have an elevator in Finland. The number of residential buildings without an elevator was about 20,000, 17,500 of which had three floors and 4,600 four or more floors. (Nouko-Juvonen 1997)

### 2.3 In conclusion

The proportion of elderly population of the total population will increase significantly in the near future in Finland. This also changes the age structure of the Finnish population. The need for services for elderly people will naturally increase. Statistics are helpful when studying the traditional services for the elderly, such as housing and support services. It would be important that the future statistics could be used to study the so-called non-traditional services, such as the availability and accessibility of services that improve mobility. All in all, the statistics should always follow the current focus of the elderly policy.

### 3. REFERENCES

Appendix 1: Expenditure of hospital districts and health-centres on technical aids, total FIM/inhabitant

(mean of the years 1992 and 1993)
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CONCLUSIONS

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Action and mobility are both important to a good and long life. There is no doubt about the meaning of a good physical condition, a good (outdoor) mobility and a healthy financial situation as conditions for an independent way of life. This independence is felt by most people as a main condition for a good life. In old age these conditions can no longer be taken for granted. How can we better understand this process of ageing and its consequences for the way of life? What is the role of outdoor mobility in this process, how can we offer better conditions for mobility and what can be the role of new technological development? How can we improve the transport system, means of transport and other conditions for mobility? Does a good system of tailor-made, demand-responsive transport contribute to the desired mobility?

The person and his context or environment are the two basic components in the process of ageing, and both interact in a continuous process. A person adapts his expectations and needs to his own possibilities and to the conditions of the environment. A person compensates for his/her losses and optimises the use of resources still available.

The personal background and history are part of the development. The need for and the actual participation in social networks can explain the motivation for the efforts needed to go out. Health, physical functioning condition and mobility are basic conditions for any outdoor mobility; they represent the possibility of being active and mobile. The financial background is strongly related to the availability of means of transport and also to the type and number of facilities which are within range.

In the context of a person we can distinguish several aspects. Each person finds his way in different contexts, which together form his environment. The personal need for a social life has its contextual counterpart in the available social networks: partner, family, children and grandchildren, relatives and friends, neighbours, church, associations, etc. This part of the context can be a main motivator for going out and for several outdoor activities. This motivation derives from the stimulus that comes from the company people get, but also from the support people obtain from their social network in solving or mitigating the negative effects of mobility impediments.

The physical context strongly conditions the possibilities of going out. In this part we can distinguish the availability of relevant facilities and on the
other hand the accessibility of these facilities. Shops or a health care centre nearby, a park around the corner, cultural facilities within walking distance, these are all conditions for mobility. **Availability** is strongly related to distance or to **accessibility**. The last concept means not only the physical accessibility of buildings, good pedestrian paths or cycle paths, traffic safety, safe crossings, well-paved sidewalks, no stairs but also the available transport facilities. Owning a car, a bus-stop nearby, accessible vehicles or demand-responsive transport are all conditions for the accessibility of the physical environment. Sometimes we seem to focus too much on the physical environment as a barrier to or facilitator of mobility, but we can see it also as a motivator for mobility. Attractive surroundings with high-quality natural elements, historical and cultural buildings, social meeting points, variety of activities, lively streets, etc. may stimulate people to go out and to be more active. This may be one of the background motives when people of advanced years move (back) to inner cities.

The main aspects related to outdoor mobility were the subject of sessions during the Euroconference in Rolduc:
- mobility and activity: needs and barriers
- health conditions and physical mobility
- physical environment: accessibility and traffic safety
- development in means of transport and new technology.

**General remarks**

The subject of the outdoor mobility of the elderly is too complex to have the pretension that in one conference the main conclusions can be drawn. But some general, relevant remarks should be made.
- The research in this field is strongly focused on finding solutions for mobility problems, but before going out the elderly need to be motivated to go out. Partly this concerns their personal needs for activity and contacts, but it is also the environment in the broad sense which makes it worthwhile for them to go out. Attractive urban lay-out, attractive and varied routing and attractive goals for their mobility are important motivators.
- The research on transport facilities has focused very much on finding technical solutions for problems experienced by disabled and elderly people. This work was most directed by the available technical solutions. The supply of means of transport and adapted vehicles was more important than the demand of the target group: the elderly or others.
- The policy should be directed most towards preventing mobility problems for the elderly and other transport users. For some older people the high demands of the existing transport system are disabling their possibility of moving outdoors. To get people back to a mobile life which they have given up is much more difficult than keeping them mobile. In keeping people mobile we must be careful not to stress the car as the best way to be mobile.
- The elderly have been seen sometimes too much as people with disabilities or handicaps, but most elderly have only slightly more problems in handling complex situations with increasing age than other people have. Finding solutions should be aimed most at finding solutions
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for problems which are felt by most people and by improving the use of vehicles by all users.

