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Successful aging: Individual and societal challenges (?)



Inaugural address delivered by
Prof. dr. Y. Brehmer

Yvonne Brehmer (1977) is full professor for Successful Aging in the Department of Developmental Psychology at Tilburg University since September 2018.

She studied Psychology at Saarland University, Germany. She completed her PhD entitled “Episodic Memory Plasticity Across the Lifespan” at Max Planck Institute for Human Development (MPI) in Berlin, Germany in 2006. After her post-doctoral work at the Aging Research Center (ARC), Karolinska Institutet, Stockholm, Sweden, Yvonne established her own independent research group (Otto Hahn Research Group on Associative Memory in Old Age) at the MPI in Berlin in late 2012. This group was physically located at ARC and continued work until April 2018. From September 2017, Yvonne worked as senior lecturer focusing on the psychology of aging at Gothenburg University, Sweden, before she started her new position at Tilburg University.

Yvonne is a cognitive lifespan developmental psychologist with a strong interest in the modifiability and plasticity of cognitive development and aging, memory training across the lifespan, finding behavioral as well as neural brain correlates of inter-individual differences in memory functioning and how inter-individual differences in memory functioning are linked to successful aging.



SUCCESSFUL AGING: INDIVIDUAL AND SOCIETAL CHALLENGES (?)

Prof. dr. Yvonne Brehmer

Inaugural address

delivered in adapted form at the occasion of her inauguration as professor of Successful Aging at the Department of Developmental Psychology at the School of Social and Behavioral Sciences at Tilburg University on 13th of September 2019 by Prof. Dr. Y. Brehmer.

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Preface

Rector Magnificus,
Dean,
Colleagues, family and friends,
Ladies and gentlemen,

I am honored to have been appointed professor of Successful Aging at the Department of Developmental Psychology at the School of Social and Behavioral Sciences at Tilburg University, where I started working almost exactly one year ago. A professorship on aging from a lifespan perspective is a perfect match with my research background and interests. As you probably know, I am a cognitive lifespan developmental psychologist with a strong interest in the modifiability and plasticity of cognitive development and aging. My previous research focused on the trainability of memory functions in children, and younger and older adults, and the examination of factors accounting for inter-individual differences in memory functioning and neural correlates of age-related memory changes. However, the vacancy text was more specific: It said “Professorship of Successful Aging” from a lifespan perspective. In the job interview, I mentioned that “successful aging” is a challenging term and that the scientific community does not yet agree on one universally accepted definition; indeed, it sometimes even criticizes the use of the term. However, as you see, Tilburg University was not too impressed by my resistance to the term and hired me as “Professor of Successful Aging”. At the same time, my objections were clearly not so great as to prevent me from gladly accepting the position.

In my presentation today, I plan to provide you with my current view on successful aging and how my previous and planned research is related to it. So far, my research has mainly focused on basic experimental memory research, which includes age-comparative studies with healthy older adults. My aim in accepting the position at Tilburg University was to broaden my research focus, which will also be reflected in my presentation today. The main issues I would like to raise and discuss today are: What is successful aging? How can successful aging be reached by each and every individual? How much is aging successfully a challenge for the individual and/or society?

Why Study Aging?

Why Study Aging? Old age is normally defined by chronological age starting around 65 years of age and older. Before talking about successful aging, I would like to ask: Why should psychologists study aging or older adults at all? Why is aging not only an interesting research topic but also relevant – from both the individual and the societal perspective?

The not-so-bright side of aging

First of all, life expectancy (i.e., mean lifetime) is increasing. More specifically, people are getting older on average (e.g., World Report on Ageing and Health, 2015). This is actually positive news in general as fewer people die through avoidable circumstances such as poor health, nutrition, or hygiene. However, due to lower birthrates, societies are aging worldwide. Figure 1 represents an illustration of the population distribution in 25 European countries from 1950 to 2050. The relative proportion of older adults has increased in the last 70 years from about 22 percent to 40 percent and will increase even further in the next 30 years. In particular, the group of individuals aged 80 and older is increasing over time. At the same time the relative proportion of children, and younger and middle-aged adults, is steadily decreasing. This development leads to societal challenges such as the allocation of finance (e.g. increase in the costs of pension entitlements).

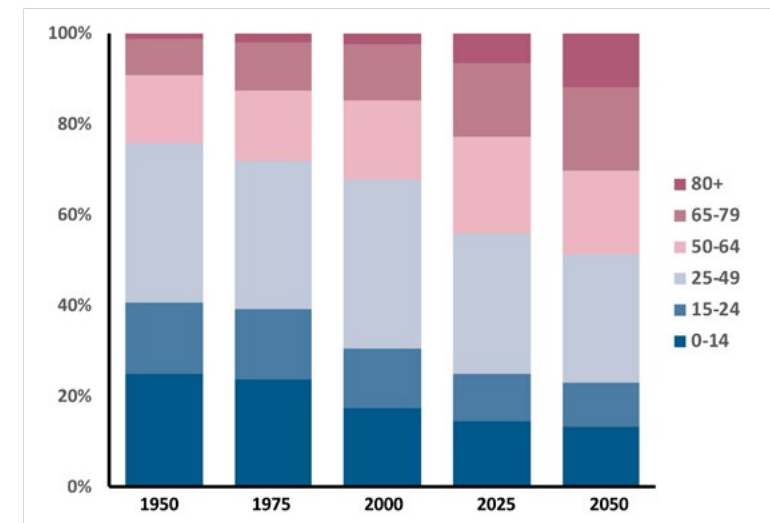


Figure 1. Population distribution in EU25 by age group (1950-2050). Based on UN World Population Prospects (2002 Revision) and Eurostat 2004 Demographic Projections (Baseline scenario).

Second, aging is the strongest risk factor for multimorbidity, which is defined as the simultaneous presence of two or more chronic diseases (Calderón-Larraña et al., 2017;

Diederichs, Berger, & Bartels, 2011) and many neurodegenerative disorders, the most prominent one being dementia (e.g., Larson, Yaffe, & Langa, 2013). Figure 2 represents the percentage distribution of a number of chronic disease categories by sex and age group, based on all available data from the Swedish National Study of Aging and Care in Kungsholmen (SNAC-K; N = 3,363 older adults) and inpatient data from the National Swedish Patient Register. According to this data set, only 3.2 percent of participants were free from any of the 60 pre-defined disease categories (e.g., ischemic heart diseases, dementia, hypertension, heart failure, Parkinson's disease) while 88.6 percent were identified having at least two, 73.2 percent having at least three and 55.8 percent having 4 or more chronic diseases. In both men and women, the number of chronic diseases increased with age. Importantly, more than 30 percent of the older adults aged 90 years and older experienced seven or more chronic diseases (see Barnett et al., 2012 for similar findings in a large-scale Scottish data set; Calderón-Larrañaga et al., 2017).

