How future mobility systems can contribute to successful aging

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Samenvatting

Hoe toekomstige mobiliteitsystemen kunnen bijdragen aan succesvol ouder worden

De Nederlandse bevolking vergrijst. Vergrijzing van moderne maatschappijen is een van de meest belangrijke trends binnen het veld van duurzame mobiliteit. Mobiliteit is belangrijk voor het welzijn van ouderen. Echter, mobiliteit komt in gevaar naarmate mensen ouder worden. Het welzijn van ouderen kan inzichtelijk worden gemaakt aan de hand van 'succesvol ouder worden', een combinatie van drie dimensies: 'lage kans op ziekten en gebreken', 'hoge cognitieve en fysieke capaciteit' en 'betrokkenheid bij de samenleving'.

Dit paper beschrijft een onderzoek naar hoe toekomstige mobiliteitsystemen (beschreven als een combinatie van landgebruik- en het transportsysteem) kunnen bijdragen aan het succesvol ouder worden van ouderen. Het theoretisch kader laat zien dat mobiliteit een rol speelt voor de dimensie 'betrokkenheid bij de samenleving', omdat mobiliteit het mogelijk maakt om sociale contacten te bereiken, sociale activiteiten te ondernemen, voorzieningen te bereiken en (recreatief) te reizen. Hiernaast laat het theoretisch kader zien hoe alle dimensies van 'succesvol ouder worden' worden beïnvloed door het mobiliteitsysteem.

Dit onderzoek gebruikt de methode 'backcasting' als invalshoek, om wenselijke toekomstbeelden in kaart te brengen. Bij bedrijven, kennisinstellingen, overheden en belangenorganisaties zijn interviews uitgevoerd. De data vanuit deze interviews is gebruikt als input voor een scenarioanalyse. Met behulp van de twee belangrijkste dimensies zijn vier verschillende scenario's opgesteld: (1) geconcentreerd wonen en multimodaal transport, (2) verspreid wonen en auto-afhankelijk transport, (3) geconcentreerd wonen en auto-afhankelijk transport en (4) verspreid wonen en multimodaal transport. De scenario's zijn coherente toekomstbeelden, die elk een andere combinatie van mogelijke bijdragen aan succesvol ouder worden bieden.

Het eerste en tweede scenario leveren totaal verschillende bijdragen aan succesvol ouder worden (het derde en vierde scenario zijn een combinatie). In de toekomst zal een deel van de ouderen geconcentreerd wonen. Tegelijkertijd zal een ander deel verspreid wonen. Als gevolg hiervan kan, afhankelijk van de woonsituatie, een bijdrage geleverd worden aan het succesvol ouder worden van ouderen.

1. Introduction

As well as other modern societies, the Dutch society is aging. CPB (2000) shows that from 1970 to 2000, two main factors are identified that contribute to this development. These are declining fertility rates and increasing life expectancy. As a result of this trend, 20% of the Dutch population will be 65 years or older in 2020 (Jorritsma & Olde Kalter, 2008).

Personal mobility is essential for functioning in society. However, mobility becomes at risk as individuals age. Therefore, mobility behaviour of older adults is currently at interest. According to Rudinger et al. (2004), aging of modern society is one of the most significant trends within the field of sustainable transport. This is underlined by OECD that stresses that aging of modern societies will influence almost all aspects of life (OECD, 2001) and that one of these aspects is mobility. OECD (2001) stresses that mobility of older adults should be secured by well thought-out planning.

The process of aging of individuals is addressed by the scientific field of gerontology. Within this field, Rowe & Kahn (1997) postulate the distinction between usual aging and successful aging. Moreover, Rowe & Kahn propose a model that defines the concept of successful aging as a combination of three dimensions*: "low probability of disease and disease-related disability, high cognitive and functional capacity, and active engagement with life"* (Rowe & Kahn, 1997: 433).

Successful aging of older adults can be influenced by adapting factors underlying the three dimensions. Intervention studies should concentrate on strategies that increase the share of older adults aging successfully (Rowe & Kahn, 1997). The distinction between usual and successful aging can be used to indicate direction for interventions that lead to successful aging (Rowe & Kahn (1997). In this context, interventions to secure the mobility of older adults can be given direction with use of the concept of successful aging.