- The direction of solutions in the transport system must be focused more on the integration of systems than on the improvement of one of the systems as such. Difficult and insufficient trip chaining is a major barrier to outdoor mobility. In most trips made by elderly people private means of transport, walking, cycling or car trips are preferred. This could be mainly explained by the clear concept of these unimodal trips. Public transport is nearly always complicated by time schedules, ticket types, changing modes and by transport to and from the stops. Multimodal transport concepts can be a real alternative if they acquire most of the characteristics of the private trip: comfort, flexibility, door-to-door service and a conceivable concept with clear information about the trip.

Besides these general remarks many other important observations have been mentioned in presentations and discussions. We shall try to summarise some of them using the main themes of the sessions.

Mobility and activity: needs and barriers

Private transport is an important part of mobility. Car ownership and driving licences are the main conditions for the use of a car. Car mobility decreases now with age. The cohort effect is partly responsible for this finding: the older age groups (more women) have fewer driving licences and are less often owner of a car. The common pattern shows that males drive more kilometres, have more cars and driving licences.

This tendency towards preference for private modes applies to all age groups, but the elderly experience some extra barriers. The future car will be improved by new telematics systems, which reduce the complexity of driving a car. Acceptance of these new types of equipment calls asks for a better design. User-friendly design is a condition for application.

Acceptance of new services based on technology is always risky. People should be able to take their own decisions based on sufficient information. Involvement in the process of developing and designing creates the best conditions for this acceptance.

Information and access to information about mobility is important. It must be part of education in a period of life in which people develop their attitudes to mobility.

Cultural difference must be taken into account in drawing conclusions about the perception of people. More insight into the behaviour and experience of the elderly is needed to develop applicable systems. Adapted to national, cultural differences information should be provided in different ways and along different lines. In Finland the public library is an important source of information; in Italy TV plays this role.

One of the private modes is walking, very important to older people and contributing to a sustainable environment. In the inner-city the creation of more pedestrian areas is needed to stimulate walking as a replacement for car mobility. Pedestrian routing can be developed to offer surroundings where people can meet each other and where social activities can be realised.
Health conditions and physical mobility

In several studies researchers have concluded that a high level of activity contributes to a longer life. Thus, the question of physical functioning is essential in the research field of elderly people. New technological solutions are being developed for prevention and remediation purposes and the number of supportive devices is increasing. This development is welcome, but on the other hand people should be encouraged to use their own body and to do physical exercises. In other words, technical solutions should not be used to support passivity in outdoor mobility. The use of cars and other non-human powered transport, for example, plays an important role in the possibilities moving outdoors. On the other hand, this trend might contribute to less physical activity already at a younger age. The key term in considering health and mobility questions is ‘autonomy’. An important part of autonomy is physical functioning and fitness. As the differences between individuals increase with age, for example in muscular strength and in balance, it is important to remember that there is no such thing as a physically or otherwise homogeneous group of elderly people. This imposes special requirements for both the research and for the practical solutions. This could be summarised in a phrase ‘design for all – design for nobody’.

Improvements in promoting physical mobility include counselling, which could and should be an integral part of general health examination and counselling; indoor sports halls and swimming baths, which are especially important when environmental conditions restrict mobility (e.g. short period of daylight, snow and ice); and considering the ergonomics of products used by elderly persons. The elaboration of new devices for measurement and measurement scales is also an important target of development.

Physical environment: accessibility and traffic safety

Designing urban areas is as such an important issue. Integration of the elderly in existing patterns should be part of it. The most that can be done is offering the best possible conditions, but the satisfaction of the elderly is no guarantee.