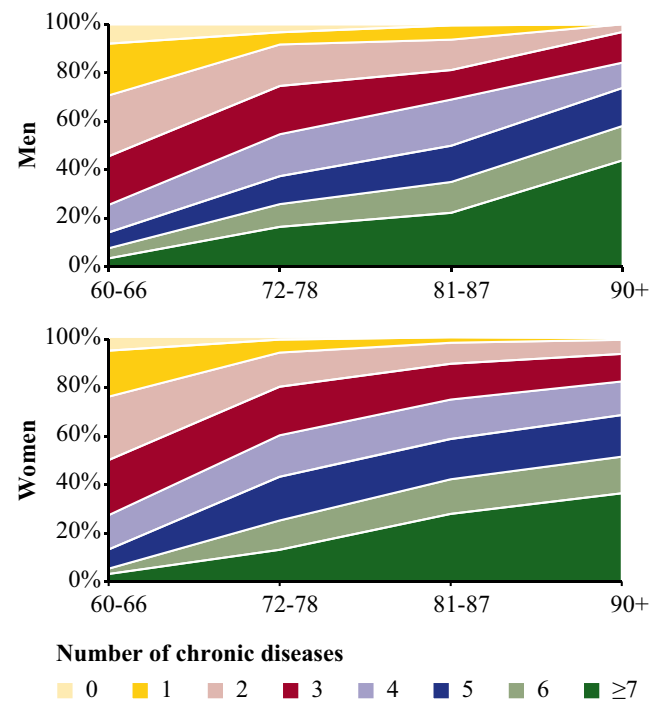


Figure 2. Percent distribution of number of chronic disease categories by sex and age group considering all available data sources (N = 3,363). Swedish National study of Aging and Care in Kungsholmen (SNAC-K) data and inpatient data from the National Patient Register (Adopted from Calderón-Larrañaga et al., 2017).

Multimorbidity affects older adults' everyday functioning and social life, their independence and autonomy, well-being and life satisfaction. At the same time, these diseases are linked to huge societal costs for formal and informal care (Onder et al., 2015) and hence impact not only the older people affected, their relatives and primary care givers, but society as a whole. In addition to multimorbidity and pathological aspects linked to old age, even normative aging processes are typically accompanied by cognitive decline (Rönnlund, Nyberg, Bäckman, & Nilsson, 2005) and physical restrictions (Amarya, Singh, & Sabharwal, 2018).

The arguments I have presented so far portray old age in the light of major health-related losses and diseases, including physical and mental decline. In addition, old age is linked to major challenges in social and personal aspects, such as major life transitions (e.g., retirement), last opportunities due to length of life limitations, confrontation with one's own mortality, loss of loved ones, loss of independence, loss of purpose, loneliness, and financial restrictions. This might leave you with the impression that it is actually not very enjoyable studying old age as it is so negative, with aging being solely linked to individual losses and societal costs. However, these age-related challenges are only one side of the coin and we need to view older adults in a more holistic manner.

The way we perceive older adults can only be understood in the historical context of our western countries, which is influenced by industrial capitalism, "where human value became equated with productivity and, at the same time, retirement was institutionalized as a symbol of non-productivity" (M. M. Baltes & Carstensen, 1996, p. 400). This negative view on aging was then reinforced by research focusing on decline and losses, as I mention above, even suggesting that aging should be classified as a disease (Nieuwenhuis-Mark, 2011, for an opinion paper). We often speak about older adults in a stereotypic and negative way, and rate the process of aging as universal and homogenous, neglecting the multidimensionality and multi-directionality of the aging process and the variability among older adults (see ageism for example in Ayalon & Tesch-Römer, 2018; see also P. B. Baltes, Lindenberger, & Staudinger, 2007).

That older adults are perceived differently and that different stereotypes about old age exist in different societies and cultures is nicely illustrated by an anecdote of a colleague of mine, Håkan Fischer, from Karolinska Institute in Stockholm, who was traveling in Ghana 20 years ago and got into contact with local inhabitants. They told him that Europe is a great continent. They had heard that older adults do live less often with their primary families but move to special places (referring to nursing homes). They found this very smart, as if a problem or conflict arises, there is no need to walk around and get seniors of the community together; instead one could simply go to the place where all their expertise and wisdom is concentrated to support society and solve conflicts.

We might smile now, as this is probably not our first association with nursing homes and it might not be what nursing homes in our societies are used for. However, reflecting on our view of nursing homes might also be informative about the current standing of older adults in our western society, especially in situations where they are fragile and no longer “productive”.

The bright side of aging

Importantly, research on older adults more often highlights their cognitive, psychological and social potential. One line of my previous research concerns the ability of older adults to improve memory performance through instruction and training (e.g., memory plasticity; Brehmer, Kalpouzos, Wenger, & Lövdén, 2014). I found that older adults in general can improve their memory performance after instruction and training in memory strategies that support the learning and remembering of information (Brehmer, Li, Muller, von Oertzen, & Lindenberger, 2007; Brehmer et al., 2008; Brehmer, Shing, Heekeren, Lindenberger, & Backman, 2016; Lövdén, Brehmer, Li, & Lindenberger, 2012). In addition, older adults gained from process-based interventions, where individuals practice the same tasks repeatedly without specific instruction on how to perform the tasks (e.g., Brehmer et al., 2011; Brehmer, Westerberg, & Bäckman, 2012). This indicates that old age is not only characterized by cognitive decline but that older adults also have the potential to learn new techniques and to improve their memory functioning through training.

In addition, research and society are getting more sensitive to the fact that “older adults” are not a homogenous group, but that the aging process needs to be viewed differentially. In general, different strengths and challenges are linked to a person aged 65 (young old) or 85 (old old). However, even among individuals of the same age, certain individuals are still cognitively and physical flexible and active, while others show early signs of cognitive and physical impairments. These inter-individual differences exist of course across the entire lifespan; however, they have been shown to be magnified in old age (Lindenberger, 2014).

I would like to provide you with one example of my own work that illustrates these large inter-individual differences among healthy (pathology-free) older adults. Much of my research has been conducted in the domain of episodic memory, which refers to the conscious remembrance of events situated in time and place (Tulving, 1972). I am specifically interested in a specific type of episodic memory, namely the memory for associations. Where did I place my keys? (i.e., association between an object and a location), did I take my medication this morning? (i.e., association between an object and a point in time), who is this person again? (i.e., association between two objects, a face and a name) for example. Episodic memory functioning declines in older age (Rönnlund et al., 2005) in general. But while older adults show no or only minor age-related reductions in memory for single items (e.g., faces, names), their

memory for associations (e.g., face-name pairs) is markedly reduced in comparison to younger adults (Chalfonte & Johnson, 1996; Naveh-Benjamin, 2000). Beyond the average pattern of age-related associative memory decline, individuals of the same age differ markedly in their memory performance.

In all my studies, huge inter-individual differences have been observed in memory functioning as well as in how much individuals gain from cognitive interventions (Brehmer et al., 2007; Lövdén et al., 2012). In a lifespan associative memory training study (Brehmer et al., 2016; Shing, Brehmer, Heekeren, Bäckman, & Lindenberger, 2016), individuals had to remember a certain amount of word pairs before and after training, in order to fulfill specific requirements for the analysis of functional brain imaging data. Hence, to be eligible for study participation, individuals had to be able to remember at least three out of ten unrelated word pairs. Older adults in particular had to be excluded from the study due to difficulties in meeting this criterion. In order to involve 38 individuals in the study, 111 were excluded, because they had problems remembering a sufficient number of word pairs. Interestingly, older individuals who were excluded, did not differ in any other assessed cognitive ability from those who were able to remember 3 out of 10 word pairs (i.e., memory for single items, vocabulary, working memory, processing speed, attention, creativity). These findings show that even among very healthy older adults (who fulfill the strict health requirements for being scanned in a magnetic resonance imaging scanner), older adults differ a lot in their memory functioning.