Within the field of gerontology, the concept of mobility can be defined as *"…a person's purposeful movement through the environment from one place to another"* (Owsley, 2002: 220). Although the concept of mobility gives insight in a person's physical and psychological wellbeing (Owsley, 2002), aspects of the physical environment are not addressed. In order to include these aspects, one should include elements from transport theory. Geurs and Van Wee (2004) postulate that four (interrelated) components of the mobility system influence the accessibility of places. These are a land-use component, a transport component, a temporal component and an individual component. The first two components relate to the design of the mobility system.

The aim of this research is to identify (1) how future mobility systems can contribute to successful aging and (2) what can be learned from the different future scenarios. In order to do so, this research highlights the role of mobility in successful aging, how mobility systems influence successful aging and how different future scenarios can be described.

2. Theoretical framework

2.1 Transport theory

Geurs & Van Wee (2004) propose that accessibility is influenced by four (interrelated) components of the mobility system[1]. These are a land-use component, a transport component, a temporal component and an individual component. As the first two components relate to the physical design of the mobility system, they are used to define the mobility system throughout the research.

The land-use component consists of the land-use system. The land-use system can be defined by three elements. These elements are *"the amount, quality and spatial distribution opportunities supplied at each destination"*, *"the demand for these opportunities at origin locations"* and *"the confrontation of supply and demand for opportunities"* (Geurs & Van Wee, 2004: 128). Other authors (Van Acker & Witlox, 2005; Geurs & Ritsema Van Eck, 2001) define the land-use system with three similar elements. Since this research focuses on the physical design of the mobility system, the first element is relevant here.

The influence of the first element of the land-use system on mobility can be further specified. Van Wee (2002) identifies several characteristics of land-use that significantly influence mobility. The most important characteristics are *"densities, the level of mixed land-use, neighbourhood design and distance to railway connections"* (Van Wee, 2002: 261). For this research, the last characteristic is broadened to 'distance to transport connections', since there are more possibilities for transport than railway connections[2]. Reason for this is that other transport connections are possibly relevant for this research, that are designed specifically for older adults and therefore not the public.

The characteristic density relates to the amount of opportunities within a certain area. Possible opportunities are dwellings, shops or hospitals. Density affects mobility since a higher density can provide an environment wherein individuals have to travel less to reach opportunities. It has to be noted that this influence on mobility is only relevant for relatively large areas. In smaller areas this influence will be less relevant, because a greater part of opportunities will be outside of the dense area. The level of mixed land-use relates to the mixing of different opportunities within a certain area. Again, a higher level of mixed land-use can provide an environment wherein individuals have to travel less to reach opportunities (van Wee, 2002).

Neighbourhood design is relates to the lowest scale of land use, for instance the dwelling and its direct vicinity. Although this characteristic is studied less in the literature, it is significant for mobility. For instance, the availability of cycling lanes and sidewalks can provide an environment wherein individuals can use slow modes. In addition to infrastructure and opportunities, architecture can provide an attractive environment.

[1] Geurs & Van Wee (2004) use the model to analyze accessibility in evaluations of land-use and transport strategies. Although this research does not evaluate these strategies, the model is suitable to obtain insight in the concept of accessibility.

[2] The characteristic 'distance to railway connections' is broadened to 'distance to public transport connections' in the work of Van Wee (2002).

Distance to public transport connections obviously affects mobility. A lower distance to public transport connections can provide an environment wherein individuals can more easily make use of public transport (van Wee, 2002).

The transport component consists of the transport system. The transport system allows individuals to reach the opportunities they choose to participate in. Comparable to the landuse system, the transport system is defined by three elements, which are "the disutility for an individual to cover the distance between an origin and a destination", "supply of infrastructure" and "demand for infrastructure" (Geurs & van Wee, 2004: 128). Again, other authors (van Acker & Witlox, 2005; Geurs & Ritsema van Eck, 2001) define the land-use system with three similar elements. As with the land-use system, the element relating to supply is relevant for this research, given the focus on the physical design of the mobility system.

