Doctoral thesis submitted to
the Faculty of Behavioural and Cultural Studies
Heidelberg University
in partial fulfillment of the requirements of the degree of
Doctor of Philosophy (Dr. phil.)
in Psychology

Title of the publication-based thesis

Subjective Aging Experiences and Negative Affectivity: Examination of Fundamental Associations and of Underlying Pathways

presented by
Anne Josephine Dutt

year of submission
2018

Dean: Prof. Dr. Dirk Hagemann
Advisor: Prof. Dr. Hans-Werner Wahl

I will never be an old man.
To me, old age is always 15 years older than I am.

Francis Bacon

Table of Contents

Acknowledgments

To my advisor Prof. Dr. Hans-Werner Wahl, who provided moral support and intellectual guidance throughout my entire dissertation. Each and every day you demonstrated that outstanding scientific standards and expertise, enthusiasm, and empathy could be reconciled. Your door was always open and the advice you gave showed trust and confidence in my research and in my academic and personal development. In challenging times your commitment and your interest in my research projects were a source of great inspiration and motivation. I thank you for providing me with excellent working conditions, notably the provision of an office and of financial means (e.g., an expense allowance for the many study participants), the possibility to participate in supplementary publications, the opportunity to take on teaching responsibilities, and the chance to connect with other scientists within the scope of national and international scientific conferences. Without your support, the final stages of my dissertation would not have run as smoothly as they did. I am very grateful that you became my advisor.

To Prof. Dr. Susanne Wurm, my second reviewer, for the time and effort you invested in the evaluation of this comprehensive piece of work.

To the "Konrad-Adenauer-Stiftung", my scholarship provider. Your endowment gave me financial freedom and enabled me to work in a focused way on my dissertation. The participation in the foundation's extensive seminar program along with my membership of the "Hochschulgruppe Heidelberg 07" allowed me to gain new insights and to acquire knowledge beyond my dissertation project.

To my colleagues at the Department of Psychological Aging Research, Heidelberg University. The familial atmosphere in our department provided excellent working conditions. Special thanks are due to Martina Gabrian who collected the 2012 AARC data. I am grateful that I could use this data set for my longitudinal analyses. I also thank Fiona Sophia Rupprecht for her support in conducting the latent change score analysis as part of Paper 2. Without your sound assistance, I would have been stuck at this final stage of my dissertation. Special thanks are also due to our secretary Anja Schilling. Your reliable support and your great knowledge regarding the practical implementation of my research ideas contributed to a smooth and trouble-free procedure. I also thank my student research assistants, Petra Herrmann and Rosa vom Eyser. Your contributions to the experi-

mental study and your proficient assistance during the data collection were a great support. To my master's student Sevilay Alhan for the effort you invested in entering the 2017 AARC data.

To the Heidelberg Graduate School for the Humanities and Social Sciences. The participation in the interdisciplinary seminar program permitted me to establish contacts beyond the field of psychology.

To my numerous study participants for the time and energy you invested in the completion of the comprehensive questionnaires. I am thankful for the fascinating insights you allowed me to gain during many personal conversations with you. Your wisdom and experience demonstrate the multifacetedness of the aging process better than all theories. Your recognition of my work in terms of practical relevance was a great motivation for me to keep on going.

To the "Heidelberger Akademie für Ältere", particularly to Dr. Angela Hack. Without your support in the recruitment of the study participants, I would not have been able to carry out the experimental study successfully.

To my friends, my most important leisure time resource. Special thanks go to Julia Mahal. I am truly glad that we had—by lucky coincidence—the chance to work in parallel on our dissertation projects, thereby sharing many rewarding experiences. To all my "university canteen companions". The daily time-out with you during lunchbreaks was often the highlight of my day and a pleasant change to the long hours in the office. To the "Klangfarben" choir—our weekly rehearsals were instrumental in maintaining a healthy work-life-balance.

To my parents, Karl-Josef Dutt and Birgit Dillinger-Dutt, and to my twin sister Verena Katharina Dutt. Your confidence in me and my abilities was unwavering. When times were challenging you encouraged me to carry on, appreciating the tiniest success. I cherish your never-ending patience when it came to listening to my thoughts and problems and your reliable advice on an abundance of questions related to my dissertation. Thanks for your time and conscientiousness when proofreading my manuscripts. You were always there for me and I am incredibly grateful for your unfaltering support and love.

Extended Abstract

The aging process is characterized as a heterogeneous phenomenon with large inter- and intraindividual differences. This multifaceted character of aging cannot be reduced to objective descriptions of aging, such as chronological age or biological age. Instead, the subjective representation of the aging process needs to be taken into consideration. Subjective aging experiences comprise all aspects of the "awareness, perception, experience, evaluation, interpretation, and identification with one's own aging process" (Westerhof, Whitbourne, & Freeman, 2012, p. 52). Subjective aging research has undergone a boost in the last decades—both with regard to the refinement of its theoretical foundations, as well as with regard to the empirical examination of its plasticity, its antecedents, and its outcomes. In addition, the field has recently witnessed the development of a number of new measurement tools to assess subjective aging experiences.

The overarching question of this dissertation asks whether and how subjective aging experiences are linked to psychological well-being. In doing so, major emphasis is put on the negative affectivity–related component of psychological well-being, more specifically depressive symptoms and negative affect/ sad mood. Depressive symptoms and negative affect are examined as antecedents and outcomes of subjective aging experiences. An important research question consists in exploring in which way subjective aging experiences translate into depressive symptoms. Specific research questions, able to differentiate the aforementioned overarching goals, led to four empirical papers gathered in this cumulative dissertation.

Paper 1 (see Chapter 2) investigated bidirectional linkages between perceived age-related gains and losses and depressive symptoms in midlife and old age, covering a 2.5-year observational period. Assimilative and accommodative self-regulation strategies and chronological age were studied as moderators. Results suggest that perceived age-related losses in contrast to gains have an effect on change in depressive symptoms over time. This association was stable across the second half of the life span. The reverse effect with depressive symptoms predicting change in perceived age-related losses or gains was not significant. The association between perceived age-related gains and change in depressive symptoms was moderated by self-regulation; when perceived gains were low, less increase in depressive symptoms was reported when accommodation was high.

Paper 2 (see Chapter 3) extended these findings by examining the moderating role of two processing strategies, that is, mindfulness and negative repetitive thought, for the association between perceived age-related gains and losses and change in depressive symptoms in middle and old adulthood, covering a 4.5-year observational interval. Mindfulness buffered the harmful effect of high levels of perceived age-related losses on change in depressive symptoms. Conversely, negative repetitive thought exacerbated the detrimental effect of many perceived age-related losses and few perceived age-related gains on change in depressive symptoms. With regard to the interplay between perceived age-related gains and mindfulness, effects were less robust, although the direction of the findings was consistent with theoretical considerations. Effects were comparable across middle-aged and older individuals.

Paper 3 (see Chapter 4) focused on the mediating pathways in the association between subjective aging experiences and depressive symptoms. This paper examined the mediating role of future time perspective and general self-efficacy for the association between perceived age-related losses and depressive symptoms in middle and old adulthood based on three measurement points. A higher amount of perceived age-related losses dampened future time perspective and general self-efficacy 2.5 years later, which in turn increased the level of depressive symptoms 2 years later. Effects were comparable across middle-aged and older individuals.

Finally, in Paper 4 (see Chapter 5), an experimental mood-induction paradigm was implemented in a sample covering midlife and old age to investigate associations between mood and subjective age. Sad or neutral mood was induced by texts and music. Participants receiving the sad mood induction reported changes toward older felt ages relative to chronological age from pre- to postinduction. Participants receiving the neutral mood induction reported stable levels of subjective age from pre- to postinduction. Effects were comparable across middle-aged and older participants as well as in participants high and low in neuroticism.

A conflating discussion of the four individual studies is provided in Chapter 6. The results of this thesis suggest that perceived age-related losses are longitudinally associated with depressive symptoms; that is, perceiving the aging process as being associated with many losses is linked to increasing depressive symptoms. This association is likely unidirectional and not bidirectional. The effect of perceived age-related losses on change in de-

pressive symptoms was moderated by processing strategies (i.e., mindfulness and negative repetitive thought) and mediated by future time perspective and general self-efficacy. Perceived age-related gains were not associated with depressive symptoms at the bivariate level. Considering individual differences, it was found that in case of low levels of accommodation and high levels of negative repetitive thought few perceived gains were linked to increases in depressive symptoms. Regarding short-term associations between subjective aging and well-being, an experimental study suggests that negative affect translates into older felt ages.

In conclusion, this dissertation contributes to the understanding of subjective aging experiences in several ways. It suggests that fundamental associations between well-established subjective aging constructs and negative affectivity found in past research can be transferred to a recently developed construct capturing perceived age-related gains and losses. The dissertation illuminates the pathways which explain how subjective aging translates into depressive symptoms (mediators) and suggests that subjective aging always needs to be considered within the context of other individual differences (moderators). The dissertation also provides additional insights into the short-term modifiability of subjective age, taking up the important and so far not well addressed issue of whether subjective age operates at the state- or trait-like level or at both levels. The strong linkages of subjective aging experiences with key developmental outcomes suggest that they should be considered more explicitly and directly within established life-span developmental theories, such as *socioemotional selectivity theory* (Carstensen, Isaacowitz, & Charles, 1999) or the *dual-process model of goal pursuit and goal adjustment* (Brandtstädter & Rothermund, 2002).

At the practical level, the findings underscore the importance of subjective aging phenomena with regard to psychological well-being. Given the pivotal role of negative views of aging in terms of depressive symptoms and negative affect, our views of the aging process need to be critically reflected. Public health initiatives should more thoroughly consider subjective aging experiences as an integral part in psychological prevention and intervention programs to promote successful aging. The thesis closes with a discussion of ethical concerns tied to the treatment of subjective aging experiences.

List of Publications for the Cumulative Dissertation

I. Publication

Dutt, A. J., Gabrian, M., & Wahl, H.-W. (2016). Awareness of age-related change and depressive symptoms in middle and late adulthood: Longitudinal associations and the role of self-regulation and calendar age. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, Advance online publication. doi:10.1093/geronb/ gbw095

II. Publication

Dutt, A. J., Wahl, H.-W., & Rupprecht, F. S. (under revision). Mindful vs. Mind full: Processing strategies moderate the association between subjective aging experiences and depressive symptoms. *Psychology and Aging.*

III. Publication

Dutt, A. J., & Wahl, H.-W. (submitted). Future time perspective and general self-efficacy mediate the association between awareness of age-related losses and depressive symptoms. *European Journal of Ageing*.

IV. Publication

Dutt, A. J., & Wahl., H.-W. (2017). Feeling sad makes us feel older: Effects of a sad-mood induction on subjective age. *Psychology and Aging, 32*, 412-418.
doi:10.1037/pag0000179

1

General Introduction

General Introduction: Chapter Overview

General Introduction: Chapter Overview (continued)

Background: On the Importance of Considering Subjective Aging

The characterization of aging as primarily defined by chronological or calendar age still dominates many societal and legal domains in Germany and in many countries around the world. For example, in Germany, important transitions in life, such as the transition into the retirement period, are still tied to a large extent to the attainment of an ex ante defined chronological cutoff age. The view of aging as predominantly mirrored by chronological age is also of great relevance in many areas of everyday life. For example, public transport associations and travel agencies provide special offers to their customers "aged 60+". Educational institutions implement training programs eligible for residents "aged 60 or older". Chronological age is among the most central information to characterize a person in societal terms and is as such a major social category. It also plays a pivotal role in many research fields. Study participants are assigned to different study groups according to their age and many data analyses and graphical illustrations are driven by chronological age. Moreover, chronological age is often included as a control variable into the analyses, to statistically partial out its influence from the investigated patterns of association.

The operationalization of the aging process in terms of chronological age offers a range of advantages. Usually, the age of a person can easily and precisely be determined. Moreover, the age information is very parsimonious. As outlined above, at the legal, societal, or political level, there is a long-standing consensus to rely on chronological age when it comes to decisions of being eligible or not for certain roles, acts, or financial support options. However, at the same time this practice is very reductionist. For example, Staudinger (2015)—a prominent life-span researcher—claimed that "research in the tradition of life-span psychology as well as life course sociology has shown that the meaning of age must not be reduced to that of chronological age" (p. 188). Instead, life-span psychologists consider the aging process as a heterogeneous phenomenon at any level of chronological age. In other words, aging follows a multidirectional trajectory, characterized by the co-occurrence and dynamic interplay of gain- and loss-related developments (P. Baltes, 1987; Heckhausen, Dixon, & Baltes, 1989). Also of great importance, each person ages individually, that is, the aging process comprises large interindividual differences. Moreover, the intraindividual level, too, is full of dynamics that cannot simply be reduced to chronologi-

cal age: The experienced gain-loss–balance fluctuates within a person, for example, as a result of external life events (Kotter-Grühn, Neupert, & Stephan, 2015). Moreover, the gain-loss–balance differs across life domains. As such, a person who experiences cognitive deficits might nevertheless still show high levels of physical functioning. Again, this multifaceted character of the aging process can only inaccurately be captured by means of chronological age (Montepare, 2009). About 50 years ago, Peters (1971) summarized these limitations of chronological age: "Chronological age then seems to be a poor index of aging and may serve as only a convenient means of ordering developmental data" (p. 72; see also Staudinger, 2015).

In conclusion, studying the aging process certainly requires other perspectives—going beyond chronological age—which tackle the heterogeneity and complexity of the aging process. In this context, Staudinger (2015) distinguishes between "outside" and "inside" perspectives on aging. Outside perspectives comprise biological (e.g., telomere length), social (e.g., fulfillment of social age norms), and psychological (e.g., cognitive functioning, personality) ages. Inside perspectives comprise the subjective representation of the aging process. Hence, in addition to asking how old individuals are, we need to address how old they feel and how they perceive and interpret their aging process.

Concepts Related to Subjective Aging

The Concept of Subjective Aging

The concept of subjective aging experiences comprises a class of related constructs which, due to their similarities, can be subsumed under the theoretical umbrella terms of *awareness of aging* (Diehl et al., 2014) or *views on aging* (Wurm, Diehl, Kornadt, Westerhof, & Wahl, 2017). However, the various concepts that exist in this field differ according to their specific frames of reference (Dutt, Wahl, & Diehl, in press). (1) Do they target aging perceptions held by society or by the aging individual? (2) Do they capture beliefs about a person's own aging process or general beliefs about aging (e.g., age stereotypes)? (3) Do they involve past-present–comparisons or anticipations of the aging process concerning future developments (e.g., fear of aging)?