Apart from these cognitive examples, I would like to shift your attention to well-being and life satisfaction in older adults. Despite the challenges related to old age (see the negative side of aging), cross-sectional as well as longitudinal research shows an increase in well-being and life satisfaction in old age, a phenomenon called the “well-being paradox” (Netuveli & Blane, 2008). This means that even though older adults experience many losses, their well-being is often high. This increase in well-being seems to depend less on an increase in positive emotions and more on decrease in negative emotions. It has been shown that older adults experience less anger, less stress and worries, while happiness and enjoyment are relatively stable in comparison to other periods of the lifespan (e.g., Stone, Schwartz, Broderick, & Deaton, 2010). Empirical studies showed that this drastic reduction in negative emotions of older adults compared to younger adults was based on older adults moving out of negative emotional states faster, being less emotionally reactive to stressors, engaging less in destructive conflict strategies and finding tense interpersonal situations less stressful (Mather, 2012, for review).

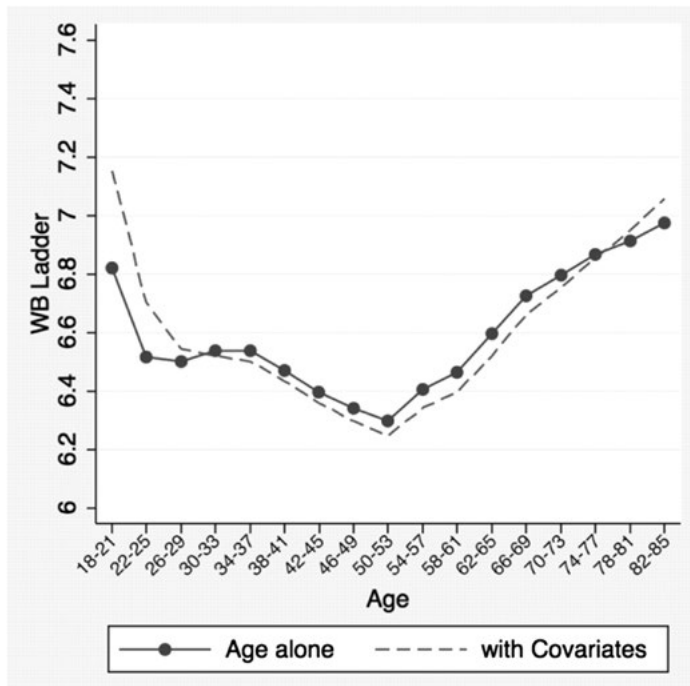


Figure 3. Global well-being ladder across adult life. Mean (unadjusted and adjusted) plotted by 4-year age groups (Adopted from Stone et al., 2010)

I hope you agree that (a) the fact that societies are aging worldwide and (b) the interaction between physical, mental and societal challenges and the ability to learn and to deal with these challenges makes this phase of the lifespan not only an interesting research topic but also a relevant one. For me, the huge between-person differences in how people age and deal with age-related challenges are of specific interest.

To illustrate this variance in the process of aging, I would like to share another anecdote with you. My husband and I regularly visited an old couple when we were living in Stockholm some years ago. Yngve was 94 years old, mentally and physically active, impressing us with his very active Yoga exercises, which we were not able to repeat. He was outgoing, had several hobbies, and had lived with his wife in the same apartment for over 50 years. Yngve was physically, mentally and socially high functioning. Herta, his wife, was a very sweet and friendly person, 92 years old, a bit fragile but able to walk and go out for lunch every day. However, she had severe dementia. She told me the same stories from the past over and over again; she was not connected to the present but traveling through time. Herta was completely dependent on her husband, not able to take care of herself anymore. However she was happy and accepted the situation

of not understanding her husband’s reasoning and behavior, trusting him and his decisions. Yngve and Herta – two exceptional people, similar considering their age and warmth, but very different in cognitive, physical and social capacities. Here the term “*success*” comes into play. We would no doubt agree that Yngve aged successfully. He is physically and mentally active and high functioning, socially integrated and satisfied with his life. However, what about Herta? Is physical or mental health a prerequisite for successful aging? Or a long life? Can a person who passes away at 70 be called a successful ager? What about a person who is cognitively and physically healthy but feels lonely and lacks purpose in life?

What is Successful Study Aging?

What is Successful Aging? When it comes to defining the term successful aging, there is no single, widely accepted definition. In addition, there are many other terms often used interchangeably such as active aging, healthy aging, positive aging, productive aging and competent aging. Baltes and Carstensen (1996) stated that ... “what successful aging means has *changed over historical times and will continue to vary along with changes in societal, cultural and biological norms*” (p. 399). Currently, over 100 different definitions and models of successful aging exist, which vary in several dimensions, for example (a) on the perspective (objective versus subjective), (b) the number of criteria included (single versus multiple), (c) the focus of the role of society and the individual and (d) whether successful aging is viewed as a process or an outcome. A systematic review of these models and the history of the conception over the past 70 years is beyond the scope of this presentation. However, I will briefly talk about several prominent views on successful aging to illustrate the complexity of consolidating the different positions into one holistic conception.

The term successful aging has developed on parallel paths, focusing either on mental states such as life satisfaction (i.e., psychosocial view) or on the avoidance or absence of disease and disability (i.e., the biomedical view; Glass, 2003). I will present both perspectives in the following as well as adding the layperson's perspective, which is an important complement to scientific theorizing.

Biomedical models of successful aging highlight optimization of life expectancy, while minimizing physical and mental disability and decline. The focus of these models is the absence of chronic diseases and risk factors for diseases, good health, and high levels of physical and cognitive functioning, mobility, and functional independence (Bowling & Dieppe, 2005).

The most prominent model is the MacArthur model from Rowe and Kahn (1987, 1997, 2015). The model was developed to account for the fact that the aging process is not homogeneously characterized by losses in all individuals, but that it is heterogeneous and differs across individuals. In the model, *usual aging* (i.e., non-pathological but at high risk) is characterized by normal (i.e., intrinsic, primarily genetic) age-related decline in physical, social and cognitive functioning. In contrast, *successful aging* (i.e., low risk and high function) is characterized by three factors: (a) the absence of disease and risk factors for disease, (b) the maintenance of physical and cognitive functioning, and (c) the active engagement with life, which includes relations with others and productive activities (see Fig. 4).

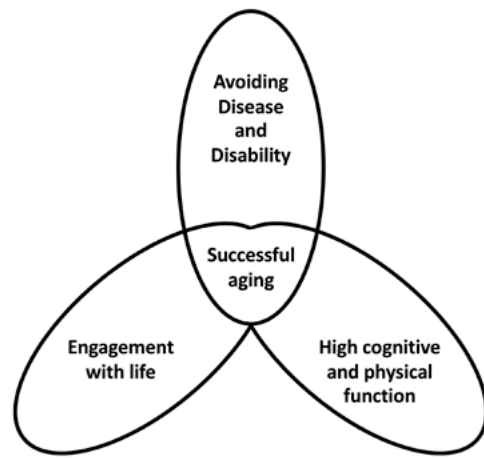


Figure 4. Mac Arthur Model of Successful Aging (based on Rowe & Kahn, 1997)

This model has been discussed and, importantly, also experimentally operationalized and tested. Critically, the model lacks a subjective component (i.e., subjective judgement of having aged successfully) and does not include social factors that influence the capacity of individuals to age successfully, such as socio-economic status and family structure, as well as economic conditions or access to high quality affordable health care. Hence, the model can easily stigmatize and discriminate individuals on factors that are not necessarily linked to old age but already existed earlier in life (e.g., Martinson & Berridge, 2015). In addition, the focus on physical and mental integrity lowers the model's validity in, for example, old-old adults (85 years and older). Here, chronic diseases and neurodegenerative disorders are so prominent (see Fig. 2) that it is hardly possible to find a person without physical or cognitive impairments (e.g., Martin et al., 2015), which would imply that almost no old-old person can be defined as successfully aged.