The influence of the element relating to supply can be further specified. Geurs & Ritsema van Eck (2001) propose three basic components of the transport system that influence accessibility. These components are time, cost and effort. The component time includes pre-transport time, transport time (including congestion time, parking time) and post-transport time. The component costs includes fixed costs, operational costs (for instance fuel, parking, road-pricing) and maintenance costs. The component effort includes issues as level of comfort, physical effort, reliability, stress, accident risk, social safety, information and status (Geurs & Ritsema van Eck, 2001).

Together, the three components indicate the resistance individuals face when travelling between an origin and destination. Understandably, these three components are perceived differently on the individual level. For every mode of transport, the three components differ. Geurs & Ritsema van Eck (2001) make a distinction between car, public transport, and bicycle and walking. Obviously, these three components can also be used for other modes of transport. Thus, for every mode of transport, the three components can be filled in distinctively[3].

Concluding, the physical design of the mobility system can be defined by a combination of the land-use system and the transport system. For the land-use system, density, mixed landuse, neighbourhood design and distance to transport connections are relevant for accessibility. For the transport system, the components time, cost and effort are relevant for accessibility.

2.2 Gerontology

The distinction between the third and fourth age

Baltes & Smith (2003) propose that aging of human beings is marked by two periods; the so-called third and fourth age. They argue that the third age is characterized by demonstrations of gains. Evidence shows that older adults can be more valuable in effective and productive terms than current society allows for. In order to improve this,

[3] For instance, van Wee & Annema (2009) argue that for public transport, the effort component includes comfort, physical strain, reliability, information, social safety, image and accessibility for disabled people. For walking, the effort component includes comfort, physical strain, social safety and weather influences.

science and policy should address opportunities from different disciplines. Contrary to the third age, the fourth age is characterized by demonstrations of losses. Evidence shows that the group of older adults in the fourth age, often suffer from dysfunction. Improving functions is possible in this age, though the chances to do so decline.

The concept of successful aging

Rowe & Kahn (1997) argue that in gerontology, it has been a trend to only stress the distinction between older people with diseases or disabilities, and older people without any of these. Gerontologists refer to them as pathologic and non-pathologic. Rowe & Kahn (1997) propose another distinction within the non-pathological group; the distinction between usual and successful aging. Moreover, they propose a conceptual model for the concept of successful aging. Successful aging is defined as a combination of three dimensions: *"low probability of disease and disease-related disability, high cognitive and functional capacity, and active engagement with life"* (Rowe & Kahn, 1997: 433), hereafter referred to as 'risk', 'capacity' and 'engagement'. Separately, these three dimensions are all important for older adults. However, true successful aging consists of a combination of these three dimensions.

It is argued that the dimensions are hierarchical, at least to a certain extent. This means that low risk is partly a condition for capacity. Subsequently, capacity is partly a condition for engagement (Rowe & Kahn, 1997). Rowe & Kahn (1997) argue that several of the factors underlying the three dimensions can be adapted. This adaptation can be done by individuals themselves, or by the environment they live in. By adapting the three dimensions, successful aging of older adults can be influenced.

As Strawbridge et al. (1996) argue, indicating an objective measurement for successful aging is problematic. Reason for this is that individual older adults perceive criteria for successful aging differently, which makes them rather subjective. Thus, when studying the role mobility plays in successful aging, one should consider that there can only be indicated how mobility can contribute to successful old age.

The role of mobility in successful aging

A clear distinction should be made between the role mobility plays in successful aging, and influences from the mobility system on successful aging. The role mobility plays in successful aging indicates why mobility is specifically relevant for the different dimensions of successful aging. Influences from the mobility system indicate how the mobility system has influence on the different dimensions of successful aging.