Subjective aging as used in this dissertation refers to the subjective representation of one's own aging process and comprises "all aspects of the awareness, perception, experi-

ence, evaluation, interpretation, and identification with one's own aging process" (Westerhof et al., 2012, p. 52). In terms of the above-mentioned classification aspects, subjective aging thus (1) targets aging perceptions held by the aging individual which (2) concern one's own aging process (3) as it has been occurring until the present moment. Subjective aging can thus be considered as an essential part of the aging self and self-concept (Diehl et al., 2014; Westerhof et al., 2012). It is also closely linked to the subjective perception of progressing lifetime (Gabrian, Dutt, & Wahl, 2017).

Note that this conceptualization of subjective aging does *not* include age stereotypes. Age stereotypes are often considered under the same umbrella term as subjective age, attitude toward own aging, or self-perceptions of aging. However, age stereotypes refer to *general* views about aging, whereas this dissertation focuses on subjective perceptions of one's *own* aging process. This is a fundamental conceptual difference.

Several constructs can be subsumed under this subjective aging conceptualization. The various constructs differ according to their specific features (Dutt et al., in press). (1) Are they explicit, conscious, and rooted within concrete, behavioral experiences, or implicit and pre-conscious? (2) Are they descriptive or evaluative, and, in case of the latter, do they comprise cognitive or affective judgments? (3) Do they target aging experiences at a global level or do they distinguish between aging experiences across different life domains? (4) Do they treat perceived age-related gains and losses as two ends of the same continuum or as separate scales?

In the following, four key subjective aging constructs will be focused on and discussed, that is, (1) subjective age; (2) attitude toward own aging; (3) self-perceptions of aging; and (4) awareness of age-related change. The decision to concentrate on these measures was driven by three considerations. First, as will be described in more detail in the following paragraphs, the constructs thoroughly differ according to their key features, such that they provide a broad overview over the subjective aging field. For example, whereas subjective age and attitude toward own aging are (1) rather implicit measures of subjective aging experiences which ask for (2) evaluations of the aging process which are (3) global and (4) cover a continuum from positive to negative subjective aging experiences, self-perceptions of aging and awareness of age-related change are rather (1) explicit (2) descriptions of the aging process which take into account the (3) multidimensionality and (4) multidirectionality of development. Second, subjective age, attitude toward own

aging, and self-perceptions of aging are frequently used and well-established instruments (of which subjective age is targeted in Paper 4) in the extant empirical literature on subjective aging. Third, although awareness of age-related change is a more recent measure that has found only limited empirical attention so far, more research on this construct is warranted due to its promising theoretical foundations (and it is thus targeted in Papers 1–3).

Subjective age

Subjective age, sometimes also referred to as age identity (e.g., Bowling, See-Tai, Ebrahim, Gabriel, & Solanki, 2005), captures how old a person perceives him- or herself to be. Usually, it is operationalized as a unidimensional measure asking respondents to indicate how old they *feel*. Inspired by classic work of Kastenbaum et al. (1972), several authors distinguished between feel-age, that is, how old a person feels, look-age, that is, how old a person looks, do-age, that is, how involved a person is in doing things favored by members of a certain age group, and interest-age, that is, how similar a person's interests are to members of a certain age group (see also Barak & Schiffman, 1981; Barak & Stern, 1986; Goldsmith & Heiens, 1992). In a similar vein, Montepare (1996) distinguished between psychological, physical, and social subjective age perceptions. All subjective age components seem to be highly interrelated and have been found to load on one latent dimension (Henderson, Goldsmith, & Flynn, 1995; Hubley & Russell, 2009; Stephan, Caudroit, & Chalabaev, 2011; Teuscher, 2009; Wilkes, 1992). Slightly different from these subjective age conceptions are questions asking adults to indicate their desired/ ideal age (Hubley & Russell, 2009; Öberg & Tornstam, 2001). The following considerations refer to the understanding of subjective age as a one-item measure in terms of felt age, as this is the most commonly used measurement approach (Pinquart & Sörensen, 2001).

Children and adolescents usually tend to feel older than they are in terms of chronological age. Around the age of 25 years, there seems to be a turning point from which on most adults feel younger than they are (Rubin & Berntsen, 2006). This discrepancy between felt age and chronological age seems to be rather robust across the second half of the life span (Uotinen, Rantanen, Suutama, & Ruoppila, 2006); it has been found that people aged 40 and older feel approximately 20% younger than they are in terms of chronological age (Rubin & Berntsen, 2006).

A youthful age identity might stem from various reasons. First, according to a motivationally driven argument, dissociating oneself from being an “old person” helps to pro-

tect against the negative age stereotypes held by society (Peters, 1971; Teuscher, 2009; Weiss & Lang, 2012). Hence, a youthful age identity can be considered a self-protective and self-enhancement strategy or defense mechanism. Second, according to the so-called information-processing approach older adults tend to look younger nowadays than formerly. When individuals compare themselves to an age-prototype which is no longer accurate they may underestimate their own age (Teuscher, 2009). Third, feeling younger may be an attempt to maintain self-consistency or self-continuity across the life span by integrating ongoing experiences into previously established self-schemata; this phenomenon is known as identity assimilation (Westerhof et al., 2012).

A clear strength of the subjective age concept lies in its parsimonious character and in its easy way of assessment. Nonetheless, subjective age is highly predictive with regard to important developmental outcomes, such as health and mortality (see Westerhof et al., 2014 for a meta-analysis), memory performance (Stephan, Sutin, Caudroit, & Terracciano, 2016), and depressive symptoms (Spuling, Miche, Wurm, & Wahl, 2013; Stephan et al., 2016). This may explain why subjective age is the most established subjective aging measure.

Although subjective age, in its origin, is a fairly simple construct which can be operationalized as a manifest variable (e.g., "Indicate in years the age you feel most of the time"), there is no clear consensus on how felt age measures should be linked to chronological age (Dutt et al., in press). For example, feeling 10 years younger is qualitatively completely different when a 90-year-old person is considered compared to when a 30-year-old person is considered. Hence, whereas some researchers worked with the felt age raw scores (e.g., Hughes & Lachman, 2016), others calculated a discrepancy score between felt age and chronological age (e.g., Spuling et al., 2013) or divided this discrepancy by chronological age to obtain a proportional discrepancy score (e.g., Gabrian & Wahl, 2017; see also Paper 4 of this dissertation). Still others used a visual analogue scale (e.g., Hughes, Geraci, & De Forrest, 2013; see also Paper 4 of this dissertation), or asked their study participants to classify themselves into categories of middle-aged and old (e.g., Bultena & Powers, 1978). Certainly, the optimal way of assessment depends on the research question and on the analytical procedure of the specific study under question. However, the comparability of findings is challenged due to this heterogeneity of operationalizations.

Another limitation of subjective age comprises its reductionistic character which is in contrast to the widely established multidimensionality of human development. The multidimensional measurement approach also advocated by Kastenbaum et al.'s (1972) work on subjective age too often has remained unconsidered in the existing subjective age literature at large. Instead, people typically were solely asked to provide a global evaluation of how old they feel in general and most of the time (Pinquart & Sörensen, 2001). This approach does not reflect the complexity of development with its underlying idea that perceived aging experiences may differ across life domains. Moreover, simply asking how old an individual feels does not provide any information regarding the person's actual aging experiences underlying the subjective age rating (Diehl et al., 2014). Given the propositions of life-span developmental psychology regarding the dynamic interplay between growth and decline accompanying the aging process (P. Baltes, 1987), the validity of the subjective age concept is challenged (Gendron, Inker, & Welleford, 2017). As we do not know what growing older means for the aging person (for some it is decline, for some it is growth, and for others again it is a combination of both), we are not able to know what feeling younger or older actually means. Despite the multidirectional character of development, feeling older is often equated with an unfavorable state. This not only seems to be a too pragmatic resolution of the validity problem, but the stigmatization of older felt ages as something unpleasant also raises ethical concerns. Although empirical research indeed suggests that older felt ages are more likely to be associated with poorer developmental outcomes (e.g., Westerhof et al., 2014), naively connoting older felt ages with negative states imposes a normative view of the aging process as an only negative phenomenon (Gendron et al., 2017). This limitation is addressed with the implementation of more complex subjective aging constructs which are rooted in a person's concrete aging experiences, hence providing less room for inconclusive interpretations and meanings.

Attitude toward own aging

Another widely established measure of subjective aging experiences is attitude toward own aging (ATOA). The terminology in this area is somewhat inconsistent and terms like satisfaction with aging (e.g., Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008) are often used as synonyms for ATOA. ATOA comprises concrete evaluations regarding the cognitive-emotional experience of aging (Kleinspehn-Ammerlahn et al., 2008). ATOA is usually assessed with a scale developed by Lawton (1975) as part of the Philadelphia Ger-

iatric Center Morale Scale. Originally, the ATOA subscale constituted one of three factors of the scale—with the other two factors labeled Lonely Dissatisfaction and Agitation. The five ATOA items assess judgments about temporal changes in happiness, energy level, life quality, and perceived usefulness (Kleinspehn-Ammerlahn et al., 2008). Examples for item formulations are "Things keep getting worse as I get older" or "I am as happy now as when I was younger." Items are evaluated on a dichotomous yes-no scale. All items have been found to load on a single factor (Liang & Bollen, 1983; McCulloch, 1991); hence, the ATOA scale can be considered a unidimensional scale.

ATOA shows large interindividual variability particularly in midlife as compared with old age (Miche, Elsässer, Schilling, & Wahl, 2014). With increasing age, ATOA becomes more negative (Kleinspehn-Ammerlahn et al., 2008). According to distance-to-death analyses this decline can be best interpreted as a mortality-related phenomenon, with a pronounced downward trend prior to death (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009).

ATOA predicts health, health behaviors, and survival (see Westerhof et al., 2014 for a meta-analysis) and is linked to measures of psychological well-being, such as depressive symptoms (Han & Richardson, 2015) or will to live (Levy, Slade, Kunkel, & Kasl, 2002).

However, the unidimensional character of the ATOA construct is a limitation of this concept, as it neglects that aging experiences may vary across different life domains.

Self-perceptions of aging

This limitation is overcome within the construct of self-perceptions of aging (SPA).[1] Again, the terminology is somewhat unclear and SPA are often used interchangeably with terms like aging-related cognitions (e.g., Wurm, Tesch-Römer, & Tomasik, 2007). Two measurement instruments stand out. Steverink, Westerhof, Bode, and Dittmann-Kohli (2001) distinguished between the subscales physical decline (focusing on worsening health and functional limitations), continuous growth (comprising aspects of personal development), and social loss (capturing, for example, loneliness or decreasing respect by others). In a similar vein, Laidlaw, Power, and Schmidt (2007) differentiated in their SPA

[1] Note that self-perceptions of aging are sometimes also used to refer to ATOA (e.g., Sargent-Cox, Anstey, & Luszcz, 2014) or understood as an umbrella term subsuming the constructs of subjective age and ATOA (Kleinspehn-Ammerlahn et al., 2008; Kotter-Grühn et al., 2009). Basically, the use of each terminology can be considered a somehow arbitrary decision. In the context of this dissertation, SPA and ATOA are used to refer to different measurement approaches.

scale between physical change, psychological growth, and psychosocial loss. The subscales are independent from each other, so that they can also be investigated separately according to the particular research question (e.g., Wurm & Benyamini, 2014).

A clear strength of the SPA concept lies in its consideration of different life domains, such as the interpersonal or physical domain, thus acknowledging the multidimensionality of life-span development. Moreover, SPA take into account the multidirectional character of development with a co-occurrence of gain- and loss-related experiences.

SPA have been shown to be linked to key developmental outcomes, such as physical health (Wurm & Benyamini, 2014; Wurm et al., 2007; Wurm, Tomasik, & Tesch-Römer, 2008), processing speed (Seidler & Wolff, 2017), and measures of psychological well-being such as life satisfaction (Wurm et al., 2008) or depressive symptoms (Wurm & Benyamini, 2014).

Awareness of age-related change

The development of the SPA scales constitutes a progress with regard to the consideration of the multifaceted character of human development. The recently introduced construct of awareness of age-related change (AARC) which has been established by Diehl and Wahl (2010) takes up these features, while at the same time taking into account the idea that aging constitutes change over time. AARC "[…] refers to all those experiences that make a person aware that his or her behavior, level of performance, or ways of experiencing his or her life have changed as a consequence of having grown older […]" (p. 340). AARC captures the awareness of positive (AARC gains) and negative (AARC losses) age-related changes, irrespective of objective occurrences related to aging. Two aspects are important here. First, AARC exclusively refers to *changes* in experiences. That is, if an aging person is aware of, for example, a pessimistic outlook on the future, but has been adopting this negative perspective for the most part of his or her life, this experience would not be mirrored here. Second, perceived changes have to be attributed to increasing chronological age, that is, to the aging process. If an aging person is aware of, for example, restrictions in his or her social network, but attributes these changes to a change of residence place, this experience would not be considered as AARC. Following these considerations, AARC does not reflect a person's resource status per se, but rather targets perceived changes in a person's resource status. As such, the perception of, for example, few age-related gains does not necessarily imply that the person has a bad resource status. Rather, it suggests

that the person perceives the aging process as being accompanied by the emergence of few positive experiences.

The AARC items were developed based on conceptual reasoning (Diehl & Wahl, 2010) as well as empirical research targeting everyday aging awareness experiences (Brothers, Gabrian, Wahl, & Diehl, conditionally accepted; Miche, Wahl, et al., 2014). The AARC items cover five behavioral domains central to gain- and loss-related aging experiences, that is, health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive/social-emotional functioning, and lifestyle and engagement. Each item is preceded by the item stem "With my increasing age, I realize that…" and comprises the description of a positive (gains) or negative (losses) experience in one out of five behavioral domains. An example for a positive aging experience (interpersonal relations) is "…that I am more open toward other people." An example for a negative aging experience (cognitive functioning) is "…that it is more difficult for me to learn new things."

By specifying gains and losses, AARC differs from global subjective aging constructs, such as subjective age and ATOA (Lawton, 1975), which treat positive and negative experiences as two ends of the same continuum. Although exploratory and confirmatory factor analyses point to a high stability of the AARC gains and AARC losses scales across different samples (Brothers et al., conditionally accepted; Diehl, Wahl, Brothers, & Miche, 2013), the psychometric distinction of the behavioral subscales was found to be less robust. Hence, domain-specific analyses should currently be carried out with caution. That is, the domain-specific character of the AARC construct is considered more at the theoretical and content-related level than at the empirical level.

As the AARC construct is relatively new, empirical findings are still scarce. However, first analyses underline the heuristic approach of the AARC construct. In their cross-sectional analyses, Brothers and colleagues (2017) found that AARC is able to add explained variance regarding functional health and life satisfaction over and above subjective age and ATOA. Recent longitudinal studies point to effects of AARC on future time perspective and well-being according to an eudaimonic[2] understanding (Brothers, Gabrian, Wahl, & Diehl, 2016). In general, perceived age-related losses were found to exert a larger impact on developmental outcomes as compared with perceived age-related gains.