Psychosocial models of successful aging focus more on life satisfaction, social functioning and psychological resources. Bowling and Diepe (2005) summarize these components as follows: *Life satisfaction* includes zest, resolution and fortitude, happiness, relationships between desired and achieved goals, self-concept, morale, mood and overall wellbeing. *Social functioning* refers to social role functioning, positive interactions or relationships with others, social integration, and reciprocal participation in society. Finally, *psychological resources* include positive outlook and self-worth, self-efficacy or sense of control over life, and effective coping and adaptive strategies in the face of changing circumstances.

Some psychosocial models relate successful aging to adaptation. Adaptation defines the potential of individuals to actively adjust to age-related changes (e.g., Jopp & Smith, 2006; Jopp et al., 2015) and re-interpret and re-define the relative importance of specific aspects in life. In contrast to the biomedical models of successful aging, successful adaptation to health-related decline would allow a person to identify him/herself as successful ager (Tate, Lah, & Cuddy, 2003) despite severe mental or physical impairments.

Adaptation is also highlighted in lifespan psychology theory (e.g., P. B. Baltes, 1987; P. B. Baltes & Baltes, 1990; P. B. Baltes et al., 2007), where the focus is more on the process of how to age successfully and less on how to define successful aging as an outcome. In the light of lifespan development, which is characterized by reductions in general reserve capacity and losses in specific functions, age-graded adaptation is specified by three processes, namely selection, optimization, and compensation (SOC; see Fig. 5).

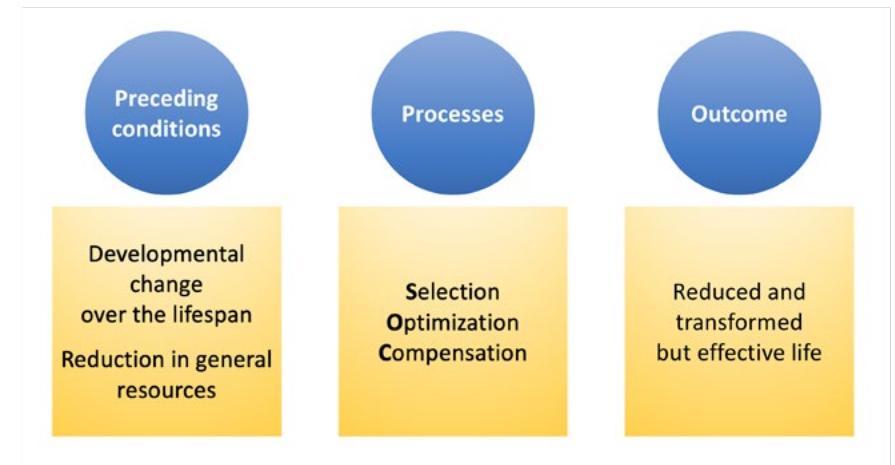


Figure 5. Model of Selective Optimization with Compensation (based on Baltes & Baltes, 1990)

Selection refers to the directionality of development including selection of alternative contexts, outcomes and goals. For example, an older person who was a passionate hill walker, but who might not be able to continue due to age-based physical limitations, might decide “to walk to the hills rather than up the hills” (Carpentieri, Elliott, Brett, & Deary, 2017, p. 355). *Optimization* refers to all means that support achieving desired outcomes and attaining higher levels of functioning, such as attention allocation, goal-directed practice, investment of time and effort and acquisition of new abilities and resources. An older person might become aware of age-related loss in physical stability and start exercising to counteract physical decline, even though

the person was not physically active earlier in his or her life. Finally, *compensation* refers to the activation or acquisition of new substitutive means for counteracting loss/decline in means that threatens maintenance of a given level of functioning. These means include exchange of performance tools, mobilization of unused or new abilities, extra use of time and effort (more practice), and use of external help (other individuals or prostheses). A person who lives independently but cannot manage to prepare meals herself or himself anymore after a stroke might decide to stop cooking but start using home delivery services.

According to the SOC model, actively applying these adaptive processes leads to a reduced and transformed but effective life where gains are maximized, losses minimized and functions, when possible, maintained and losses regulated (P. B. Baltes & Baltes, 1990).

However, huge inter-individual differences exist here too, and obviously some older adults can adjust more easily to age-related changes than others. The term resilience (see also resistance or reserve) has been introduced to explain individual differences in susceptibility to cognitive or functional impairments in the presence of age or disease-related brain changes (Stern, 2002; Stern, Gazes, Razlighi, Steffener, & Habeck, 2018). More specifically, why do some people maintain high levels of mental and functional integrity in old age, while others show severe age-related decline? In addition to biological and genetic differences, several psychological, social and environmental resources have been linked to high functioning in old age. These factors include psychological resources (e.g., positive outlook and self-worth, self-efficacy or a sense of control over life), social functioning (e.g., positive interactions or relations with others, social integration and reciprocal participation in society). In addition, life exposures such as education and occupational attainment have been linked to higher resilience and hence higher levels of successful aging (Harada, Natelson Love, & Triebel, 2013).

Finally, scientific theorizing needs to reflect and be linked to reality to have societal impact and relevance. The **lay perspective** is normally assessed with qualitative interviews or structured questionnaires. When older individuals are asked about their view on successful aging, their understanding is normally very broad, and the relative importance of different aspects is sample specific. Themes that are often included are mental, psychological, physical and social health, life satisfaction, having a sense of purpose, financial security, learning new things, accomplishments, physical appearance, productivity, contribution to life, sense of humor and spirituality (Phelan, Anderson, Lacrois, & Larson, 2004).

Who is classified as successful ager and who is not varies a lot, depending on the perspective and model applied. I would like to illustrate this point by presenting a

study conducted by colleagues from the VU and Leiden university (von Faber et al., 2001). In this study, almost 600 adults aged 85 years and older from the Longitudinal Leiden 85-plus study have been classified according to the MacArthur model of successful aging, which was extended by a subjective well-being dimension. In comparison, a classification system was established based on qualitative interviews, where 27 older adults were asked what is relevant in order to age successfully.

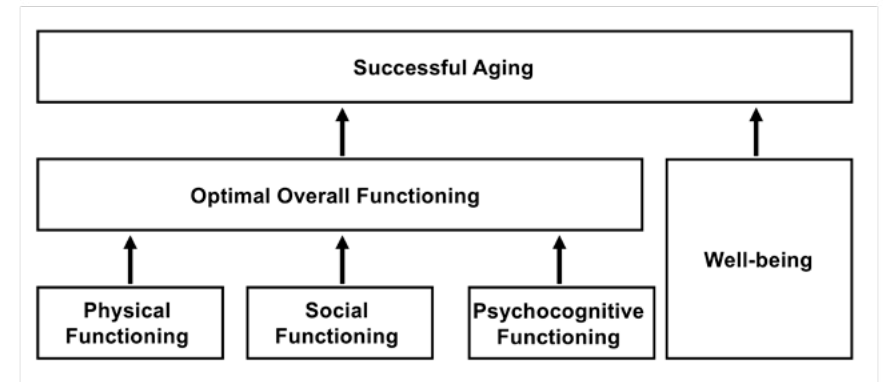


Figure 6a. Quantitative model of successful aging, (based on von Faber et al., 2001).