For the improvement of traffic safety of many suggestions can be made. Technical solutions are available, but they should take into account the different roles of traffic participants. Part of the solution could be that people experience the complications of the different positions of transport users: being a pedestrian or cyclist makes a car driver more alert to the specific hindrances these users experience.

The urban environment should be given back to the most important user’s group: the pedestrians. The car very often intrudes in the urban core, which has been built in different times for pedestrian users. Pedestrians are in the number of trips, but not in the distances travelled, the most important user’s group. This would be a good development for the elderly too. But we have to underline that the main risk for the pedestrians is the chance of accidents happening. For this reason the elderly live in an unsafe environment and the perception of unsafeness and fear of lacking public safety could reduce their mobility.
Thus the ageing of the population requires a new way of designing and building, answering the need of the elderly to move in a safe and integrated environment.

**Development in means of transport and new technology.**

In order to improve the mobility of the elderly individual and collective transport subsystems should be better connected in time and space than they are now. Integration of several systems in a new concept offers new opportunities. Travel services should be oriented to group and market segment in order to become effective and efficient transport products. Most of these services are too much focused on their own internal organisational efficiency and cost-benefit efficiency. The demand should be the driving force of new developments. More real experiments should be carried out to learn from the mistakes made in real life situations. Costs are always a discussion point. More than high or low costs the affordable costs are the most relevant. In the discussion of alternative transport attention is too much focused on the direct costs of new transport systems and not enough on the total costs of the existing system including the costs people incur for owning and using a private car.

Only tailor-made transport products can improve the mobility of the elderly. This is necessary for all users to make these transport products competitive with a private transport product like the car.

The introduction of more technology and robotics could be a way to solve some problems. Feedback and feed-forward are both important parts of the evaluation. Feed-forward means that the ideal generation will already be included in the planning process regarding new functionality and services. A basic assumption in implementing new technology is that people must have the opportunity to use their discretion. They have to decide between using technology or personal help. The fast advance of this technological development makes it exciting, but will it be accepted by older users? This acceptance will be based on the degree in which these applications are driven by the aspirations and special characteristics of the users including the elderly. People want to see that it works and that it is functional.

Some examples of supporting new technology have been the subject of discussion. With the expectation of a dramatic increase in older drivers some measures will be needed to guarantee traffic safety. Vision enhancement systems can be supportive for car mobility, but the safety of the system must prevail. Fear of in-vehicle technology, difficulties in integrating new information into driving skill repertoires and the distraction of attention can be fundamental barriers to acceptance and safe use by society as well as by the users.

**Recommendations**

The various presentations showed the importance of the integration of the
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available knowledge into several scientific approaches. Mobility problems are related to several potential influences. This also means that solutions should be sought not only in removal of some physical barriers, but also in the motivation of people and in the information on possibilities and alternatives. The same is valid for the technical solutions and supply of alternative means of transport. Integration of well-functioning, available subsystems must be considered as part of the solution. The possibilities of new technologies can be used to link, to coordinate and to integrate different systems.

One of the striking findings of this conference is the similarity in the problems and the explanatory factors, despite the cultural, geographical and socio-economic situations in the countries. The same can be said of the types of solutions. The problems and solutions have so much in common in different countries that an international approach is much more promising than national solutions.

Not only similarity can be found. Different cultural traditions have proven to be as important as geographical conditions. That means that information about the broader context of people is necessary to explain differences in mobility behaviour and also in developing solutions. Sometimes we can learn from the solutions people have found in coping with mobility problems in different countries. Not always is the border between countries the main explanation of cultural and functional differences. The differences between urban areas and the countryside can be very decisive in large countries. Even the gender role can have a major impact on the mobility behaviour of people. In future research, rural/urban differences and gender differences, too, should be taken into account.

Even in this project with very closely co-operating researchers there was a remarkable finding that the use of the national data in one big database took more time than expected. This problem of the compatibility of official statistics of different countries is even greater. One has to be very careful with the comparison of national data.

With regards of a future research programme we are convinced that in a greying society more attention to the elderly is necessary. In such a programme the impact of possible solutions on the long term should also be part of the design. Longitudinal studies can be a good approach to finding the effects of some measures, but also to gaining more insight into the coping behaviour. This last aspect is important to find ways developing new solutions, which fit in a real demand of the target group of the elderly.
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