[2] An eudaimonic understanding of well-being comprises the subscales self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth (Ryff, 1989).

Theoretical Considerations on Psychological Well-Being–Related Correlates of Subjective Aging

Theoretical considerations suggest bidirectional associations between subjective aging experiences and psychological well-being. It is acknowledged that subjective aging experiences are also linked to other important developmental correlates, such as health, health behaviors, mortality (see Westerhof et al., 2014 for a meta-analysis; see Westerhof & Wurm, 2015; Wurm et al., 2017 for reviews), and cognition (e.g., Robertson, King-Kallimanis, & Kenny, 2016; Seidler & Wolff, 2017; Siebert, Wahl, & Schröder, 2016; Stephan et al., 2016). However, in line with the focus of this dissertation, the following considerations exclusively refer to associations between subjective aging and psychological well-being.

Psychological well-being can be considered an important indicator of successful aging (Rowe & Kahn, 1987). Successful aging is an interdisciplinary phenomenon and can be understood as a multidimensional construct encompassing objective occurrences and subjective perceptions of, inter alia, physical, cognitive, psychological/emotional, and social functioning (Bülow & Söderqvist, 2014; Cheng, 2014; Cosco, Prina, Perales, Stephan, & Brayne, 2014a, 2014b; Phelan, Anderson, LaCroix, & Larson, 2004; Pruchno, Wilson-Genderson, & Cartwright, 2010; Vahia, Thompson, Depp, Allison, & Jeste, 2012; Wahl, Siebert, & Taubert, 2017). Most operational definitions converge in the idea that psychological well-being is a central component of successful aging (Bowling & Dieppe, 2005; Havighurst, 1961).

According to Diener et al. (1999), psychological well-being encompasses life satisfaction and positive and negative affectivity. Positive affectivity includes feelings such as joy, elation, and happiness, whereas negative affectivity encompasses feelings of sadness, anxiety, and depression (Diener et al., 1999). These aspects are also considered within the mental health construct (Ware, Kosinski, & Keller, 1996). Apart from this hedonic approach, other authors adopt an eudaimonic view (see Huta & Ryan, 2010 for an overview) and understand psychological well-being as a conglomerate of behaviors and orientations such as self-acceptance, positive relations with others, or personal growth (Ryff, 1989).

Although, as will be outlined later on, the focus of this dissertation lies on a subcomponent of psychological well-being (i.e., depressive symptoms and negative affect), the

following considerations explicitly include the full range of psychological well-being–related constructs to provide an extensive overview over the current state of research within this field. In terms of subjective aging experiences, age stereotypes are not considered here, as this dissertation focuses on subjective perceptions of a person's *own* aging process which are conceptually different from general views about aging.

Psychological Well-Being as an Antecedent of Subjective Aging

Theoretical considerations suggest that psychological well-being might exert an effect on subjective aging experiences (see Figure 1.1). Subjective aging experiences are based on the assumption that individuals construct, hold, and reconstruct awareness and knowledge of their own aging process (Diehl, Wahl, Brothers, & Miche, 2015). The subjective representation of the aging process requires an elaborate search for and processing of information (Diehl et al., 2014), triggering processes such as autobiographical memory research, evaluative judgments, or within–person past–present comparisons. In line with theoretical models, these processes can hinge on a person's psychological well-being, resulting in well-being–congruent subjective aging experiences. Specifically, a person's psychological well-being should translate into subjective aging experiences through different psychological (i.e., cognitive and motivational) pathways.

In terms of *cognitive* pathways, the *associative network theory of memory and emotion* (Bower, 1981) postulates that human memory can be modeled in terms of an associative network of semantic concepts. When a concept is stimulated, its activation spreads from one concept to another by inter-associative linkages. The more properties two concepts have in common, the more links there are between them. Feelings can equally be considered as part of this network. The activation of a feeling unit spreads along its associative links to target items so that thoughts congruent to the current feeling are more accessible. These predictions have been verified empirically (Drace, 2013; Schnall & Laird, 2003) and apply also in old age (Knight & Durbin, 2015; Knight, Maines, & Robinson, 2002). Hence, a worse psychological well-being should facilitate the retrieval of negative age-related experiences and impede the retrieval of positive age-related experiences, thereby leading to more negative subjective aging experiences.

As the aging process started in the past and stretches to the present and future, one can assume that individuals not only consider previous experiences stored in memory

when evaluating their aging process, but also rely on current judgments. The *feelings-as-information approach* by Schwarz and Clore (Schwarz, 2001; Schwarz & Clore, 1983) highlights the informational function of moods for judgments. Affective experiences have a signaling function and inform about the nature of one's current situation, thus serving as a heuristic strategy. When making judgments, people "consult" their feelings, leading to an impact of feelings on evaluative judgments. Evidence for the informational function of feelings on evaluative judgments has been provided both with experimentally as well as naturally induced moods (Abele & Gendolla, 1999; Brose, Lindenberger, & Schmiedek, 2013; Schwarz & Clore, 1983). Hence, individuals in a negative mood should perceive and evaluate their aging process more negatively than individuals in a more positive mood.

Moreover, and specific to depressed mood, depressive symptoms are accompanied by a range of negative developmental outcomes, such as worsening health (Ho et al., 2014; Noël et al., 2004), decreasing cognitive performance (Bunce, Batterham, Christensen, & Mackinnon, 2014; Montejo et al., 2014), or reduced social functioning (Furukawa, Azuma, Takeuchi, Kitamura, & Takahashi, 2011; Kennedy, Foy, Sherazi, McDonough, & McKeon, 2007; Szanto et al., 2012). When these changes are misattributed to increasing age, the subjective representation of the aging process might be tainted by depressive symptoms.

In addition to the cognitive processes outlined above, the impact of psychological well-being on subjective aging experiences can also be guided by *motivational* processes. Individuals are motivated to verify their self-view, even if this view is negative, in order to bolster their perception that the world is predictable and controllable (Swann, 1983), which results in a selective attention to and interpretation of information consistent with a person's ongoing mood state. In line with this strive for self-verification and self-consistency, individuals in a negative mood should selectively attend to negative subjective aging experiences. Furthermore, the congruency between psychological well-being and subjective aging experiences may also be the result of a misattribution: An individual who is placed in an affectively charged situation is motivated to search for an explanation for this mood. He or she should then selectively attend to stimuli congruent with the to-be-explained mood (Blaney, 1986). As a consequence, being in a negative mood should draw an individual's attention to negative subjective aging experiences.

Apart from psychological well-being affecting subjective aging experiences, the reverse direction of associations it also conceivable.

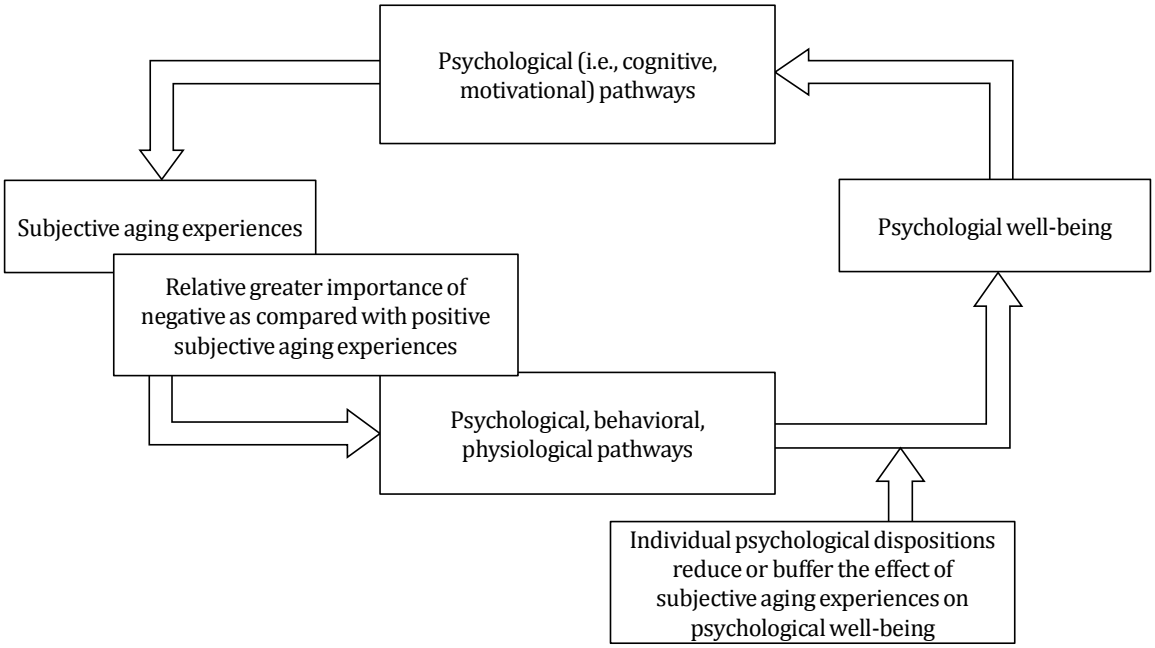


Figure 1.1. Theoretical considerations on associations between subjective aging and psychological well-being.

Psychological Well-Being as an Outcome of Subjective Aging

In her *stereotype embodiment theory*, Levy (2009) proposes several pathways via which subjective aging experiences translate into developmental outcomes (see Figure 1.1). The theory has originally been designed to explain effects of age stereotypes on developmental outcomes. Although age stereotypes and subjective aging experiences as understood in this dissertation (Westerhof et al., 2012) can be considered as different constructs due to their different frames of reference (beliefs about one's own aging process versus beliefs about the aging process in general; Diehl et al., 2014), the theory can also be extended to subjective representations of one's own aging process, as Levy assumes that age-stereotypes become self-stereotypes when individuals reach old age. Precisely, Levy suggests three mediating pathways through which subjective aging experiences exert an effect on psychological well-being.

First, according to the *psychological* pathway, subjective aging experiences turn into self-fulfilling prophecies, as the subjective representation of the aging process triggers a selective attention for information consistent with this self-view. This phenomenon can also be considered as a *motivational* one (Swann, 1983). Moreover, subjective aging experiences are accompanied by changes in psychological variables, such as control beliefs or

future time perspective, which, in turn, influence developmental outcomes (Brothers et al., 2016; Levy, Slade, & Kasl, 2002).

Second, the *behavioral* pathway comprises effects of subjective aging experiences on health behaviors such as physical exercise (Levy & Myers, 2004; Wurm, Tomasik, & Tesch-Römer, 2010) or on social and cognitively stimulating activities (Robertson & Kenny, 2016). In addition, subjective aging experiences are accompanied by a specific degree of adaptive coping strategies (Dutt, Gabrian, & Wahl, 2016b; Wurm, Warner, Ziegelmann, Wolff, & Schüz, 2013). Health behaviors and coping strategies, in turn, are associated with psychological well-being (Khalaila & Litwin, 2014; Sanjuan & Magallares, 2015).

Third, according to the *physiological* pathway, negative subjective aging experiences can be considered as a stressor eliciting physiological arousal (i.e., higher blood pressure, higher heart rate, and higher cortisol levels) which, in the long run, is linked to a worsening of psychological well-being. Although this pathway is difficult to test, as it requires the use of complex methods to assess these physiological measures, the robust association between subjective aging experiences and physical health (see Westerhof et al., 2014 for a meta-analysis; see Westerhof & Wurm, 2015; Wurm et al., 2017 for reviews) corroborates such a mediating pathway. In line with this idea, Stephan, Caudroit, and Chalabaev (2011) found that subjective health mediates the association between subjective age and life satisfaction. Moreover, first evidence for a physiological pathway with regard to another developmental outcome, that is, longevity, has been provided by Levy and Bavishi (2016) who found that C-reactive protein, a marker of cumulated stress-reactive inflammation, mediates the association between ATOA and longevity.

With regard to subjective aging measures treating age-related gains and losses as two separate scales (i.e., SPA, AARC), it also has to be asked whether the effects of perceived gains or losses on psychological well-being differ in size, that is, if negative subjective aging experiences "do harm" to the same degree than positive subjective aging experiences "help" (Meisner, 2012). In general, negative information is processed more thoroughly than positive information which might be due to the more contagious character of bad entities as compared with good entities (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001). This observation has been verified in the domain of age stereotypes. A meta-analysis with seven articles conducted by Meisner (2012) revealed that priming negative age stereotypes influenced behavior (i.e., measures of performance

and perception) on average 2.6 times more in the negative direction than did positive age stereotype priming in the positive direction. According to Meisner, the omnipresence, persistence, and rigidity of negative age stereotypes as compared with positive age stereotypes decreases the threshold to which these stereotypes are activated and applied to behavior. This phenomenon might also apply to perceptions of one's own aging process and their effect on psychological well-being. Negative age-related changes remind the individual that life is finite, thus being more diagnostically relevant than positive ones (see Figure 1.1).

According to the *preventive and corrective proactivity model* (Kahana & Kahana, 1996), the individual is an active, self-constructing, self-reflecting developmental agent (see also Lerner & Busch-Rossnagel, 1981). Following such a view, the developing and aging individual is, at least to some extent, a shaper of his or her environment, rather than being a mere responder to environmental circumstances. This proactive view of aging implies the idea that psychological dispositions can reduce or buffer the impact of stress on outcomes of successful aging, such as psychological well-being. In a similar vein, Wrosch, Dunne, Scheier, and Schulz (2006) suggest that older adults can avoid the adverse effects of encountering age-related challenges if they engage in adaptive self-regulation strategies. Comparable models have been established in clinical psychology. For example, the *diathesis–stress–model*, sometimes also referred to as *vulnerability–stress–model* (Ingram & Luxton, 2005), postulates an interaction between stress and vulnerabilities in the prediction of psychological disorders. That is, the impact of stressful events is buffered or exacerbated depending on individual differences. This assumption is further advocated within the *cognitive catalyst model of depressive vulnerability* (Ciesla, Felton, & Roberts, 2011; Ciesla & Roberts, 2007). According to this model, cognitive content (e.g., the cognitive representation of a stressor) interacts with an individual's preferred response style (e.g., rumination) to amplify or reduce each other's impact on depressive symptoms. Transferred to the concept of subjective aging, these models lead to the assumption that subjective aging experiences should not be seen as an isolated phenomenon, but should be considered within the context of other individual differences (see Figure 1.1).

These theoretical predictions on an association between psychological well-being and subjective aging experiences are enriched by a review over the empirical literature published so far in the field of subjective aging.