Figure 6 presents the two different approaches used in this study. The quantitative model is an extended MacArthur model, which differentiates between optimal overall functioning (based on the three MacArthur components) and subjective well-being to define successful aging (Fig. 6a). From the 600 people involved in this study, only 45 percent could be classified having optimal well-being. 13 percent had optimal overall functioning and only 10 percent could be classified as successfully aged.

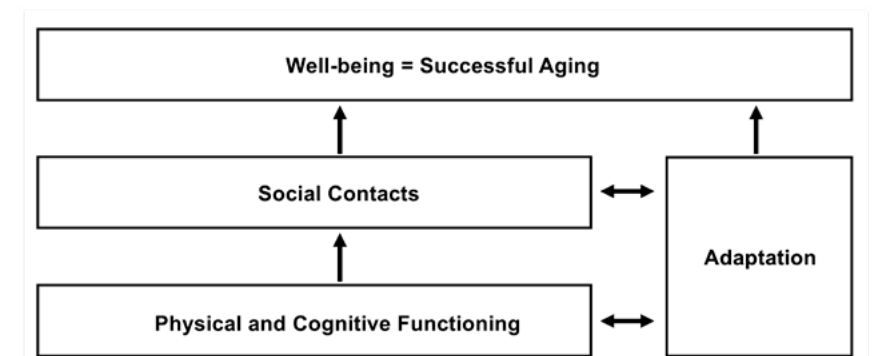


Figure 6b. Qualitative model of successful aging, (based on von Faber et al., 2001).

In contrast, the qualitative model (Fig. 6b) shows that when asking older adults directly, physical and cognitive functioning was a prerequisite for social contacts, which was again relevant for well-being. Well-being was the indicator for aging successfully, in older adults' view. Importantly, older adults considered success as a process of adaptation to age-related changes instead of a state of being. According to the lay perspective, almost all individuals of the sample should be scored as successfully aged.

This discrepancy between how many people can (should) be classified as successful agers varies not only in this study but in general. A recent systematic review found 105 operational definitions across 84 studies using unique models of successful aging. These definitions differed in content and number of constructs included and identified between less than 1 percent and more than 90 percent of different samples as successful agers (Cosco, Prina, Perales, Stephan, & Brayne, 2014).

With this presentation of different traditions and conceptions of defining successful aging, I aimed to convince you that defining successful aging is a clear challenge. The definition will always depend on the authorities (individual, society), the criteria of assessment (biological, psychological, social), the societal, historical and environmental contexts as well as inter-individual differences with regard to personal prerequisites, preferences, capacities, and resources. Measuring success against one standard probably does not help us to understand the heterogeneity of the aging process.

In my view, success is not an all-or-nothing conception, but should be regarded as a continuum where individuals can be more or less successful on multiple dimensions. In my opinion, success is the ability of each and every individual to adapt to age-related losses and challenges and to make optimal use of their latent psychological, mental, physical and social potentials. Research is needed to investigate protective and risk factors of older adults for utilizing their latent potential, taking inter-individual differences in resources, capacity, and environmental support into consideration.

What I have presented so far might give the impression that successful aging is an individualistic concept; however, as mentioned previously, individuals' development and aging does not take place in isolation but as a dynamic interplay within environmental and societal contexts. Hence, in addition to knowing how successful aging might be defined, you might be interested in knowing which conditions and opportunities older adults have in the Netherlands and how they compare with other European countries, for example, in terms of successful aging (see, Smits, van den Beld, Aartsen, & Schroots, 2014).

Societal and Environmental Conditions for Aging Successfully

Societal Conditions for Aging Successfully The topic of successful aging received considerable attention from policy makers (for review see EuroHealthNet, 2012) mostly because of the expected major financial costs linked to increased life expectancies and aging societies. However, societal actions are still on a more descriptive level, as the creation and implementation of inter-individual differences in the aging process and the integration of person-centered solutions seems to be rather challenging.

One example of actual political implementation and action is the invention of the term *active aging* and the work of the World Health Organization (WHO) together with the European Commission (EC) that aims to facilitate the rights of older people to remain healthy (reducing costs of health and social care) and remain in employment (reducing pension costs) while also participating in community and political life. Importantly, “active” was defined as “*continuing participation in social, economic, cultural, spiritual and civic affairs, not just the ability to be physically active or to participate in the labor force*” (WHO, 2002; p.12). An index for active aging was created to measure and compare the potential for active and healthy aging across countries according to four domains (Fig. 7a), namely the level to which older adults (a) participate in paid employment, (b) participate in society, (c) live independent lives, and (d) have the capacity to age actively.

Participation in society includes voluntary activities, providing care to children and grandchildren or infirm and disabled people as well as political participation. Independent, healthy and secured living referred to the amount of physical exercise, access to health services, independent living, financial security, physical safety and lifelong learning opportunities. Higher scores in any of the domains is linked to more active aging. According to the definition, the first three domains, namely employment, participation in society and independent healthy and secure living indicates the actual experience of active aging for older adults, while the fourth domain refers to the capacity of individuals to age actively. This domain includes the remaining life expectancy at age 55, the share of healthy life expectancy at age 55, mental well-being, use of information technology, social connectedness and educational attainment. Again, higher scores on the different sub-domains were scored as opportunities for more active aging.

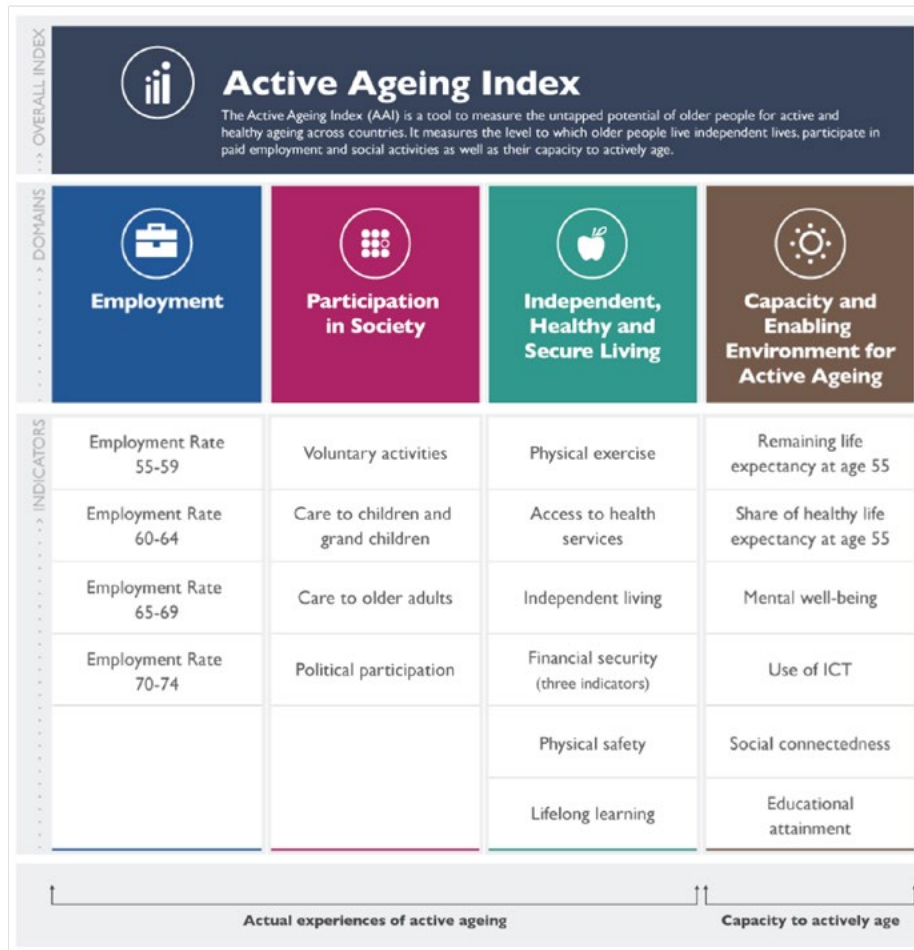


Figure 7a. Active Ageing Index (AAI): Description (Source: UNECE / European Commission (2019) "2018 Active Ageing Index: Analytical Report")