With use of the literature, no specific role of mobility can be identified in the first and second dimension. The role mobility plays in the third dimension, engagement, deserves a more elaborate discussion here. The precise role mobility plays in engagement is rather complicated (Mollenkopf, 1997). Metz (1999) depicts that before considering interventions aimed at improving older adults' mobility, the contribution of mobility to older adults' life has to be clarified. Metz (1999) proposes a framework that includes elements of mobility that are related to older adults' experience. Four of these elements can be These are (1) the ability to access social relations, (2) the ability to participate in social activities, (3) the ability to access services and facilities and (4) the ability to travel and go sightseeing.

2.3 Comprehensive framework

The first dimension of successful aging, risk, is influenced by safety issues, as it includes the risk of disease and disability. Safety issues are covered by the effort component from the transport system. Two types of safety issues can be distinguished, road safety and social safety (Van Wee & Annema, 2009).

The second dimension of successful aging, capacity, is influenced by the degree to which a mobility system challenges the cognitive and functional capacity of older adults. Again, this can be related to the effort component from the transport system. Several issues are relevant for this dimension of successful aging. These are the level of cognitive strain, physical strain, stress, required exercise and overall comfort (Van Wee & Annema, 2009). Together, these issues are summarized to usability issues.

The third dimension of successful aging, engagement, is influenced by the effort component from the transport system as well. Relevant issues here are reliability and information (Van Wee & Annema, 2009). These issues are summarized to quality issues. Apart from these issues related to effort, the component time and cost are both relevant here. Time and cost obviously influence the degree to which an individual older adult can be mobile. The land-use system influences this dimension of successful aging.