Literature Review on Empirically Established Psychological Well-Being–Related Correlates of Subjective Aging

Search Criteria

The review comprises longitudinal as well as experimental studies and encompasses a broad range of subjective aging constructs.[3] Cross-sectional findings are not considered for two reasons, a pragmatic and a methodological one: First, in terms of pragmatic considerations, there has been a boost in subjective aging research in recent years. Due to limitations in space, it is impossible to take into account all of them within this literature review. Thus, a focus on a subgroup of studies seems warranted here. Second, in terms of methodological considerations, cross-sectional studies inhibit the drawing of any causal conclusions, thus having limited informative value compared with longitudinal studies.

An extensive literature research was conducted in summer and autumn 2017 in the databases PsycINFO and PSYNDEX, based on the following keywords: "awareness of aging", "views of aging", "views on aging", "felt age", "perceived age", "subjective ag*", "age ident*", "attitudes to* ag*", "self-perceptions of aging", "aging self-perceptions", "aging satisfaction", "awareness of age-related change", "aging-related cognitions", "fear of ag*." Each keyword was combined (= "AND") with the keywords "experiment*" and "longitudinal." Moreover, the reference lists of included articles as well as of review articles in this field were scanned for further studies. Studies were included when they fulfilled the following criteria: (1) Investigation of at least one construct targeting the perception or interpretation of a person's own aging process (e.g., subjective age, ATOA, SPA, AARC) as an outcome or antecedent in relation to psychological well-being; (2) longitudinal or experimental study design; (3) aging population (i.e., middle- and old-aged) as target population (i.e., exclusion of studies targeting solely nursing home staff or adolescents). The research resulted in a selection of 24 studies. Among these, 11 targeted well-being–related antecedents of subjective aging, 10 investigated well-being–related outcomes of subjective aging, and 3 studies comprised antecedents as well as outcomes of subjective aging.

[3] Although, as has been outlined above, the various subjective aging constructs differ according to their specific features, the aim of the review is to provide an overarching picture of associations between psychological well-being and subjective aging experiences *as a whole*, thus refraining from contrasting the different subjective aging constructs with regard to their associations with psychological well-being.

Psychological Well-Being–Related Correlates of Subjective Aging

Studies targeting psychological well-being as an antecedent of subjective aging

The observational interval in the reviewed studies ranged between 1 (Bowling et al., 2005) and 17 (Avidor, Levin, & Solomon, 2016) years. Most studies point to expectation–consistent associations between psychological well-being–related antecedent variables and subjective aging experiences.[4] That is, a worse psychological well-being is linked to more negative subjective aging experiences over time.

Avidor, Levin, & Solomon (2016)

Country	Israel
Study design	Longitudinal; 17 years between T1 (1991) and T3 (2008)
Sample size	234 Israeli veterans (2 study groups: ex-prisoners of war & combat veterans who were not held captive)
% women (at T1)	0%
Age of participants (in years)	*M* = 57.00, *SD* = 5.00 at T3
Subjective aging measure	Subjective age (5-item scale: respondents rated different facets of subjective perceptions of their age as younger than, same age as, or older than one's chronological age)
Antecedent measure	Depressive symptoms
Investigation of pathways	Guilt (mediator), study group (moderator)
Control variables	Age, stressful postwar life events
Main results	Chronic and delayed depressive symptoms at T1 were associated with a higher subjective age at T3. The path from depressive symptoms at T1 to subjective age at T3 was fully explained by heightened levels of guilt-distress at T2. This mediation effect of guilt-distress was significantly stronger for ex-prisoners of war than for control veterans.

Ayalon, Palgi, Avidor, & Bodner (2016)

Country	United States
Study design	Longitudinal; 4 years between T1 (2008) and T2 (2012)
Sample size	2,591
% women (at T1)	58.20%
Age of participants (in years)	65+, *M* = 73.80, *SD* = 6.40 at T1

[4] The studies are presented in separate tables to make best possible use of the available space. Findings marked with an asterisk (*) signalize null-findings, that is, no associations between subjective aging and psychological well-being were found. Findings marked with two asterisks (**) signalize counterintuitive findings, with more positive subjective aging experiences being associated with lower psychological well-being. *M* = mean; *SD* = standard deviation; T1 = first measurement; T2 = second measurement, etc.

Ayalon, Palgi, Avidor, & Bodner (2016) (continued)

Subjective aging measure	Subjective age (accelerated increase = increase in felt age over the 4 years greater than 5 years versus accelerated decrease = increase in felt age over the 4 years lower than 3 years versus change consistent with the passage of time = increase in felt age over the 4 years between 3 and 5 years)
Antecedent measure	Depressive symptoms
Investigation of pathways	–
Control variables	Age, sex, education; change in physical difficulties, medical comorbidity, loneliness, social contacts
Main results	An increase in depressive symptoms over time resulted in an accelerated increase in subjective age over time.

Bergland, Nicolaisen, & Thorsen (2014)

Country	Norway
Study design	Longitudinal; 5 years between T1 (2002–2003) and T2 (2007–2008)
Sample size	2,471
% women (at T1)	52.37%
Age of participants (in years)	40–79, M = 56.00, SD = 10.00 at T1
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age)
Antecedent measure	Mental health (Short Form-12 questionnaire; Ware et al., 1996)
Investigation of pathways	–
Control variables	Age, sex, education, marital status, physical health, mastery
Main results	Good mental health at T1 significantly predicted a youthful subjective age at T2. Within age group specific analyses, good mental health was a predictor of a younger subjective age only in those aged 70–79 years.

Bowling, See-Tai, Ebrahim, Gabriel, & Solanki (2005)

Country	Britain
Study design	Longitudinal; 12–18 months between T1 (2000) and T2 (2001–2002)
Sample size	999 at T1; 540 at T2
% women (at T1)	50.00%
Age of participants (in years)	65+ at T1
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age)
Antecedent measure	Mental health (depression, anxiety, fears about aging)
Investigation of pathways	–
Control variables	(Change in) health and functional status
Main results	A positive mental health at T1 predicted feeling younger at T2.

Bryant, Bei, Gilson, Komiti, Jackson, & Judd (2016)

Country	Australia
Study design	Longitudinal; 9 years between T1 (2001–2002) and T2 (2010)
Sample size	419
% women (at T1)	61.58%
Age of participants (in years)	60+, *M* = 71.70, *SD* = 7.94 at T1
Subjective aging measure	SPA (subscales psychosocial loss, physical change, psychological growth)
Antecedent measure	Mental health (Short Form-12 questionnaire; Ware et al., 1996), life satisfaction
Investigation of pathways	–
Control variables	Age, partner status, financial status, employment status, personality; (change in) physical health, life satisfaction
Main results	Better baseline mental health as well as more positive changes in mental health over time predicted less negative scores on the T2 psychosocial loss scale. More positive changes in mental health over time predicted more positive scores on the T2 physical change scale. Mental health was unrelated (*) to the T2 psychological growth scale. Better baseline life satisfaction as well as more positive changes in life satisfaction over time predicted less negative scores on the T2 psychosocial loss scale. Life satisfaction was unrelated (*) to the T2 physical change scale. Better baseline life satisfaction as well as more positive changes in life satisfaction over time predicted more positive scores on the T2 psychological growth scale.

Han & Richardson (2015)

Country	United States
Study design	Longitudinal; 4 years between T1 (2008) and T2 (2012)
Sample size	3,921
% women (at T1)	56.60%
Age of participants (in years)	50–96, *M* = 65.38, *SD* = 0.21 at T1
Subjective aging measure	ATOA
Antecedent measure	Depressive symptoms
Investigation of pathways	–
Control variables	Age, sex, education, ethnicity, marital status, employment status, physical functioning, perceived age discrimination
Main results	Higher levels of T1 depressive symptoms predicted a worsening of ATOA over time.

Note. The study examined depressive symptoms both as an antecedent as well as an outcome of ATOA and is thus listed in both categories.

Levy, Slade, Kunkel, & Kasl (2002)

Country	United States
Study design	Longitudinal; 2 years between T1 (1975) and T2 (1977)
Sample size	660
% women (at T1)	48.79%
Age of participants (in years)	50–94, *M* = 63.00, *SD* = 9.23 at T1
Subjective aging measure	ATOA
Antecedent measure	Will to live (judgment that the perceived benefits of one's life outweigh the perceived hardships)
Investigation of pathways	–
Control variables	Age, sex, socioeconomic status, ethnicity, functional health, self-rated health, loneliness
Main results	Higher will to live at T1 predicted a more positive ATOA at T2.

Note. The study examined will to live both as an antecedent as well as an outcome of ATOA and is thus listed in both categories.

Miche, Elsässer, Schilling, & Wahl (2014)

Country	Germany
Study design	Longitudinal; 12 years between T1 (1992–1993) and T3 (2004–2005)
Sample size	Middle-aged: 501 at T1; 408 at T3 Young-old: 500 at T1; 352 at T3
% women (at T1)	Sample was stratified by sex
Age of participants (in years)	Middle-aged: birth cohort 1950–1952, *M* = 43.80, *SD* = 0.90 at T1 Young-old: birth cohort 1930–1932, *M* = 62.50, *SD* = 1.00 at T1
Subjective aging measure	ATOA
Antecedent measure	Depressive symptoms
Investigation of pathways	–
Control variables	Sex, education, physical health, subjective health, neuroticism, extraversion
Main results	Participants experiencing more depressive symptoms at T1 became more positive (**) in their ATOA over time.

Palgi, Ayalon, Avidor, & Bodner (2017)

Country	United States
Study design	Longitudinal; 4 years between T1 (2008) and T2 (2012)
Sample size	4,174
% women (at T1)	60.37%
Age of participants (in years)	50–96, *M* = 67.97, *SD* = 8.82 at T1
Subjective aging measure	Change in subjective age (accelerated increase = increase in felt age over the 4 years greater than 5 years vs. accelerated decrease = increase in felt age over the 4 years lower than 3 years vs. change consistent with the passage of time = increase in felt age over the 4 years between 3 and 5 years)

Palgi, Ayalon, Avidor, & Bodner (2017) (continued)

Antecedent measure	Positive affect, negative affect
Investigation of pathways	–
Control variables	Age, sex, education, change in medical conditions
Main results	An increase in positive affect and a decrease in negative affect over time predicted an accelerated decrease in felt age over time. Both changes in positive affect and negative affect were not (*) significantly associated with an accelerated increase in felt age. There was an interaction effect showing that for those with an increase in negative affect, a higher change in positive affect mitigated an accelerated increase in felt age.

Schafer & Shippee (2010a)

Country	United States
Study design	Longitudinal; 10 years between T1 (1995) and T2 (2005)
Sample size	1,668
% women (at T1)	54.10%
Age of participants (in years)	24–74, *M* = 47.28, *SD* = 12.44 at T1
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age)
Antecedent measure	Positive affect
Investigation of pathways	–
Control variables	Age, sex, education, ethnicity, household income, working status, retirement status, family adversity, family roles, health status, (change in) personal control
Main results	Diminishing positive affect over time was associated with an accelerated worsening in subjective age over time.

Schafer & Shippee (2010b)

Country	United States
Study design	Longitudinal; 10 years between T1 (1995) and T2 (2005)
Sample size	496
% women (at T1)	54.70%
Age of participants (in years)	55–74, *M* = 62.34, *SD* = 5.51 at T1
Subjective aging measure	Views about cognitive aging
Antecedent measure	Negative affect
Investigation of pathways	–
Control variables	Age, education, ethnicity, employment status, marital status, parental status, difference between felt age and chronological age, physical health, disability, sense of control, cognitively engaging activities
Main results	Adults with higher negative affect at T1 were more negative about their cognitive aging at T2.

Schelling & Martin (2008)

Country	Germany
Study design	Longitudinal; 4 years between T1 (1994) and T2 (1998)
Sample size	500 at T1; 334 at T2
% women (at T1)	48.00%
Age of participants (in years)	60.27–64.78, *M* = 62.96, *SD* = 0.90 at T1
Subjective aging measure	Attitudes toward one's own aging, with a focus on affective aspects (9 items from the Riegel-scale; Riegel & Riegel, 1960)
Antecedent measure	Depressive symptoms
Investigation of pathways	Age (moderator)
Control variables	Age, sex, education; (change in) objective and subjective health, morbidity, satisfaction with health, daily impairments, cognition
Main results	Lower T1 depressive symptoms and decreasing depressive symptoms over time contributed to the prediction of more positive attitudes toward one's own aging at T2. The importance of the resources increased with growing age.

Shenkin, Laidlaw, Allerhand, Mead, Starr, & Deary (2014)

Country	United Kingdom
Study design	Longitudinal; 3–6 years between T1 (2004–2007) and T2 (2010)
Sample size	792
% women (at T1)	49.60%
Age of participants (in years)	Birth cohort 1936, *M* = 69.50, *SD* = 0.83 at T1
Subjective aging measure	SPA (subscales psychosocial loss, physical change, psychological growth)
Antecedent measure	Depressive symptoms, anxiety
Investigation of pathways	–
Control variables	Age, sex, education, employment status, current living arrangements, social class, childhood deprivation, adult deprivation, physical functioning, cognition, personality
Main results	Higher levels of T1 depressive symptoms and anxiety predicted more negative attitudes to psychosocial loss at T2. T1 depressive symptoms and anxiety were unrelated (*) to T2 attitudes to physical change and T2 attitudes to psychological growth.

Spuling, Miche, Wurm, & Wahl (2013)

Country	Germany
Study design	Longitudinal; 6 years between T1 (2002) and T2 (2008)
Sample size	3,038 at T1; 1,771 at T2
% women (at T1)	49.70%
Age of participants (in years)	40+, *M* = 61.30, *SD* = 12.52 at T1
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age)
Antecedent measure	Depressive symptoms

Spuling, Miche, Wurm, & Wahl (2013) (continued)

Investigation of pathways	–
Control variables	Age, sex, education, place of residence
Main results	T1 depressive symptoms did not (*) predict change in subjective age over time.

Note. The study examined depressive symptoms both as an antecedent as well as an outcome of subjective age and is thus listed in both categories.

Despite ample empirical evidence for an effect of psychological well-being on subjective aging, which can be underpinned with theoretical considerations, some studies did not find any longitudinal links between psychological well-being and subjective aging. For example, Bergland et al. (2014) found that the detrimental effect of a bad mental health on subjective age is restricted to adults aged 70–79 years. Moreover, the association between mental health and depressive symptoms, respectively, seems to be stronger for loss-related as compared with gain-related subjective aging perceptions (Bryant et al., 2016; Shenkin et al., 2014). And a cross-lagged panel model by Spuling et al. (2013) suggests that the association between subjective age and depressive symptoms is unidirectional, with no effect of depressive symptoms on subjective age. There is also one counterintuitive finding: Miche et al. (2014) found that participants experiencing more depressive symptoms at baseline became more *positive* in their ATOA over the course of 12 years. The authors offer several explanations for their finding, such as regression to the mean or selective drop-out of study participants over the course of the study.

Subjective aging experiences cannot only be considered as a potential outcome of psychological well-being–related variables, but might also function as a predictor of psychological well-being–related variables in themselves.