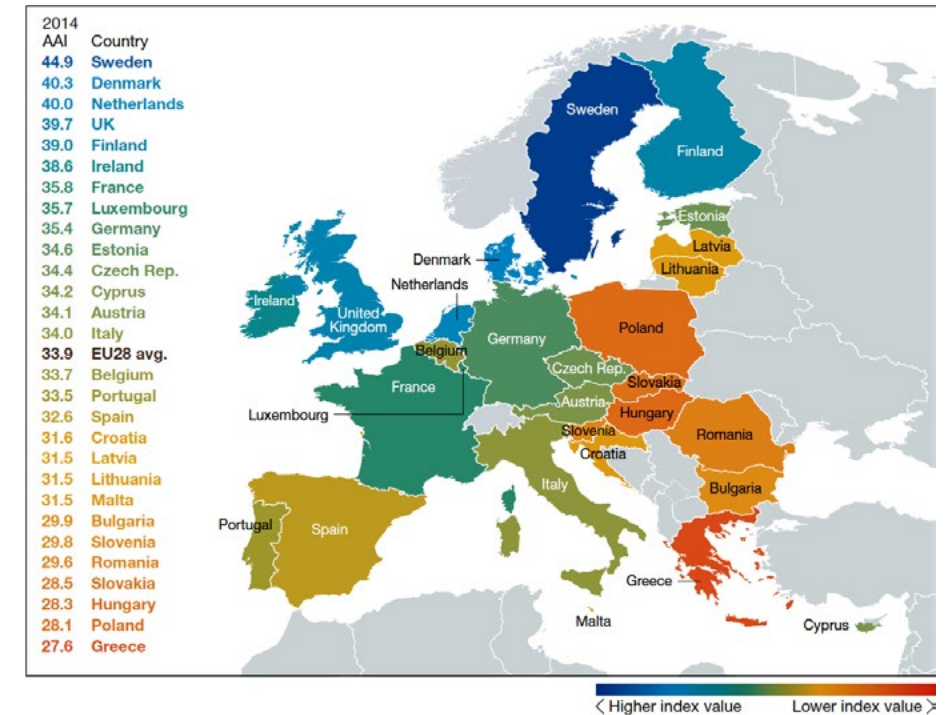


Figure 7b. Ranking of 28 EU Member States on the basis of the 2014 overall AAI

The average active aging index was calculated across the four domains, allowing comparison of the potential for older adults to age actively in different countries. The active aging index is presented in Figure 7b. The colors of the countries on this map indicates the height of the active aging index (the higher the better). The Netherlands scored rather high on the active aging index score in 2014; however, even more informative than the comparison across countries is the investigation of the scores for each of the four sub-domains (Fig. 7c).

The Netherlands score clearly about the European average across 28 countries, but like all the other countries, still have room to improve in each of the four domains. The scores could be used as inspiration and as a foundation to compare societal specificities and conditions in different countries, and how this is linked to providing older adults with opportunities to age actively. It is obvious that this active aging index not only disregards the subjective perspective of well-being and life satisfaction, but also does not account for inter-individual differences. Depending on cultural and personal differences, staying in paid work might not be rated as equally important across or within countries and the relative importance of the different domains might vary as well. Harmonizing

individual and societal needs and actions, and accounting for inter-individual differences in capacities, support and resources to allow successful aging in all periods of late life, are major individual as well as societal challenges. Future research should clearly try to link environmental and societal contexts to the subjective perspective on successful aging as this will provide us with more information about predictive and risk factors that can help to understand the huge inter-individual differences in the aging process and to develop interventions that can counteract preventable age-related declines and losses.

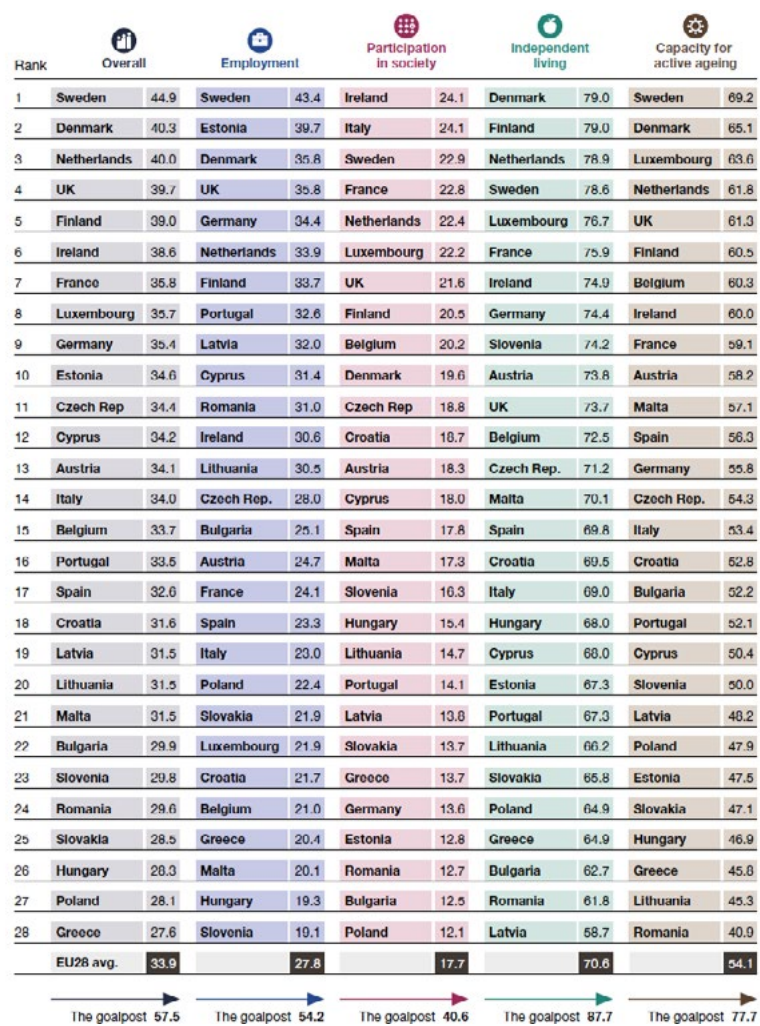


Figure 7c. Ranking of 28 EU Member States: Overall AAI and the four domains, separately (2014).

Personal Reflections and Future Plans

Personal Reflections and Future Plans After this brief excursion into societal and environmental conditions that might foster successful or active aging, I would like to spend the last part of this presentation by proposing some ideas for research that I am planning to conduct in the coming years and showing how they are linked to my perspective on successful aging.

Subjective predictors of cognitive training and ecologically valid transfer effects

As I mentioned briefly at the beginning, my previous research focused on memory functioning and plasticity, the ability to improve memory performance by cognitive training, across the lifespan and specifically in old age. I am clearly biased by the positive view of aging, trying to release the latent potential of older adults' memory functioning. As intact memory functioning has been shown to be highly relevant for individuals' everyday life, independence, frequency and quality of social interactions and engagement in cognitive stimulating activities (Park et al., 2002), this line of research has clear potential to foster older adults' well-being and life satisfaction as well as mental and physical functioning (Park et al., 2014).