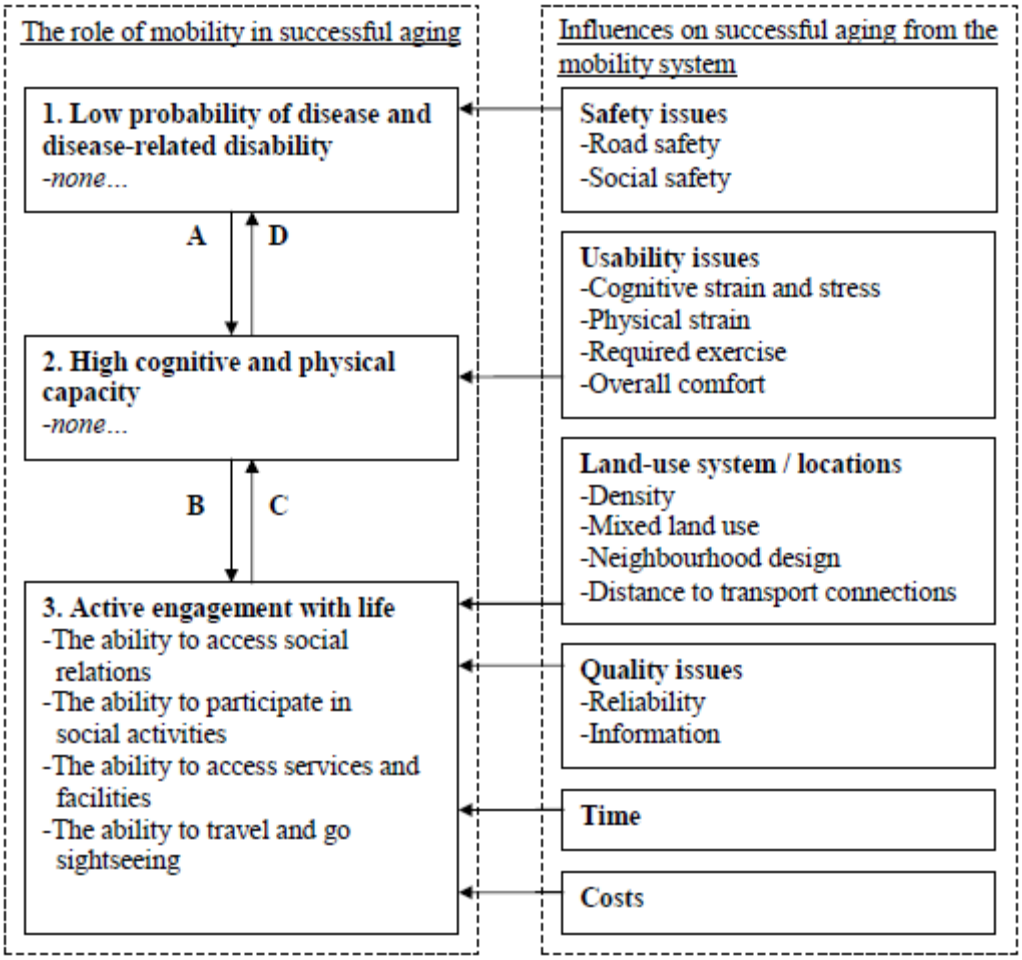

Figure A: Characteristics of, and influences on successful aging and mobility

3. Research design

3.1 Backcasting

The first, and perhaps main methodological issue of this research is that it does not focus on historical development, but on future development. Within the field of future studies, the two main approaches can be identified. These are forecasting and backcasting. Where forecasting focuses on the most likely future, backcasting focuses on the most desirable future. Backcasting can be considered as an approach, valuable in terms of exploration (Dreborg, 1996). The main goal of backcasting is to *"…providing policy maker and an interested general public with images of the future as a background for opinion forming and decisions"* (Dreborg, 1996: 813).

For backcasting, five different stages are defined: *"Strategic problem orientation", "Construction of sustainable future visions or scenarios", "Backcasting", "Elaborating, analysis and defining follow-up and (action) agenda" and "Embedding of results and generating follow-up and implementation"* (Quist & Vergragt, 2006: 1033). This research is limited to the first and second stage. Quist & Vergragt (2006) state that the first stage if formed by *"…setting the normative assumptions and goals…"* (Quist & Vergragt, 2006: 1033). These normative assumptions are typically defined by the involved stakeholders.

3.2 Interviews

Throughout this research, the first stage, strategic problem orientation, is executed by interviewing stakeholders. As interviewing is a targeted and insightful method of data collection, it is considered to be a suitable method here, given the limited time for this research. The interviews provide insight in the normative options for (desired) future contributions from the mobility system on the wellbeing of older adults. The interviewees are all individuals from organizations that already have some kind of experience with the subject aging and mobility.

Four different societal groups relevant for backcasting are indicated. These groups are firms, research institutes, government, and interest groups (Quist & Vergragt, 2006). Correspondingly, two, ten, six and four people from these groups are interviewed for this research.

3.3 Scenario development

The second stage in backcasting is the construction of scenarios. The most important findings from the interviews are reported and checked by the interviewees, as described. The reports form the actual data used as input for scenario development. The reports are analyzed by means of computer assisted qualitative data analysis, resulting in concepts. The development of scenarios, is based on the work of Hofmann et al. (2007). The concepts from the qualitative data analysis (which are all important factors of influence on structural change) are the trends and drivers that form the starting point of the scenario analysis.

Concepts that cannot be influenced (as they are not the subject of policy here, give the scope of this research), are the **trends**. These trends are considered to be constant developments. The concepts from the qualitative data analysis that can be influenced are the **drivers**. These drivers are considered to be inconstant, as they are the subject of policy.

Trends that are thematically related to each other in terms of future development are bundled into **trend-like dynamics**. Logically these trend-like dynamics cannot be influenced in this research. Therefore, the trend-like dynamics provide the background wherein the different scenarios exist. Drivers that are thematically related to each other in terms of future development are bundled as well, into **dynamics**. Thus, dynamics are aggregations of drivers, which are thematically related to each other, as their future development is correlated. In contradiction to trend-like dynamics, dynamics can be influenced in this research. The dynamics provide the building blocks for the scenarios. The two dynamics that have the biggest impact on structural change of the mobility system, are the **core dynamics**.

The core dynamics present the key dimensions of the scenarios. With use of these key dimensions, four scenarios are identified. To the core dynamics, specific for a scenario, other – logically related- dynamics are added, in order to create consistent images of the future. However, not all dynamics can be logically related to the scenarios. These dynamics are so-called **wild cards**, which are presented separately.