Studies targeting psychological well-being as an outcome of subjective aging

The observational interval in the reviewed studies ranged between 6 months (Wurm et al., 2013) and 10 years (Mock & Eibach, 2011). Most studies point to expectation–consistent links between subjective aging and psychological well-being.[5] That is, more negative subjective aging experiences are linked to decreasing well-being over time.

[5] The studies are presented in separate tables to make best possible use of the available space. Findings marked with an asterisk (*) signalize null-findings, that is, no associations between subjective aging and psychological well-being were found. Findings marked with two asterisks (**) signalize counterintuitive findings, with more positive subjective aging experiences being associated with lower psychological well-being. *M* = mean; *SD* = standard deviation; T1 = first measurement; T2 = second measurement, etc.

Brothers, Gabrian, Wahl, & Diehl (2016)

Country	United States, Germany
Study design	Longitudinal; 2.5 years between T1 (2012) and T2 (2015)
Sample size	537
% women (at T1)	63.30%
Age of participants (in years)	40–98, *M* = 64.41, *SD* = 12.04 at T1
Subjective aging measure	AARC
Outcome measure	Eudaimonic understanding of well-being: subscales autonomy, environmental mastery, personal growth, purpose in life, positive relations with others, and self-acceptance (Ryff, 1989)
Investigation of pathways	Future time perspective
Control variables	Education, self-rated health
Main results	AARC gains at T1 exerted a significant direct positive effect on well-being at T2. This association was mediated by decreases in T2 AARC losses. AARC losses at T1 were not directly (*) associated with well-being at T2. However, AARC losses were indirectly related to well-being via negative associations with T2 future time perspective.

Choi & DiNitto (2014)

Country	United States
Study design	Longitudinal; 1 year between T1 (2011) and T2 (2012)
Sample size	6,680 at T1; 5,414 at T2
% women (at T1)	55.80%
Age of participants (in years)	65+, *M* = 74.31, *SD* = 1.00 at T1
Subjective aging measure	Subjective age (participants were classified as feeling younger, feeling older, or feeling the same as their chronological age)
Outcome measure	Depressive symptoms
Investigation of pathways	–
Control variables	Age, sex, ethnicity, chronic illnesses, activities of daily living, subjective health, subjective memory
Main results	Feeling older than chronological age at T1 was significantly associated with changes toward higher depressive symptoms over time, while feeling younger than chronological age at T1 was not (*) associated with change in depressive symptoms over time.

Freeman, Santini, Tyrovolas, Rummel-Kluge, Haro, & Koyanagi (2016)

Country	Ireland
Study design	Longitudinal; 2–3 years between T1 (2009–2011) and T2 (2012–2013)
Sample size	6,095
% women (at T1)	51.70%
Age of participants (in years)	50+, *M* = 63.30, *SD* = 9.00 at T1

Freeman, Santini, Tyrovolas, Rummel-Kluge, Haro, & Koyanagi (2016) (continued)

Subjective aging measure	Negative aging perceptions (Brief Aging Perceptions Questionnaire; Sexton, King-Kallimanis, Morgan, & McGee, 2014)
Outcome measure	Depressive symptoms, anxiety
Investigation of pathways	–
Control variables	Age, sex, education, employment status, number of chronic medical conditions, cognitive functioning, activities of daily living
Main results	Negative aging perceptions at T1 predicted the new onset of depression and anxiety at T2. Among those with depression or anxiety at T1, negative aging perceptions at T1 also predicted the persistence of these conditions over time.

Han & Richardson (2015)

Country	United States
Study design	Longitudinal; 4 years between T1 (2008) and T2 (2012)
Sample size	3,921
% women (at T1)	56.60%
Age of participants (in years)	50–96, *M* = 65.38, *SD* = 0.21 at T1
Subjective aging measure	ATOA
Outcome measure	Depressive symptoms
Investigation of pathways	–
Control variables	Age, sex, education, ethnicity, marital status, employment status, physical functioning, perceived age discrimination
Main results	More negative ATOA at T1 as well as a worsening ATOA over time predicted increases in depressive symptoms over time.

Note. The study examined depressive symptoms both as an antecedent as well as an outcome of ATOA and is thus listed in both categories.

Levy, Slade, Kunkel, & Kasl (2002)

Country	United States
Study design	Longitudinal; 2 years between T1 (1975) and T2 (1977)
Sample size	660
% women (at T1)	48.79%
Age of participants (in years)	50–94, *M* = 63.00, *SD* = 9.23 at T1
Subjective aging measure	ATOA
Outcome measure	Will to live (judgment that the perceived benefits of one's life outweigh the perceived hardships)
Investigation of pathways	–
Control variables	Age, sex, socioeconomic status, ethnicity, functional health, self-rated health, loneliness
Main results	More positive ATOA at T1 predicted higher will to live at T2.

Note. The study examined will to live both as an antecedent as well as an outcome of ATOA and is thus listed in both categories.

Mock & Eibach (2011)

Country	United States
Study design	Longitudinal; 10 years between T1 (1994–1995) and T2 (2004–2006)
Sample size	1,170
% women (at T1)	52.90%
Age of participants (in years)	40+, *M* = 53.71, *SD* = 9.08 at T1
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age)
Outcome measure	Positive affect, negative affect, life satisfaction
Investigation of pathways	Aging attitudes (subtracting the ratings of life for people in their 20s from the ratings of life for people in their 60s) (moderator)
Control variables	Age, sex, socioeconomic status, marital status, employment status, chronic health conditions, subjective health
Main results	More favorable aging attitudes at T1 and decreasing felt ages over time were associated with changes toward more positive affect and life satisfaction and less negative affect over time. The association between felt age and negative affect and life satisfaction, however, was moderated by aging attitudes: Changes toward older subjective age predicted changes toward higher negative affect and lower life satisfaction when aging attitudes were less favorable but not when aging attitudes were more favorable.

Segel-Karpas, Palgi, & Shrira (2017)

Country	United States
Study design	Longitudinal; 9.5 years between T1 (1995–1996) and T2 (2004–2006)
Sample size	3,591
% women (at T1)	45.40%
Age of participants (in years)	*M* = 47.28, *SD* = 12.39
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age, divided by chronological age)
Outcome measure	Diagnosis of major depressive disorder
Investigation of pathways	–
Control variables	Age, sex, education, ethnicity, marital status, morbidity
Main results	Subjective age at T1 did not (*) predict change in diagnosis of major depressive disorder over time.

Spuling, Miche, Wurm, & Wahl (2013)

Country	Germany
Study design	Longitudinal; 6 years between T1 (2002) and T2 (2008)
Sample size	3,038 at T1; 1,771 at T2
% women (at T1)	49.70%
Age of participants (in years)	40+, *M* = 61.30, *SD* = 12.52 at T1
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age)
Outcome measure	Depressive symptoms

Spuling, Miche, Wurm, & Wahl (2013) (continued)

Investigation of pathways	–
Control variables	Age, sex, education, place of residence
Main results	Older felt ages at T1 predicted increases in depressive symptoms over time.

Note. The study examined depressive symptoms both as an antecedent as well as an outcome of subjective age and is thus listed in both categories.

Stephan, Sutin, Caudroit, & Terracciano (2016)

Country	United States
Study design	Longitudinal; 2 years between T1 (2008) and T2 (2010)
Sample size	5,809 at T1; 3,631 at T2
% women (at T1)	59.00%
Age of participants (in years)	50+, *M* = 69.30, *SD* = 9.61 at T1
Subjective aging measure	Subjective age (discrepancy between chronological age and felt age, divided by chronological age)
Outcome measure	Depressive symptoms
Investigation of pathways	–
Control variables	Age, sex, education, ethnicity, body mass index, medical illnesses, memory performance
Main results	A younger subjective age at T1 was associated with fewer increases in depressive symptoms over time.

Weiss & Lang (2009)

Country	Germany
Study design	Experimental
Sample size	228
% women (at T1)	72.00%
Age of participants (in years)	19–88, *M* = 52.00, *SD* = 17.90
Subjective aging measure	Manipulation of identity salience (age group identification vs. generation identification)
Outcome measure	Sense of environmental mastery and personal self-esteem (adapted from Ryff, 1989)
Investigation of pathways	–
Control variables	Sex, education, income, subjective health
Main results	Older adults' identification with their age group led to lower levels of psychological well-being. In contrast, older adults' identification with their generation led to higher levels of well-being.

Wurm & Benyamini (2014)

Country	Germany
Study design	Longitudinal; 3 years between T1 (2008) and T2 (2011)
Sample size	6,205 at T1; 2,858 at T2
% women (at T1)	49.50%
Age of participants (in years)	40–85, *M* = 61.50, *SD* = 12.10 at T1
Subjective aging measure	SPA (subscale physical losses)
Outcome measure	Depressive symptoms
Investigation of pathways	Optimism (moderator)
Control variables	Age, sex, education, place of residence, physical conditions
Main results	Negative SPA predicted deterioration in depressive symptoms over a 3-year period. This association was moderated by optimism: People who were prepared for physical losses (negative SPA), and who were nevertheless optimistic, were better able to maintain lower depressive symptoms.

Wurm, Tomasik, & Tesch-Römer (2008)

Country	Germany
Study design	Longitudinal; 6 years between T1 (1996) and T2 (2002)
Sample size	1,286
% women (at T1)	47.50%
Age of participants (in years)	40–85, *M* = 57.07, *SD* = 10.81 at T1
Subjective aging measure	SPA (subscale ongoing development)
Outcome measure	Life satisfaction
Investigation of pathways	–
Control variables	Age, sex, education, income, occupational prestige, living arrangement, place of residence, physical illnesses, functional limitations
Main results	Positive SPA at T1 positively affected change in life satisfaction over time, even in the face of a serious health event.

Wurm, Warner, Ziegelmann, Wolff, & Schüz (2013)

Country	Germany
Study design	Longitudinal; 6 months between T1 and T2 (2009)
Sample size	309
% women (at T1)	41.70%
Age of participants (in years)	65–85, *M* = 73.27, *SD* = 5.10 at T1
Subjective aging measure	SPA (subscale physical losses)
Outcome measure	Life satisfaction
Investigation of pathways	Occurrence of a serious health event (predictor); selection, optimization, compensation (SOC; P. Baltes, 1997) strategies (mediator)

Wurm, Warner, Ziegelmann, Wolff, & Schüz (2013) (continued)

Control variables	Age, sex, education, number of illnesses, serious health events between T1 and T2
Main results	Although negative SPA in general were not directly associated with lower life satisfaction (*), negative SPA after a serious health event were associated with life satisfaction through lower SOC strategy use.

Despite many expectation–consistent findings, Choi and DiNitto (2014) did not find an association between younger felt ages and depressive symptoms. In addition, the association between subjective age and clinically relevant symptoms of depression seems to be negligible (Segel-Karpas et al., 2017). Moreover, Wurm and Benyamini (2014) suggest that the detrimental effect of negative SPA on depressive symptoms is buffered for individuals reporting high levels of optimism. Similarly, a study by Mock and Eibach (2011) revealed that the harmful effect of older felt ages on negative affect and life satisfaction was restricted to individuals with unfavorable aging attitudes.

Studies targeting the directionality regarding the association between subjective aging and psychological well-being

Most studies reviewed target psychological well-being either as an antecedent or as an outcome of subjective aging experiences. The only study with a simultaneous assessment of antecedents and outcomes, thus allowing to contrast different directions of effect, was a cross-lagged panel design by Spuling et al. (2013). They found that subjective age predicts change in depressive symptoms six years later in middle- and old-aged adults, whereas the reverse direction (i.e., depressive symptoms predicting change in subjective age) was not significant. Similar results have been found in the domain of health and physical functioning, with subjective aging experiences exerting stronger effects on health than vice versa (Levy, Slade, & Kasl, 2002; Sargent-Cox, Anstey, & Luszcz, 2012; Wurm et al., 2007).

Consequently, subjective aging experiences seem to be a rather robust construct as compared with measures of physical and mental health. Subjective aging experiences are deeply incorporated into an aging person's self-concept and personal identity, particularly with growing age (Diehl et al., 2014; Westerhof et al., 2012). Hence, they may express a great stability and robustness over time.

Shortcomings of Current Research

Importance of Considering Negative Affectivity

Although the literature review encompassed a wide array of psychological well-being–related constructs to provide an extensive overview of this research area, it seems reasonable to have a closer look at one construct cluster, namely (absence of) negative affectivity (i.e., feelings of sadness, depression, negative affect). The decision to focus on negative affectivity was driven by two considerations: First, (subsyndromal) depressive symptoms and feelings of sadness are quite common in the second half of life (Beekman, Copeland, & Prince, 1999; Djernes, 2006; Luppa et al., 2012; Riedel-Heller, Busse, & Angermeyer, 2006; Sowdon, 2001) and may even increase in old age (Chui, Gerstorf, Hoppmann, & Luszcz, 2015; Kunzmann, Richter, & Schmukle, 2013). Second, late-life depressive symptoms as such are associated with adverse effects on health (Ho et al., 2014; Noël et al., 2004), cognitive performance (Bunce et al., 2014; Montejo et al., 2014), social functioning (Furukawa et al., 2011; Kennedy et al., 2007; Szanto et al., 2012), and mortality (Cuijpers et al., 2014; Gallo et al., 2005; Zivin et al., 2015). High levels of depressive symptoms and negative affect can therefore be considered as an essential threat to life quality. Given their pivotal role in terms of successful aging, a better understanding of negative affectivity is warranted.

However, as will be outlined in the following sections, associations between negative affectivity and subjective aging experiences are not fully understood so far based on the existing studies on well-being–related correlates of subjective aging experiences. The available studies in this area have some shortcomings and raise some questions. More precisely, the limitations refer to the operationalization of subjective aging experiences, to the understanding of fundamental associations between subjective aging experiences and negative affectivity as well as to the examination of potential pathways which underlie this association.

Operationalization of Subjective Aging

Most research in the subjective aging field operationalizes subjective aging experiences as felt age (relative to chronological age) (i.e., subjective age; Rubin & Berntsen, 2006) or as ATOA (Lawton, 1975). As already indicated above, these instruments have,

despite their parsimonious character, a severe limitation in that they neglect the multifaceted character of life-span development (Diehl et al., 2014). The recently introduced concept of AARC advocated by Diehl and Wahl (2010) aims at overcoming this limitation by acknowledging that aging experiences are perceived as gains and losses varying across different life domains. However, research on AARC is still at its beginnings. It thus remains unclear whether the findings on an association between subjective aging experiences and negative affectivity can be generalized to the multifaceted character of the AARC concept. One could ask, for example, whether the global evaluation of the aging process as a whole (i.e., subjective age, ATOA) qualitatively differs from the substantive processing of aging experiences (i.e., AARC) with regard to associations with negative affectivity. For example, Forgas (1995) assumes within his *affect infusion model* that the sensitivity of judgments to affective states differs depending on the respective processing mode. Hence, further research on the AARC construct seems warranted.