I am specifically interested in finding predictors for inter-individual differences in memory functioning and how much individuals gain from cognitive interventions. I showed in my previous work that older adults can benefit from strategy instruction and training as well as repetitive training in specific memory processes (Brehmer et al., 2007; Brehmer et al., 2008; Brehmer et al., 2012). However, in line with many other studies, the generalizability of these training gains to other non-trained cognitive domains has been limited. Several challenges of cognitive interventions have been identified, for example that they are time and cost intensive, that individuals are often trained for relatively short periods of time and that sample sizes are rather small and that the training of cognitive tasks is not personally meaningful and relevant (Simons et al., 2016, for overview). As many other studies, I found that especially older adults differ enormously in memory functioning and in how they gain from training. Not much is known about the underpinnings and predictors of these inter-individual differences, even though this knowledge is essential to generate optimal and targeted training conditions for each individual.

My previous work on finding potential cognitive or neurobiological predictors (genetics, structural and functional brain imaging) for inter-individual differences in memory functioning and memory plasticity has identified some indicators (Becker et al., 2015; Brehmer et al., 2011; Brehmer et al., 2016; Papenberg et al., 2017). However, the proportion of the explained variance is small. So far, only a few studies have investigated non-cognitive predictors such as motivation and self-efficacy to account for these inter-individual differences in memory plasticity; however these

studies examined mostly younger, not older, adults (e.g., Katz, Jaeggi, Buschkuhl, Stegman, & Shah, 2014). Non-cognitive measures have great personal and societal relevance; for example meaningfulness and practical applications of training contexts in everyday life are especially important for older adults. In my future work, I will examine the influence of subjective factors, such as self-belief, emotion regulation, motivation and personality, on inter-individual differences in training gains and whether, for example, subjective or objective memory restrictions influence how much individuals gain from a specific cognitive training. In addition to subjective predictors, the beneficial effects of performance gains need to be investigated not only with regard to other non-trained cognitive domains, but also to ecologically more valid variables. Maybe the effect of cognitive training has a bigger impact on individuals' well-being and influences the way they approach their lives, even though direct effects on other cognitive measures might be limited.

During my studies, I trained more than 100 older adults with a very effective but effortful associative memory strategy. I trained participants in small groups, but more importantly, in one-to-one sessions, supporting their strategy learning process by discussing their memory formation and retrieval in specific circumstances. These individual sessions were specific as they were often the point where older adults managed to learn and acquire a new memory technique and experienced for the first time the benefit of applying it. This process of acquiring a new technique, which is very effortful, and all of a sudden being able to use it and to benefit from using it, is often a special moment for older adults. Jumping from remembering 3 out of 16 word pairs to consistently remembering more than 10 out of 16 - even under more difficult task conditions - often came with additional reflections of older adults. I experienced the clear joy and pride of these older adults as they realized that they could learn something new that works. One older lady was very touched by the fact that she learned a new memory strategy and benefited so much from using it. She said that her mum always told her that she was not smart and would never manage any intellectual challenge. Learning and gaining from applying this effortful memory strategy was the first time she could remember proving her mum wrong.

Hence, in my future research I would like to link classical experimental cognitive interventions to traditional indicators of successful aging. Specific research questions are (a) How do subjective factors (self-beliefs, emotion-regulation, motivation, personality) influence inter-individual differences in training gains? (b) Do subjective versus objective memory restrictions influence whether and how much individuals gain from cognitive training? and (c) Is it possible to generalize cognitively or subjectively experienced training gains to non-cognitive measures (e.g., subjective well-being, self-esteem, motivation, openness to new experiences, increase in leisure activities)?

The importance of social roles for successful aging

The interactions with colleagues at the Developmental Psychology Department during my first year here at Tilburg University have drawn my interest to the relevance of social roles in older adults and how successful transitions between social roles in old age are linked to subjective well-being and physical and mental health.

Let me go into a bit more detail to link the relevance of social roles to successful aging. Social relations are associated with better health and well-being in old age (e.g., Holt-Lunstad, Smith, & Layton, 2010). In the broader sense, social relations refer to a wide variety of concepts that are often used interchangeably: Social integration, social engagement, social participation, social networks, social ties, and social connections (for review, see Heaven et al., 2013). Heaven et al. (2013), distinguish between the positive influence of (a) social networks, (b) social and emotional support, and (c) social roles. Social roles refer to interpersonal relationships and leisure, which are valued by the person or his/her sociocultural environment. The term *social roles* refers to a particular position in a social network and provides a sense of purpose, worth, identity and a structure of life. Individuals fulfill several social roles in their everyday life (e.g., being a partner, a colleague, a mother/father, a child, a neighbor). While earlier periods of life are often much more socially structured in terms of social embeddedness, social integration and social status, their structure is often less clear for older adults. This lack of structure, of course, provides greater freedom to older adults to individually construct their aging process. However, it also requires self-initiation and a reorientation of work- and self-identity without much social grounding. The individual judgement of social roles as subjectively meaningful or relevant has been shown to be particularly relevant for older adults' health and well-being (Reichstadt, Sengupta, Depp, & Jeste, 2010). However, previous research focuses mostly on how people spend their time and which activities they are involved in and enjoy. Including information about changes in the relative importance of different social roles for individuals across age-related transitions (i.e., years before and after the transition) will provide us with another important way to investigate inter-individual differences in how to adjust to a major lifespan transition and its impact on individuals' well-being, health and self-esteem. The transition into retirement is of particular interest in this context as older adults often reported a loss of status upon leaving work, which was related to feelings of aimlessness, loss of identity, and attempts to reconfigure a new sense of self (Jones, Leontowitsch, & Higgs, 2010).

I am interested in answering the following research questions: How does the relative importance and subjective relevance of different social roles change across the retirement process (before and after retirement)? How do individuals who had a strong work identity during midlife replace this role after retirement? Does it matter which social role individuals take over or is it only important to find a social role of

subjective relevance? How is role fulfillment and role satisfaction linked to subjective well-being, physical and mental health?

I had the great opportunity to implement questions on the relative importance of social role fulfillment in two large-scale longitudinal studies in Sweden. The HEARTS study (HEalth, Aging and Retirement Transitions in Sweden) is conducted at Gothenburg University and has been assessing information on personality, subjective health, lifestyle and cognition for several thousand participants of retirement age for the last 5 years. Detailed information about the retirement processes of all participants are available on a yearly basis. In addition, I collaborate with colleagues from the Aging Research Center, Karolinska Institute, in Stockholm in the Swedish National study of Aging and Care in Kungsholmen (SNAC-K), which is a large, population-based, longitudinal study on aging and health, which assessed lifestyle, behavior, genetic and brain data from individuals aged 60 years and older before and after retirement. I am glad that several colleagues from Tilburg University are interested in this project, as it provides great potential for cross-border collaboration.

When it comes to specific roles of older adults, I am particularly interested in grandparenthood. Some studies highlight the advantage of grandparenting for well-being, health, and cognitive functioning for older adults (e.g., Goodman, 2012). However, previous research gives also some first indications that too much grandparental involvement in grandchild care (e.g., responsibility 5 times per week or more) increases grandparents' stress and hence reduces their well-being (Burn & Szoek, 2015). I am interested whether the positive effect of grandparenthood on mental and physical health is necessarily linked to biological grandchildren or whether it is due purely to the interaction with younger generations? Whether direct contact between grandparents and grandchildren is a prerequisite for positive effects on subjective well-being or whether long-distance relationships using social media fulfill similar purposes is still an open question. Societies and living conditions are changing so much these days and grandparents do not necessarily live with their primary family anymore. Hence, these questions might provide helpful indicators for natural interventions, which might affect well-being and life satisfaction as well as cognitive flexibility and mental health in older adults.