4. Results and analysis

By following the steps described in the methodology, several results are produced (i.e. trend-like dynamics, core dynamics, dynamics and wild cards). To start with, the trend-like dynamics are presented. Hereafter, the core dynamics are presented. As the core dynamics are the key dimensions for the design of mobility systems, they are used to identify four different scenarios.

Hereafter, every scenario is presented separately. First, a description of the scenario, consisting of core dynamics and (logically related) dynamics, is presented. Second, the scenario specific results for every dimension of successful aging are presented, by relating the dynamics to the theoretical framework. A wild card is presented as well.

4.1 Trend-like dynamics

The trend-like dynamics are aggregations of trends (i.e. concepts that are not subject to policy, given the scope of this research), which are thematically related to each other. Since the trend-like dynamics cannot be influenced in this research, they present the background (or context) wherein all scenarios exist.

The first trend-like dynamic is formed by the **general characteristics of older adults**. In 2035, several characteristics of older adults have changed. On average, future older adults have a higher level of education. Older adults are expected to be less willing to compromise. On average, older adults are used to a higher level of mobility. Differences in financial status of older adults will have been increased. The spatial environment

wherein older adults will travel will has been increased, as older adults will travel further (to other countries, etc.). Furthermore, in 2035, older adults who share interests tend to visit or meet each other. However, this does not imply that future older adults who share interests per definition live near each other. Moreover, the children of older adults probably live increasingly further away. A reason to access social relations is personal care to social relations. A part of the group of older adults has children that give care to them. However, (third age) older adults themselves give a significant amount of care to other social relations.

The second trend-like dynamic is formed by **the spatial characteristics of the Netherlands**. In 2035, the spatial characteristics of the Netherlands have changed. In general, the Netherlands is densely populated. However, the distribution of the population has changed. A distinction should be considered between urban areas and rural areas. In several provinces of the Netherlands, the population of urban and rural areas has increased. However, within several provinces, the population of the rural areas has decreased. Finally, there are several provinces wherein the population in both the urban and rural areas have been decreased (for instance the province Limburg).

4.2 Core dynamics

The core dynamics are the two dynamics that have the biggest impact on structural change of the mobility system. Consequently, the core dynamics present the two key dimensions for future mobility systems. With use of the key dimensions, four different scenarios are identified.

The first core-dynamic relates to the design of the future land-use system, or more specifically, **the dwelling situation of future older adults**. The dwelling situation of future older adults is expected to have a strong influence on the whole structure of the future landuse system (and therefore on the entire mobility system). Whereas one group of interviewees argued that future older adults ideally live concentrated (i.e. concentrated living with older adults), another group of interviewees argued that future older adults ideally live dispersed.

The second core-dynamic relates to the design of the future transport system, or more specifically, the **different modes of transport** within the future transport system. The different modes of transport is expected to have a strong influence on the structure of the whole structure of the future transport system (and therefore, as above, on the entire mobility system). Whereas one group of interviewees argued that within the future transport system, there is only place for the car, another group of interviewees argued that ideally, more different modes of transport are included in the transport system.

Based on the two key dimensions (the core dynamics), four different scenarios are distinguished. Every scenarios represents another image of the future mobility system. As descried, in addition to the core dynamics, other dynamics can be logically related to the specific scenarios. By adding these dynamics, coherent images of future mobility systems are constructed.

4.3 Scenario 1 – Concentrated living, multimodal transport

Core dynamics

The first core dynamic **is concentrated living**. In this scenario, older adults prefer to live concentrated. In both urban and rural areas, older adults live near each other. The areas wherein older adults live differs in scale. Moreover, there is a difference in dwelling centres for relatively wealthy and poor older adults. Older adults are well informed on the consequences their dwelling situation has. When choosing a specific dwelling, older adults take the available services and facilities into account. In several cases, older adults' dwelling and care is combined into residential care centres.