Fundamental Associations Between Subjective Aging and Negative Affectivity

First, regarding negative affectivity as an *antecedent* of subjective aging experiences, findings based on longitudinal datasets are mixed, with some studies pointing to expectation-consistent effects of negative affectivity on subjective aging (e.g., Bowling et al., 2005), some suggesting the absence of any associations (Bryant et al., 2016; Shenkin et al., 2014), and others even revealing counterintuitive patterns of association (Miche, Elsässer, et al., 2014). Hence, more research is needed to better understand the effect of negative affectivity on subjective aging experiences.

Research on subjective aging–related antecedents has undergone a boost in the last decades with the implementation of longitudinal studies. For example, research groups examined long-term effects of negative affectivity on subjective aging including observational intervals between 1 (Bowling et al., 2005) and 17 (Avidor et al., 2016) years. Longitudinal studies allow to draw conclusions about the timely ordering of variables. However, longitudinal studies based on questionnaire data have a low internal validity. Although most studies control for potentially confounding variables, such as age or health, the full range of confounding factors cannot be taken into account. As such, it often remains unclear whether a change in subjective aging experiences is due to changes in nega-

tive affectivity or due to changes in other factors, such as changed living conditions. This limitation is overcome with experimental studies. The randomization of study participants to different experimental groups as well as the standardization of the laboratory setting allow to control for confounding factors. To date, experimental studies in the context of subjective age have focused on the manipulation of age stereotypes and age-related information (Hess & Hinson, 2006; Kotter-Grühn & Hess, 2012; Levy, 1996; Pinquart, 2002; Weiss & Freund, 2012; Weiss, Job, Mathias, Grah, & Freund, 2016; Weiss & Lang, 2012) or have manipulated the salience of aging experiences (Eibach, Mock, & Courtney, 2010; Gabrian & Wahl, 2017; Hughes et al., 2013; Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2013). However, no study is available which investigates the plasticity of subjective aging due to psychological well-being (i.e., current affectivity) within an experimental paradigm. Although a daily diary study by Kotter-Grühn et al. (2015) conducted over eight consecutive days suggests short-term associations between subjective aging and negative affect, it does not allow to draw causal conclusions.

Second, regarding negative affectivity as an *outcome* of subjective aging experiences, most longitudinal studies found robust effects (e.g., Freeman et al., 2016). Nevertheless, recent evidence points to an absence of associations (Choi, DiNitto, & Kim, 2014; Segel-Karpas et al., 2017) or suggests that the effect of subjective aging experiences on negative affectivity is restricted to some individuals depending on other variables (Mock & Eibach, 2011; Wurm & Benyamini, 2014; see also considerations in the following paragraph). Hence, we do not yet fully understand the effect of subjective aging experiences on negative affectivity.

Third, most studies in the area of subjective aging and negative affectivity target the latter as antecedents *or* outcomes of subjective aging. Less is known, however, about the *directionality* of this association (for an exception, see Spuling et al., 2013).

Pathways Underlying the Association Between Subjective Aging and Negative Affectivity

Recent research has primarily focused on the examination of basal associations between subjective aging experiences and negative affectivity. Although, as outlined above, theoretical considerations suggest a number of pathways underlying this association, so far little attention has been paid to the empirical investigation of these pathways. One can

assume, for example, that the effect of subjective aging experiences on negative affectivity is *moderated* by other constructs, that is, the strength of the association might differ depending on individual differences. Moreover, the effect of subjective aging experiences on negative affectivity might also be *mediated* by a number of other constructs (see also *stereotype embodiment theory*; Levy, 2009).

Regarding *moderators*, the field is poorly explored. Theoretical models, such as the *stereotype embodiment theory* (Levy, 2009) have primarily focused on mediators in the association between subjective aging experiences and developmental outcomes. Moderators in this association have been largely neglected within theoretical considerations specific to subjective aging. Notwithstanding this, the study results of two research groups (Mock & Eibach, 2011; Wurm & Benyamini, 2014) suggest that the effect of subjective aging experiences on depressive symptoms or negative affect differs depending on individual dispositions (i.e., optimism, aging attitudes). These findings challenge the robustness of the subjective aging—negative affectivity association. It seems warranted to extend these findings by taking into account other possible moderators for the effect of subjective aging experiences on negative affectivity.

Regarding *mediators*, we still do not know how subjective aging experiences translate into depressive symptoms. Although, as described above, Levy (2009) proposes as part of her *stereotype embodiment theory* several pathways linking subjective aging experiences to developmental outcomes (i.e., psychological, behavioral, physiological pathways; see above and Figure 1.1), empirical evidence for such mediators is lacking, particularly with regard to psychological well-being as an outcome variable (Wurm et al., 2017). A small number of studies investigating mediating pathways between subjective aging experiences and psychological well-being is available. As such, Brothers et al. (2016) found that future time perspective mediates the association between AARC losses and an eudaimonic understanding of well-being. Wurm et al. (2013) suggest that negative SPA after a serious health event are associated with life satisfaction through lower use of coping strategies. Even so, the field of examined mediators is still restricted to a small number of selected mediators and to a specific measure of psychological well-being.

Contribution of the Present Dissertation

The present dissertation aims at contributing to the growing body of subjective aging research with four individual studies presented in Chapters 2–5. More precisely, this dissertation aims at investigating associations between subjective aging experiences and negative affectivity. Before discussing the research questions, the central constructs that are included in the research questions, that is, negative affectivity and subjective aging experiences, will be clarified.

Concepts Used in the Present Dissertation

Negative affectivity, in this dissertation, includes depressive symptoms (Papers 1–3) and negative affect, with the latter also referred to as sad mood (Paper 4). Depressive symptoms comprise worry, anxiety, lethargy, feelings of overstrain, concentration difficulties, restless sleep, feelings of loneliness, sadness, or absence of happiness and optimism, persistent during the last week (Radloff, 1977). In clinical contexts, depressive symptoms are often understood as a categorical diagnosis. As such, patients are assigned to categories of either no depressive disorder, unspecified depressive disorder, or major depressive disorder depending on the number of symptoms they report (American Psychiatric Association, 2013). However, Bowins (2015) argues that such discrete categories are a social construction, whereas depressive symptoms naturally operate on the basis of a continuum. Understanding depressive symptoms as a dimensional phenomenon allows to take into consideration quantitative interindividual differences regarding the severity of depressive symptoms, thereby also including non-pathologic persons (Bowins, 2015). This approach is also taken within this dissertation: Depressive symptoms are understood as a spectrum ranging from no-to-severe symptoms. Negative affect/ sad mood is understood as current feelings of pessimism, dissatisfaction, resignation, dejection, and sadness (Gluth, Ebner, & Schmiedek, 2010).

Subjective aging experiences, in this dissertation, include AARC (Papers 1–3) and subjective age (Paper 4). The AARC construct is innovative and built on a broad and established theoretical foundation (i.e., reflections on the multifaceted nature of development) (Diehl & Wahl, 2010). It thus seems promising to further investigate the role of AARC within life-span developmental psychology in order to determine its empirical usefulness. Hence, emphasis is put on the investigation of the AARC construct in this dissertation. The

examination of the AARC construct seems particularly promising with regard to longitudinal studies covering several years (Papers 1–3). As AARC captures changes in concrete everyday experiences which may unfold over a longer time period, this measurement instrument seems well-suited here. Paper 4, however, follows a different approach. An experimental mood-induction paradigm was implemented to investigate immediate effects of an induced sad mood on subjective aging. As such, Paper 4 allowed the investigation of short-term dynamics between sad mood and subjective aging experiences. Given the experimental study design, subjective age seems to be the most suitable construct, as it is easy to administer and rapidly accessible. Instead of being rooted in concrete everyday experiences, subjective age encompasses a global evaluation of the aging process as a whole, which might display more plasticity in the short term as a response to immediate internal and external stimuli (i.e., current mood) as compared with AARC.

Some of the above-mentioned shortcomings regarding the current research are addressed within the scope of this research framework, such that the dissertation fills a number of research gaps. An overview of the research questions addressed within the dissertation is provided in Table 1.1 and in Figure 1.2.

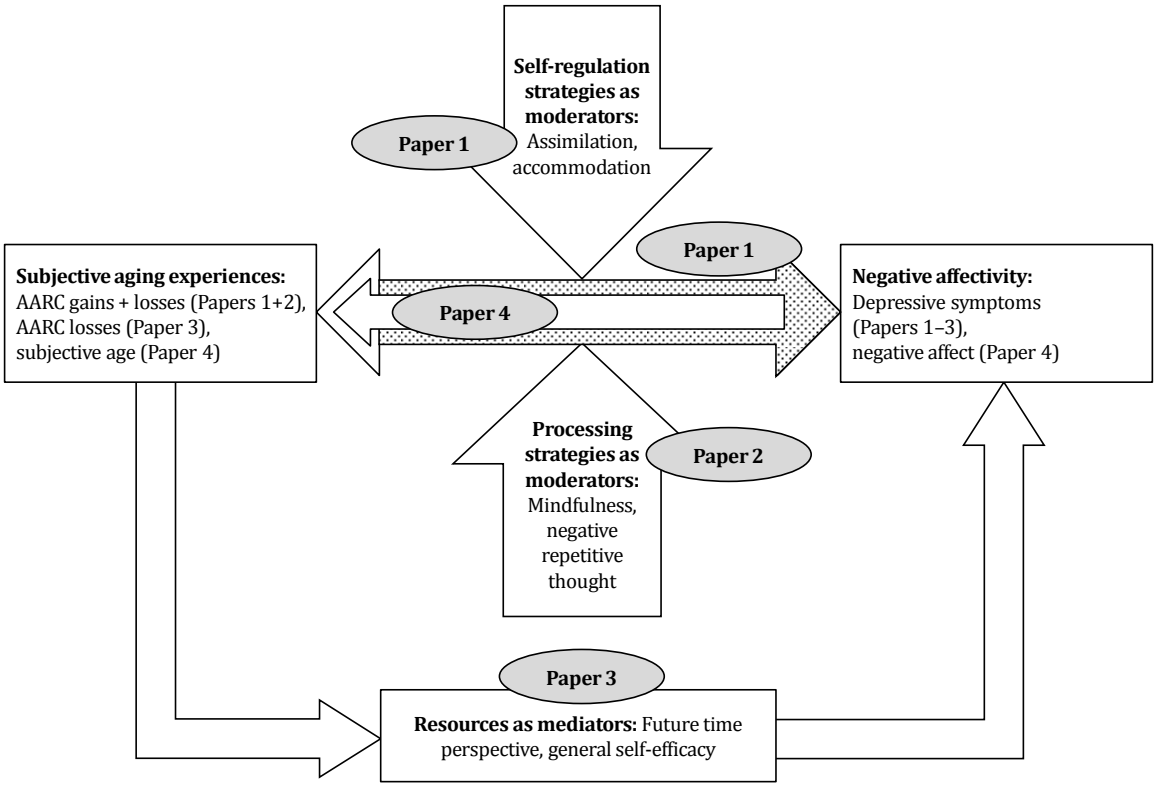


Figure 1.2. Research questions addressed in the present dissertation.

Research Questions of the Present Dissertation

Fundamental associations between subjective aging and negative affectivity

First, to address the inconclusive state of research with regard to well-being–related *antecedents* of subjective aging, Paper 1 examined the longitudinal effect of depressive symptoms on perceived age-related gains and losses (AARC) based on two measurement points covering a 2.5-year observational interval. In order to enrich the use of study designs, an experimental mood-induction paradigm was adopted in Paper 4 to explore whether current states of negative affect translate into worse subjective aging experiences. Subjective aging experiences were operationalized as felt age relative to chronological age. Participants were asked to indicate their felt age as a number (Rubin & Berntsen, 2006) and to locate their felt age on a visual analogue scale (Hughes et al., 2013). The use of a visual analogue scale has not been widely distributed in subjective aging research so far, so that Paper 4 also allows to test a relatively new measurement approach.

Second, regarding negative affectivity as an *outcome*, Papers 1–3 examined the longitudinal effect of AARC on depressive symptoms, based on a 2.5-year and a 4.5-year observational interval, respectively. Moreover, previous findings on multidirectional subjective aging constructs point to stronger associations of perceived age-related losses as compared with perceived age-related gains on developmental outcomes (e.g., Brothers et al., 2017). Due to their inclusion of both AARC scales, Papers 1 and 2 allow to contrast the predictive power of AARC losses with the explanatory value of AARC gains.

Third, a further aim of this dissertation, targeted in Paper 1, was to investigate the *directionality* of effects in the association between AARC and negative affectivity. AARC gains and AARC losses, respectively, and depressive symptoms were considered similarly at two time points to explore whether their association is uni- or bidirectional.

Pathways underlying the association between subjective aging and negative affectivity

Paper 1 takes into account assimilative and accommodative self-regulation strategies (Brandtstädter & Rothermund, 2002) as potential *moderators* for the effect of AARC gains and AARC losses on depressive symptoms based on a 2.5-year observational interval. The assimilative mode is characterized by a tenacious goal pursuit, meaning that people try actively to change their life circumstances or behavior (e.g., through increased ef-

fort or acquisition of new skills) to reach their goals. The accommodative mode is characterized by a flexible goal adjustment, which implies the adaptation of previous goals to changed circumstances or the positive reappraisal of an inconvenient situation. The idea is that an optimal fit between a person's preferred self-regulation strategy and his or her perceived resource status (in terms of AARC) is adaptive. In contrast, a too early, "premature" shift to accommodative modes despite high perceived resources might be detrimental as the person gives up too soon instead of exploiting reserve capacities. In the same way, adhering to a certain goal despite diminishing perceived possibilities to achieve this goal might be inefficient and impede the orientation towards other, more promising goals, resulting in higher levels of depressive symptoms.

As research on moderating pathways in the subjective aging—psychological well-being association is scarce, it seems necessary to have a closer look at other potential moderators, too. As such, in Paper 2, processing strategies (i.e., mindfulness and negative repetitive thought) were investigated as moderators for the association between AARC gains and AARC losses and depressive symptoms based on a 4.5-year observational interval. The idea is that the effect of subjective aging on depressive symptoms depends on the way such aging–related thoughts are processed. An open, accepting, and non-judging attitude (i.e., mindfulness) towards perceived age-related changes might protect an individual with more negatively toned AARC against feelings of depressive symptoms. Conversely, persistently and inflexibly thinking about perceived age-related shortcomings might exacerbate feelings of depression.