Increasing well-being in the oldest old: Bullying and aggression in nursing homes

The final project I would like to present today emerged in collaboration with my colleague Dr. Jelle Sijtsema from the Developmental Psychology Department here at Tilburg University. We have already received initial funding from the Dutch National Research Agenda (NWA Idea Generator) for investigating types, motivations, prevalence and consequences of bullying and aggression in nursing homes.

As I mentioned previously, physical and mental decline negatively influences indi-

vidual's social life and everyday functioning and leads to more individuals in need of formal care (e.g., nursing homes, care facilities, and assisted living residences). The transition to nursing homes is accompanied with the loss of independence and mobility. Life is often restricted to the nursing home context. Alarmingly, recent reports suggest high rates of interpersonal aggression and bullying in nursing homes (McDonald et al., 2015), with a multitude of negative consequences for residents such as increased levels of anxiety, depression, and physical injury (Trompetter, Scholte, & Westerhof, 2011). Interpersonal aggression refers to verbally, physically, emotionally, or socially harming another person. Bullying concerns repetitive interpersonal aggression with a clear power imbalance between the bully and the victim.

Bullying is primarily studied in school contexts (i.e., childhood, adolescence), showing that bullying is a group process in which dynamics related to status play a pivotal role (Menesini & Salmivalli, 2017). By victimizing peers, bullies often receive social status (e.g., popularity, visibility) from the peer group. To study and counteract bullying, many scholars and anti-bullying interventions have focused on adjusting the dynamic of social relationships and thereby successfully reduced peer bullying (Kärnä et al., 2011).

Little is known about the nature and prevalence of resident-to-resident bullying in nursing homes, the motivation for aggression, and the underlying social dynamics. Classrooms and nursing homes both contain fixed, closed-off groups of people, with multiple social interactions between people. They may thus create similar social dynamics, such as status hierarchies, social influence, and the use of aggression to safeguard one's social position (Salmivalli, 2010). However, while the size of older adults' social networks decreases, the motivation to engage in meaningful social relationships increases (Carstensen, 2006). Hence, compared to younger people, social dynamics within nursing homes may be inherently different from those in school settings. Our initial research goal is to investigate whether the constructs (i.e., affiliation, aggression, social status) driving bullying behavior early in life also drive interpersonal aggression and bullying in nursing home residents. Once we show which instruments are feasible for systematically assessing bullying, aggression, social dynamics, and social relationships in nursing homes, we can pave the way for future research to develop an inventory including protective and risk factors on the individual level (e.g., personality, motivation, mental and physical health), social level (e.g., social network, support), and institutional level (e.g., number of staff members, common space, social group activities and team-building activities). Information about such factors could help to develop personalized interventions to decrease the risk of being a victim of peer aggression and bullying in old age.

Residents of nursing homes represent a vulnerable group within our society. Hence, it is our obligation to invest in their safety and security to allow everyone to age and

live in dignity with social, mental, and physical integrity.

The different research lines I mentioned to you now range from cognitive interventions, work on social role transitions after retirement and when being a grandparent, to aggression and bullying in nursing homes. Of course, I will also continue work on structural and functional brain correlates of age-related changes, which I have not even mentioned. This means that my current and planned research approaches successful aging from very different angles, including healthy and pathological aging, cognitive and behavioral predictors, and social interactions. What unites my research is the interest in predictors, protective and risk factors for inter-individual differences in behavior and well-being of older individuals, which allow each and every individual to make optimal use of their latent potential.

I am very much looking forward to many interesting collaborations here at Tilburg University, that will help us to answer some of the questions raised and hopefully to formulate and answer even better ones.

Acknowledgements

Acknowledgements Finally, I would like to use this opportunity to express some words of gratitude.

First of all, I thank the Executive Board of Tilburg University for my appointment and the *Phillip Eijlander Diversity Program* of Tilburg University for supporting my position in the first five years. I started my work here almost a year ago and I would like to thank the Dean and Vice-Dean of Research of the School of Social and Behavioral Sciences (TSB), Prof. Jantine Schuit and Prof. Jeroen Vermunt, for welcoming me at TSB and supporting me in building interdisciplinary networks across departments within the Herbert Simon Research Institute.

My position is located within the Department for Developmental Psychology within TSB. I appreciate the warm welcome of my fellow professors, Prof. Stefan Bogaerts and Prof. Jaap Denissen, who value my research line as a clear addition to the departments' vision and join my excitement at exploring opportunities to collaborate. I am very pleased to be working in such a positive and dynamic research atmosphere, which has already resulted in several cooperative projects. This atmosphere is of course formed by all colleagues within the department. Thanks a lot for helping me understanding the Dutch (research) culture.

I am very glad that I already had the opportunity to make interesting research connections with colleagues across departments, who share my interest in interdisciplinary work and aging. I am looking forward fostering our collaborations.

Special thanks goes to the administration, Rianne Hurkmans, Mac Timmers, and Berthilde Boukema, who are always there to answer my questions, providing practical advice and solving hassles due to being new in the Netherlands and at Tilburg University.

I had great good fortune to have two mentors in my scientific career, my doctoral thesis supervisor Prof. Ulman Lindenberger and post-doc supervisor Prof. Lars Bäckman. You both shared your enthusiasm for lifespan and aging research with me, and supported me in my scientific development by always trusting in my "latent potential". I started the acknowledgements of my PhD thesis 13 years ago with the following quotation from Sobonfu Somé: "*The spirit of others gives us additional eyes and enables us to exceed our limits*". The two of you really helped me to exceed my limits. Thank you!

I have had the great pleasure working with very supportive and generous colleagues at different places in Germany as well as Sweden: Colleagues who like to discuss and criticize, to argue and evaluate each other's work and research ideas and to "give

each other additional eyes". Thanks to Prof. Yee Lee Shing, Dr. Erika Jonsson Laukka, Dr. Goran Papenberg, and Prof. Martin Lövdén.

I am thankful to have had the opportunity to work with two large-scale longitudinal Swedish data sets and to be able to continue working with these data sets in the future. I would like to thank Prof. Laura Fratiglioni for providing me with the opportunity to work with the Swedish National study of Aging and Care in Kungsholmen (SNAC-K) and Profs. Boo Johanson and Linda Hassing for allowing me working with the HEARTS study (HEalth, Aging and Retirement Transitions in Sweden).

Of course, there is also life outside academia. I would like to thank all my friends, my sisters and brother, who are by now spread across several countries and cities and who make me feel home wherever I am and independently from how often we meet in person.

I would like to thank my parents for their constant and unlimited support throughout the years and raising me to be excited, curious, persistent and not to accept simple solutions. I learned from you that at the end of our life, the tape measure is not put around our heads but around our hearts.

My final thank goes of course to my family. Stephan, thank you for our common journey throughout the last two decades. You are my base and home independently on where we are located. Martha, Grete and Lotte, the three of you clearly complete my life and mean that leaving work is a joy because I know I will spend time with you. As you know, I appreciate my work a lot, but spending time with you is even more precious and I want you to know that you are most important to me.

Thank you all for coming today and your attention.

I have spoken.

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