The second core dynamic is **multimodal transport**. Multiple modes of transport that are available for older adults, resulting in a multimodal transport system. These include both private and public modes of transport. Typically, private transport plays the most important role in mobility in the direct neighbourhood of older adults. the mobility of older adults is facilitated, by considering the whole chain of mobility. The links in the mobility chain are formed by different modes of transport. For travelling over longer distances, public transport is a link in the mobility chain that older adults are willing to use. By supplying public transport options that are suitable for older adults as well, the trend of increasing use of demand responsive transport has come to an end.

Other dynamics

The dynamics (i.e. thematically related aggregations of drivers, that can be influenced given the scope of this research) that can be logically related to this scenario are:

- Reconsideration of the place of modalities in the transport system
- Separation of traffic flows
- Examination of abilities and support
- Protection of neighbourhoods
- Supervision in public transport
- Differentiation of reference for infrastructural design
- Physical accessibility of the mobility chain
- Education of the mobility chain
- Concentration of services and facilities
- Optimization of neighbourhood design
- Supply of dedicated transport options
- Comfort of the mobility chain
- Reliability of the mobility chain
- Maximization of flexibility in terms of time
- Maximization of flexibility in terms of costs

By enhancing the dynamics, a contribution can be made to successful aging. Figure B shows to which particular dimension a contribution is made.

4.4 Scenario 2 – Dispersed living, car-dependent transport

Core dynamics
The first core dynamic is **dispersed living**. In this scenario, older adults prefer to live dispersed, for several reasons. The dwelling situation of third age older adults is classically determined by other factors than age-related factors. Consequently, there are no concentrations of individuals that belong to the same age group. Moreover, older adults typically prefer to live dispersed, as they prefer to live among other people than only older adults.

The second core dynamic is **car-dependent transport**. Only the car is available for mobility, resulting in car-dependent transport. The trend of increasing car use by older adults has continued. As a result more older adults drive a car than before. An important reason to use a car instead of other modes of transport is that the car provides individual mobility. Older adults are more used to travelling with the car and have the wish to continue this as they age.

Other dynamics
The dynamics (i.e. thematically related aggregations of drivers, that can be influenced given the scope of this research) that can be logically related to this scenario are:

- Optimization of distributor roads
- Examination of driving abilities
- Reconsideration of reference for infrastructural design
- Implementation of Advanced Driving Assistance Systems (ADAS)
- Education of traffic rules
- Dispersion of services and facilities
- Online services and facilities
- Age resistant neighbourhoods
- Demand responsive transport
- Time restrictions
- Cost restrictions

As indicated earlier, by enhancing the dynamics, a contribution can be made to successful aging. Figure B shows to which particular dimension a contribution is made.

4.5 Scenario 3 – Concentrated living, car-dependent transport

Short scenario description
This scenario is based on concentrated living and car-dependent transport. This scenario includes a mix of dynamics presented in the first and second scenario. The dynamics that form describe this scenario are optimization of distributor roads, examination of driving abilities, protection of neighbourhoods, differentiation of reference for infrastructural design, implementation of ADAS technologies, education of traffic rules, concentration of services and facilities, optimization of neighbourhood design, dedicated transport options, demand responsive transport, time restrictions and cost restrictions.

4.6 Scenario 4 – Dispersed living, multimodal transport

Short scenario description

This scenario is based on dispersed living and multimodal transport. This scenario includes a mix of dynamics presented in the first and second scenario. The dynamics that describe this scenario are: reconsideration of the place of modalities in the transport system, separation of traffic flows, examination of abilities and support, supervision in public transport, reconsideration of reference for infrastructural design, physical accessibility of the mobility chain, education of the mobility chain, dispersion of services and facilities, online services and facilities, age resistant neighbourhoods, comfort of the mobility chain, reliability of the mobility chain, maximization of flexibility in terms of time and maximization of flexibility in terms of costs.

4.7 Results for successful aging

For every scenario, figure B shows to which particular dimension of successful aging the drivers can contribute.