Moreover, Paper 3 investigates future time perspective and general self-efficacy (i.e., the psychological pathway as defined by Levy, 2009) as potential *mediators* in the association between perceived age-related losses and depressive symptoms. The decision to focus on future time perspective and general self-efficacy was driven by the idea that these constructs tap two main resource clusters, namely the perception of so-called energies (i.e., time), as well as the perception of personal characteristics (i.e., competence) (Hobfoll, 1989). Thus the consideration of both future time perspective and general self-efficacy allows investigating the mediating role of two distinct yet essential individual resources. By drawing on three measurement points covering a 4.5-year observational interval, Paper 3 addresses the chronological sequence of AARC losses, future time perspective, general self-efficacy, and depressive symptoms.

Table 1.1. Research Questions Addressed in the Present Dissertation

Thematic Area	Specific Research Question	Addressed in Paper #
Fundamental Associations Between Subjective Aging and Negative Affectivity		
Depressive symptoms and negative affect as antecedents of awareness of age-related change and subjective age	• Do depressive symptoms predict change in perceived age-related gains and losses over 2.5 years?	#1
	• Can subjective age be modified by a sad mood induction?	#4
	• Does a sad mood induction translate into older felt ages on different measurement approaches?	#4
	• Does the effect of a sad mood induction on subjective age hinge on chronological age?	#4
	• Does the effect of a sad mood induction on subjective age hinge on neuroticism?	#4
Depressive symptoms as outcomes of awareness of age-related change	• Do perceived age-related gains and losses predict change in depressive symptoms over 2.5 years?	#1
	• Do perceived age-related gains and losses predict change in depressive symptoms over 4.5 years?	#2 / #3
	• Does the explanatory power of perceived age-related changes regarding change in depressive symptoms differ depending on whether gains or losses are considered?	#1 / #2
	• Does the explanatory power of perceived age-related gains and losses regarding change in depressive symptoms over 2.5 years hinge on chronological age?	#1
Directionality of associations between awareness of age-related change and depressive symptoms	• Are the longitudinal associations over 2.5 years between perceived age-related gains and losses and depressive symptoms bidirectional or unidirectional?	#1
Pathways Underlying the Association Between Subjective Aging and Negative Affectivity		
Invididual differences as moderators for the effect of awareness of age-related change on depressive symptoms	• Does the explanatory power of perceived age-related gains and losses regarding change in depressive symptoms over 2.5 years hinge on self-regulation strategies, that is, assimilation and accommodation?	#1
	• Does the explanatory power of perceived age-related gains and losses regarding change in depressive symptoms over 4.5 years hinge on processing strategies, that is, mindfulness and negative repetitive thought?	#2
	• Does the moderating role of mindfulness and negative repetitive thought hinge on chronological age?	#2
Individual resources as mediators for the effect of awareness of age-related change on depressive symptoms	• Is the association between perceived age-related losses and change in depressive symptoms over 4.5 years mediated by future time perspective and general self-efficacy?	#3
	• Does the mediating role of future time perspective and general self-efficacy hinge on chronological age?	#3

2

Awareness of Age-Related Change and Depressive Symptoms in Middle and Late Adulthood: Longitudinal Associations and the Role of Self-Regulation and Calendar Age

[1]Anne Josephine Dutt, [1]Martina Gabrian, and [1]Hans-Werner Wahl

[1]Department of Psychological Aging Research,
Heidelberg University, Germany

Dutt, A. J., Gabrian, M., & Wahl, H.-W. (2016). Awareness of age-related change and depressive symptoms in middle and late adulthood: Longitudinal associations and the role of self-regulation and calendar age. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, Advance online publication. doi:10.1093/ geronb/gbw095

Abstract

Objectives: Studies that examine bidirectional relations between subjective aging and depressive symptoms have remained rare. We addressed this issue by investigating longitudinal linkages between awareness of age-related change (AARC) and depressive symptomatology in midlife and old age. Assimilative and accommodative self-regulation strategies and calendar age were studied as moderators.

Method: Analyses were based on two measurements (Time 1: 2012, *N* = 423 (40-98 years); Time 2: 2015, *N* = 356). AARC was operationalized as perceived age-related gains and losses. Data were analyzed by means of a cross-lagged panel model and multiple regression.

Results: Perceived losses but not gains had an effect on change in depressive symptoms over time. The reverse effect with depressive symptoms predicting change in AARC was not significant. The association between perceived gains but not losses and change in depressive symptoms was moderated by self-regulation; when perceived gains were low, less increase in depressive symptoms was reported when accommodation was high. The association between AARC and change in depressive symptoms was stable across the entire second half of the life span.

Discussion: Results suggest that a better integration of research on subjective aging with clinically relevant developmental outcomes is a promising future pathway.

Keywords: Subjective aging, Accommodation, Assimilation

Introduction

Depression ranks among the ten leading contributors to the global disease burden (Murray & Lopez, 1997) and reveals considerable frequency in middle and late adulthood, with prevalence rates including subclinical depressive states amounting to approximately 30% (Luppa et al., 2012). Late-life depressive symptoms are associated with adverse effects on health (Ho et al., 2014), cognition (Bunce et al., 2014), social functioning (Szanto et al., 2012), and mortality (Gallo et al., 2005). Less is known, however, about specific antecedents of depressive symptoms in middle and late adulthood. We argue that, although the connection between calendar age and depressive symptoms is weak (Jorm, 2000), subjective interpretations of one's aging might represent a major correlate of depressive symptoms. Conceptualizations of subjective aging have received a number of new impulses (Diehl & Wahl, 2015; Diehl et al., 2014) and we concentrate on the newly introduced concept of awareness of age-related change (AARC; Diehl & Wahl, 2010). Longitudinal analyses have remained rare regarding the AARC construct, but we are able to offer a 2.5-year observational period.

Awareness of Age-Related Change and Depressive Symptoms

A number of subjective aging constructs have been established, for example, subjective age (Rubin & Berntsen, 2006) or attitudes to aging (Laidlaw et al., 2007). They are associated with depressive symptoms cross-sectionally (e.g., Keyes & Westerhof, 2012), with more positive subjective aging experiences being linked to fewer depressive symptoms. Findings from longitudinal studies are mixed, with some studies pointing to associations consistent with expectations (e.g., Bowling et al., 2005) and others suggesting weak or no longitudinal linkages (Shenkin et al., 2014). Studies able to disentangle the direction of effects have remained rare. To our knowledge, the only study that examined bidirectional associations between subjective aging and depressive symptoms is a cross-lagged panel study by Spuling, Miche, Wurm, and Wahl (2013). They found that baseline subjective age predicts change in depressive symptoms 6 years later in adults aged 40 years and older; however, the reverse direction did not reach significance.

Given the limited consideration of these previous subjective aging conceptualizations regarding its multidirectionality and multidimensionality (Diehl et al., 2014), the construct of AARC has been established by Diehl and Wahl (2010). AARC "[…] refers to all

those experiences that make a person aware that his or her behavior, level of performance, or ways of experiencing his or her life have changed as a consequence of having grown older […]" (p. 340). AARC aims to capture the awareness of positive (AARC gains) and negative (AARC losses) age-related changes, irrespective of objective occurrences related to aging. AARC can thus also be considered as a measure of resources perceived or not perceived in one's aging process. In contrast to attitudes to aging (Laidlaw et al., 2007), AARC focuses on concrete everyday behaviors and experiences (Brothers et al., 2017). The AARC items are based on conceptual reasoning (Diehl & Wahl, 2010) as well as on empirical research targeting everyday aging awareness experiences (Miche, Wahl, et al., 2014); as a result, AARC covers five behavioral domains central to gain- and loss-related aging experiences, that is, health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive/social-emotional functioning, and lifestyle and engagement.[6] By specifying gains and losses, AARC differs from unidimensional subjective aging constructs, such as subjective age and attitude toward own aging (Lawton, 1975), which treat positive and negative experiences as two ends of the same continuum. Brothers and colleagues (2017) found that AARC is able to add explained variance regarding well-being–related outcomes over and above unidimensional subjective aging constructs. However, their study was cross-sectional. Accordingly, a first aim was to explore the longitudinal associations between AARC and depressive symptoms. We understand depressive symptoms as a continuum ranging from no-to-severe depressive symptoms, rather than adopting a categorical classification.

Based on theoretical considerations, different longitudinal operating mechanisms seem plausible: AARC as an antecedent of change in depressive symptoms and depressive symptoms as an antecedent of change in AARC.

[6] Although exploratory and confirmatory factor analyses point to a high stability of the AARC gains and AARC losses subscales across different samples (Diehl et al., 2013), the construction of domain-specific subscales was found to be less robust. Hence, domain-specific analyses should currently be done with caution. We refrain from reporting domain-specific results for the AARC construct, and focus on the global subscales of AARC gains and AARC losses instead. That is, the multidimensionality of the AARC construct is considered more at the theoretical and content-related level than at the empirical level.

AARC as an antecedent of change in depressive symptoms

Cognitive, motivational, and behavioral mechanisms might underlie predictive effects of AARC on change in depressive symptoms. Regarding cognitive mechanisms, AARC captures attributions on internal, stable, and global causes, that is, age. This attributional style in the case of negative events (i.e., high AARC losses) strengthens depressive symptoms, whereas it is beneficial when it comes to the explanation of positive events (i.e., high AARC gains) (Sanjuan & Magallares, 2015). In terms of motivational pathways, people aim at maintaining a consistent self-view, resulting in mechanisms of self-verification (Swann, 1983). AARC should affect depressive symptoms via a selective perception of information consistent with the valence of the perceived age-related changes. AARC may also exert an effect on depressive symptoms through behavioral investments. For example, the perception of age-related gains may be associated with beneficial health behaviors, such as physical activity (e.g., Wurm et al., 2010) and adaptive coping strategies (e.g., Wurm et al., 2013), which are associated with fewer depressive symptoms (e.g., Khalaila & Litwin, 2014; Sanjuan & Magallares, 2015).

Depressive symptoms as an antecedent of change in AARC

Depressive symptoms may act as a filter through which age-related changes are perceived. The evaluation of one's aging process requires the reflection upon past and current experiences. An individual's mood can prime memories and impact judgments (Forgas, 1995). Depressive symptoms are associated with developmental outcomes, for example, health (Ho et al., 2014), cognition (Bunce et al., 2014), and social functioning (Szanto et al., 2012). When these changes are misattributed to increasing age, AARC might be tainted by depressive symptoms.

Longitudinal studies that concurrently explore bidirectional relations between subjective aging and depressive symptoms have remained rare. However, studies revealed stronger effects of subjective aging on change in physical health—a correlate of AARC (Brothers et al., 2017)—than the other way around (Sargent-Cox et al., 2012; Wurm et al., 2007). Based on these findings, and in line with Spuling and colleagues (2013), we assumed that the effect of AARC on change in depressive symptoms is stronger than the converse.

Previous findings pointed to stronger associations between loss-related subjective aging and developmental outcomes as compared with gain-related subjective aging (Brothers et al., 2017). This is in line with the finding that negative information is processed more thoroughly than positive information (Rozin & Royzman, 2001). Negative age-related changes remind the individual that life is finite, thus being more diagnostically relevant than positive ones. Hence, we expected that AARC losses would exert stronger effects on change in depressive symptoms than AARC gains.

The Role of Calendar Age for the Effect of Awareness of Age-Related Change on Change in Depressive Symptoms

Theoretical considerations suggest that the role of perceived age-related gains and losses changes across the life span. In mid-adulthood, negative age-related changes are non-normative and unanticipated, thus threatening (P. Baltes, Reese, & Lipsitt, 1980). Accordingly, the effect of AARC losses on change in depressive symptoms might be stronger in middle-aged as compared with older-aged adults. Positive developments, however, are rather non-normative for older adults (Kite, Stockdale, Whitley, & Johnson, 2005). Hence, they might be particularly valued in old age. Based on these considerations, we assumed that calendar age moderates the effect of AARC on change in depressive symptoms.

The Role of Self-Regulation for the Interlinkage of Awareness of Age-Related Change and Change in Depressive Symptoms

We also claim that the association between AARC and change in depressive symptoms depends on self-regulatory processes. In respective theoretical models, self-regulation is understood as an adaptive process to minimize discrepancies between goals and reality by means of goal engagement or goal disengagement (Haase, Heckhausen, & Wrosch, 2013). An established model rather parsimoniously capturing the interplay of these modes is the *dual-process model* (e.g., Brandtstädter & Renner, 1990; Brandtstädter & Rothermund, 2002). The model distinguishes two antagonistic but complementary processes: The assimilative mode is characterized by a tenacious goal pursuit, where people actively change their life circumstances or behavior (e.g., through increased effort or search for external help) to attain their goals. The accommodative mode is characterized by a flexible goal adjustment, which includes the adaptation of goals to changed circumstances or the positive reappraisal of an inconvenient situation.

Relevantly for our work, the fit between perceived resources and the preferred self-regulation strategy plays a pivotal role in terms of depressive symptoms. A premature shift to accommodation can be detrimental because available resources are no longer being used. In the same way, adhering to a goal despite diminishing possibilities to achieve it might be inefficient and impede the orientation toward more promising goals, resulting in feelings of frustration (Brandtstädter & Rothermund, 2002). Similar predictions have been made by Wrosch and colleagues within their control-process approach; self-regulative control processes moderate the detrimental impact of age-related challenges on emotional distress (Wrosch, Schulz, & Heckhausen, 2004). Empirical findings highlight this contextual dependency and suggest that the fit between perceived resources and self-regulation plays a crucial role in sustaining high levels of well-being (e.g., Dunne, Wrosch, & Miller, 2011).

In the light of such reasoning, we expect that the beneficial effect of high AARC gains or low AARC losses on depressive symptoms is particularly pronounced when levels of assimilation are high, as resources can be optimally used to pursue goals effectively (Brandtstädter & Rothermund, 2002). At the same time, the beneficial effect of high AARC gains or low AARC losses should be weakened when levels of accommodation are high. A person with the latter resource status is at risk of missing promising opportunities due to a premature turning away from goals (Brandtstädter & Rothermund, 2002).

Conversely, in the case of high AARC losses or low AARC gains, self-regulation strategies may exert a moderating effect of an opposite direction. We assumed that the detrimental effect of high AARC losses or low AARC gains on depressive symptoms is attenuated with increasing levels of accommodation. In this case, a flexible goal adjustment helps to maintain control (Dunne et al., 2011). The detrimental effect of high AARC losses or low AARC gains on depressive symptoms should be exacerbated when levels of assimilation are high. In the face of a tenacious striving for unattainable goals, the individual will soon feel overburdened (Brandtstädter & Rothermund, 2002).