Scenarios / Dimensions successful aging	**Scenario 1:** Concentrated living, multimodal transport	**Scenario 2:** Dispersed living, car-dependent transport	**Scenario 3:** Concentrated living, car-dependent transport	**Scenario 4:** Dispersed living, multimodal transport
Risk	-reconsideration of the place of modalities in the transport system -separation of traffic flows -examination of abilities and support -protection of neighbourhoods -supervision in public transport	-optimization of distributor roads -examination of driving abilities	-optimization of distributor roads -examination of driving abilities -protection of neighbourhoods	-reconsideration of the place of modalities in the transport system -separation of traffic flows -examination of abilities and support -supervision in public transport
Capacity (the individual perception of…)	-differentiation of reference for infrastructural design -physical accessibility of the mobility chain -education of the mobility chain	-reconsideration of reference for infrastructural design -implementation of ADAS technologies -education of traffic rules	-differentiation of reference for infrastructural design -implementation of ADAS technologies -education of traffic rules	-reconsideration of reference for infrastructural design -physical accessibility of the mobility chain -education of the mobility chain
Engagement	-concentration of services and facilities -optimization of neighbourhood design -dedicated transport options -comfort of the mobility chain -reliability of the mobility chain -maximization of flexibility in terms of time -maximization of flexibility in terms of costs	-dispersion of services and facilities -online services and facilities -age resistant neighbourhoods -demand responsive transport -time restrictions -cost restrictions	-concentration of services and facilities -optimization of neighbourhood design -dedicated transport options -demand responsive transport -time restrictions -cost restrictions	-dispersion of services and facilities -online services and facilities -age resistant neighbourhoods -comfort of the mobility chain -reliability of the mobility chain -maximization of flexibility in terms of time -maximization of flexibility in terms of costs

Figure B: Results for successful aging

4.7 Wild card

One dynamic cannot be related to the scenarios. This so-called wild card is **individualization**. The future development of the social phenomenon of individualization is rather uncertain, based on the findings from the interviews. Several interviewees argued that the Dutch society is further individualized and ‘hardened’ in 2035. However, several other interviewees argued that the current trend of individualization in the Dutch society has come to an end in 2035.

5. Conclusions

Throughout the theoretical framework, it is argued that mobility plays a role in the third dimension of successful aging (active engagement with life). Based on other theories, four different roles of mobility are identified. These are the ability to access social relations, access social activities, access services and facilities, and to travel and go sightseeing.

Furthermore, throughout the theoretical framework, it is argued that the mobility system influences the dimensions of successful aging. The first dimension of successful aging is influenced by safety issues, including both road safety and social safety. The second dimension of successful aging is influenced by usability issues, including cognitive strain and stress, physical strain, required exercise and comfort. It has to be noted that usability issues do not influence the second dimension in absolute terms. However, usability issues influence older adults' perception of the second dimension. The third dimension of successful aging is influenced by the land-use system including the dwelling situation of older adults, the availability of services and facilities, neighbourhood design and transport options. Furthermore, this dimension is influenced by quality issues, including reliability and information. Moreover, time and costs present an influence on this dimension.

Four different future scenarios are identified during the research, based on two key dimensions (core dynamics). The first key dimension relates to the design of the land-use system. This is the dwelling situation of older adults, which can be concentrated, or dispersed. The second key dimension relates to the design of the transport system. This dimension is formed by the different available modes of transport. A distinction is made between a transport system that is dependent on the car, and a multimodal transport system.

The scenario analysis shows that different combinations of these most important influences on structural change provide different possibilities to contribute successful aging. Moreover, these scenarios all have other results for successful aging. The scenarios give valuable insight, especially on the dimension 'active engagement with life'. The influence of land-use system and the transport system cannot be perceived separate from each other. In general, the four scenarios show that successful aging (and in particular engagement) is influenced by both the land-use and the transport system. For instance, in the two scenarios based on concentrated living, successful aging is less dependent on the transport system. Likewise, in the two scenarios based on dispersed living, successful aging is more dependent on the transport system.

It is not considered to be likely that all older adults live concentrated in 2035, or that all older adults live dispersed. Thus, the future mobility system is expected to be a mix of different presented scenarios. Dependent on the dwelling situation of older adults (concentrated, or dispersed) contributions to the mobility system can be made, in order to facilitate successful aging, as described in the first and second scenario. Several issues prove to be relevant for all scenarios.

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