Research Aims and Hypotheses

This study examines associations between AARC and depressive symptoms. We assume bidirectional linkages between AARC and depressive symptoms, with negative associations between AARC gains and depressive symptoms and positive associations between

AARC losses and depressive symptoms (Hypothesis 1a). We assume that the effect of AARC on change in depressive symptoms is stronger than the converse (Hypothesis 1b). We expect stronger effects of AARC losses on change in depressive symptoms as compared with AARC gains (Hypothesis 1c). Calendar age is assumed to moderate the effect of AARC on change in depressive symptoms, with stronger effects of AARC gains on change in depressive symptoms in older as compared with middle-aged adults, and stronger effects of AARC losses on change in depressive symptoms in middle-aged as compared with older adults (Hypothesis 2). The AARC–depressive symptoms relation is expected to be moderated by self-regulation; the enhancing effect of high AARC gains or low AARC losses on change in depressive symptoms should be strengthened when levels of assimilation are high or when levels of accommodation are low. The detrimental effect of high AARC losses or low AARC gains on change in depressive symptoms should be weakened when levels of accommodation are high or when levels of assimilation are low (Hypothesis 3).

Method

Study Design and Participants

Data were collected from a sample of 423 German adults aged 40 years and older in 2012 (Time 1 [T1]). Participants were contacted again after 2.5 years. 356 individuals (84%) responded to our Time 2 (T2) questionnaire. 26 persons specified their reasons for dropping out, with lack of interest (35%) or time (8%) and health problems (23%) being most often mentioned. T2 participants were on average 5.66 years younger than dropouts, $t(421) = 3.64$, $p < .001$. The selectivity effect (Lindenberger, Singer, & Baltes, 2002) amounted to 0.08 standard deviations, which indicates a small effect. Thus, analyses were based on the 423 T1 participants. Missing data were replaced by the full information maximum likelihood estimate for the path analyses and via expectation maximization for the regression analyses. At T1, participants were between 40 and 98 years old ($M = 62.94$ years, $SD = 11.84$ years). Two thirds were women (64%). 61% were partnered or married. Education was high, with an average of 11.53 years ($SD = 1.96$ years) of schooling, and with more than half of the participants (55%) having a general qualification for university entrance. 40% were retired. Descriptive information of the study variables is summarized in Table 2.1.

Measures

Awareness of age-related change

AARC was measured with a 50-item scale (Brothers et al., conditionally accepted; Diehl et al., 2013). Each item is preceded by the item stem "With my increasing age, I realize that…" and comprises the description of a positive (gains) or negative (losses) experience in one out of five behavioral domains, for example, health and physical functioning. Gains and losses are assessed with 25 items each, representing evenly the five behavioral domains. An example for a positive aging experience (interpersonal relations) is "…that I am more open toward other people." An example for a negative aging experience (cognitive functioning) is "…that it is more difficult for me to learn new things." The scales were developed within a cross-cultural research collaboration, including U.S. focus groups and a German diary study. All items underwent a rigorous translation/back-translation process. Participants indicated their agreement on a 5-point Likert scale, ranging from 1 (*not at all*) to 5 (*very much*). Exploratory and confirmatory factor analyses support a two-factor structure, separating AARC gains and AARC losses (Brothers et al., conditionally accepted; Diehl et al., 2013). This structure was replicated in our sample (root mean square error of approximation [RMSEA] = .033, 90% confidence interval [CI] [.028, .037], comparative fit index [CFI] = .972 at T1; RMSEA = .041, 90% CI [.037, .045], CFI = .953 at T2). The internal consistency for the sum scores was good (Cronbach's $\alpha = .92$ for AARC gains and AARC losses at T1 and T2).

Depressive symptoms

The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) measures an individual's current level of depressive symptoms. The 10-item version used here shows good reliability and validity in old adults (Irwin, Artin, & Oxman, 1999). An example for an item formulation is "My sleep was restless" (established German version: Kohlmann & Gerbershagen, 2006). The items were evaluated on the basis of the symptoms during the past week and judged on a 4-point Likert scale, ranging from 1 (*rarely or none of the time*) to 4 (*most or all of the time*). The internal consistency was good, with Cronbach's $\alpha = .85$ at T1 and T2.

Self-regulation

Assimilation and accommodation were assessed at T2 with the Ten-Flex scales (Brandtstädter & Renner, 1990). Although assimilative and accommodative self-regulatory strategies are expected to change across the life span, with an increasing tendency toward accommodation as people age, they are also conceptualized as containing strong dispositional components (Brandtstädter & Renner, 1990). As our study covers a 2.5-year observational period, we assumed that assimilation and accommodation measured at T2 represent an individual's self-regulatory style for the entire study interval, without pronounced intra-individual change. Each Ten-Flex subscale contains 15 items, for example, "I can be very obstinate in pursuing my goals" (assimilation) or "I can adapt quite easily to changes in a situation" (accommodation). The items were answered on a 5-point Likert scale, ranging from 1 (*not at all true*) to 5 (*very true*). Both scales showed good internal consistency (Cronbach's $\alpha = .84$ for assimilation and Cronbach's $\alpha = .81$ for accommodation).

Control variables

T1 calendar age, sex, education, T1 physical health, and T1 neuroticism were used as control variables, as they are associated with the study variables (e.g., Jylhä & Isometsä, 2006; Khalaila & Litwin, 2014). Physical health was operationalized as the SF-36 physical health component summary score, which comprises eight subscales (established German version: Bullinger, Kirchberger, & Ware, 1995). Cronbach's α ranged between .76 and .93 for the eight SF-36 subscales. Sex was coded as 0 (*male*) and 1 (*female*). Education was operationalized as years of schooling. Neuroticism was assessed by the NEO five-factor inventory (established German version: Borkenau & Ostendorf, 2008). The items were rated on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The 12 items corresponding to the neuroticism subscale showed a good internal consistency (Cronbach's $\alpha = .84$).

Data Analyses

All study variables were normally distributed and did not show any nonlinear association or multicollinearity. Nine cases exhibited a *z*-standardized score with an absolute value greater than 3.29, thus being considered as outliers. Similar results were obtained

with outliers included and with outliers removed, and we report all findings for the complete sample.

Hypothesis 1 was tested via a path-analytic, cross-lagged panel design. In order to determine the longitudinal associations between AARC and depressive symptoms, we adopted a four-step approach (Martens & Haase, 2006), with different nested models being estimated: (a) a model containing the autoregressive paths (M_1); (b) M_1 including the cross-lagged paths predicting depressive symptoms from AARC (M_2); (c) M_1 including the cross-lagged paths predicting AARC from depressive symptoms (M_3); and (d) M_1 including all cross-lagged paths (M_4). Two additional models were specified, with the cross-lagged paths between AARC and depressive symptoms set equal for AARC gains (M_5) and for AARC losses (M_6) (Spuling et al., 2013). The models were compared using chi-square difference tests.[7] Pairwise parameter comparisons were used to compare the associations between AARC gains and AARC losses and depressive symptoms, respectively, within M_2.

Hypotheses 2 and 3 were tested carrying out hierarchical multiple regression analyses. Two models were tested to assess independently the incremental predictive power of the interaction terms with regard to each set of moderator variables. The variables were mean-centered and entered in separate blocks in the following order: T1 control variables, T1 depressive symptoms, T1 AARC, two-way interactions between T1 AARC and T1 calendar age for Hypothesis 2; and T1 control variables, T1 depressive symptoms, T1 AARC, T2 self-regulation, two-way interactions between T1 AARC and T2 self-regulation for Hypothesis 3.

Controlling for baseline depressive symptoms within the analyses allowed linking AARC to the residualized depressivity scores, thereby exploring the effect of AARC on rank-order changes (in the following, shortened to changes) in depressive symptoms from T1 to T2. Analogous patterns apply for the effect of depressive symptoms on AARC within the cross-lagged panel model.

[7] For reasons of parsimony, the models specified within the path analyses did not take into account bidirectional associations between AARC gains and AARC losses, as those were not part of the main study hypotheses. The extension of the final models by bidirectional links between AARC gains and AARC losses did not significantly improve the model fit. Accordingly, no such associations were assumed.

Table 2.1. Descriptive Information and Bivariate Associations Between Awareness of Age-Related Change (AARC) and Depressive Symptoms at Time 1 (T1, 2012) and Time 2 (T2, 2015)

	M (SD)	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
1. AARC gains T1	3.10 (0.65)	–							
2. AARC losses T1	2.23 (0.61)	.32***	–						
3. Depressive symptoms T1	1.76 (0.51)	-.03	.57***	–					
4. AARC gains T2	2.88 (0.69)	.64***	.27***	.10	–				
5. AARC losses T2	2.09 (0.59)	.15**	.70***	.46***	.36***	–			
6. Depressive symptoms T2	1.75 (0.49)	-.02	.44***	.58***	.07	.59***	–		
7. Assimilation[a] T2	3.17 (0.58)	.02	-.25***	-.18***	.03	-.27***	-.21***	–	
8. Accommodation[a] T2	3.57 (0.52)	.20***	-.16**	-.21***	.16**	-.21***	-.36***	.14*	–

Notes. M = mean; SD = standard deviation. All parameters reported have been adjusted by the full information maximum likelihood estimate. [a]Measured at T2 only. $N = 423$. * $p < .05$, ** $p < .01$, *** $p < .001$.

Results

Descriptive Findings

Bivariate correlations between the study constructs are displayed in Table 2.1. AARC losses were positively associated with depressive symptoms, but AARC gains were not linked to depressive symptoms, both within and between measurements.

Hypothesis 1—Longitudinal Associations Between Awareness of Age-Related Change and Depressive Symptoms

The fit indices for the models specified are displayed in Table 2.2. The model that best fit the data included the autoregressive paths and the paths predicting depressive symptoms from AARC (M_2), $\chi^2(4) = 4.34$, RMSEA = .014, 90% CI [.000, .076], CFI = 1.000 (Figure 2.1). AARC losses at T1 were positively associated with change in depressive symptoms when controlling for baseline depressive symptoms, demographic variables, physical health, and neuroticism, $\beta = .19$, $p < .01$. The effect size, calculated as *z*-value (un-standardized coefficient divided by its standard error) relative to the root of the sample size (Rosenthal, 1994), amounted to $r = .15$. AARC gains did not exert any effect on change in depressive symptoms. The effect of AARC losses on change in depressive symptoms was larger than the effect of AARC gains on change in depressive symptoms, $z = -2.67$, $p < .01$. The reverse relationship with depressive symptoms predicting change in AARC was not supported.

Hypothesis 2—The Role of Calendar Age for the Effect of Awareness of Age-Related Change on Change in Depressive Symptoms

The regression weights for the prediction of change in depressive symptoms are displayed in Table 2.3 (Model 1). Neither the T1 AARC gains × T1 Age ($\beta = .05$, $p = .265$) nor the T1 AARC losses × T1 Age ($\beta = .03$, $p = .406$) interaction terms reached significance, suggesting that the association between AARC and change in depressive symptoms is comparable across the second half of the life span.

Table 2.2. Goodness-of-Fit Summary for the Models Tested

Models	χ^2	*df*	CFI	RMSEA [90% CI]	$\Delta\chi^2$
M_1: Autoregressive paths	13.485	6	.995	.054 [.013, .094]	–
M_2: Autoregressive paths + AARC → depressive symptoms	4.344	4	1.000	.014 [.000, .076]	| M_1 – M_2 | = 9.141*
M_3: Autoregressive paths + depressive symptoms → AARC	10.830	4	.996	.064 [.019, .111]	| M_2 – M_3 | = 6.486*
M_4: Autoregressive paths + all cross-lagged paths between AARC and depressive symptoms	2.047	2	1.000	.007 [.000, .097]	| M_2 – M_4 | = 2.297
M_5: M_4 with cross-lagged paths between AARC gains and depressive symptoms set equal	4.943	3	.999	.039 [.000, .098]	| M_2 – M_5 | = 0.599
M_6: M_4 with cross-lagged paths between AARC losses and depressive symptoms set equal	3.030	3	1.000	.005 [.000, .082]	| M_2 – M_6 | = 1.314

Notes. AARC = awareness of age-related change; CFI = comparative fit index; CI = confidence interval; *df* = degrees of freedom; RMSEA = root mean square error of approximation. All analyses have been controlled for Time 1 (T1) age, sex, years of education, T1 physical health, and T1 neuroticism. All parameters reported have been adjusted by the full information maximum likelihood estimate.
$N = 423$. * $p < .05$.

Hypothesis 3—The Role of Self-Regulation for the Interlinkage of Awareness of Age-Related Change and Change in Depressive Symptoms

The regression weights for the prediction of change in depressive symptoms are displayed in Table 2.3 (Model 2). The inclusion of the T1 AARC × T2 Self-regulation interaction terms in the fifth step increased the amount of explained variance, $\Delta R^2 = .02$, $p < .05$. The T1 AARC gains × T2 Accommodation product term reached significance, $\beta = .12$, $p < .001$ (Figure 2.2). The semipartial correlation (*sr*) amounted to .12. Only *sr* of T1 depressive symptoms (.26) and T2 accommodation (-.20) were higher in the last step of the analysis. Individuals who perceived few age-related gains and at the same time were not able to adjust their goals flexibly reported stronger increases in depressive symptoms than did individuals who perceived few age-related gains but showed high levels of accommodation. The critical role of accommodative strategies did not occur when it came to the perception of many age-related gains.[8,9]

Discussion

We examined bidirectional longitudinal linkages between AARC and depressive symptoms in middle and late adulthood. Results revealed an adverse effect of AARC losses on depressive symptoms 2.5 years later when controlling for baseline depressive symptoms, demographic variables, health, and neuroticism. AARC gains did not exert any statistically meaningful effect on change in depressive symptoms. Conversely, the reverse effect with depressive symptoms predicting change in AARC was not significant. The effect of AARC on change in depressive symptoms was stable across the entire second half of the

[8] We also tested whether the adaptive value of assimilative and accommodative strategies hinges on the balance of these strategies. The effects of assimilation and accommodation on developmental outcomes are not additive, but cancel each other out (Bak & Brandtstädter, 1998). Hence, the effect of a self-regulation strategy could unfold particularly in those cases where the respective other self-regulation strategy is less strongly pronounced. However, the three-way interactions AARC × Assimilation × Accommodation did not reach significance.

[9] Theoretical considerations suggest that the two-way interactions between AARC and self-regulation differ as a function of chronological age. Middle-aged adults have multiple roles and responsibilities, and growth and achievement are still important developmental tasks. Hence, in case of a positive resource status (perception of many gains/few losses), tenaciously pursuing goals instead of flexibly adjusting them should be especially important for middle-aged adults. However, when loss experiences start to accumulate, the need to reduce assimilation in order to adjust goals might be especially promising for middle-aged adults and serve as a means to prepare for the forthcoming aging process. Accordingly, the moderating role of assimilation and accommodation for the association between AARC and depressive symptoms should be particularly pronounced in mid-adulthood. However, our analyses revealed no significant increase in the amount of explained variance when adding the three-way interactions to the model ($\Delta R^2 = .01$, $p = .358$).

life span. Accommodation moderated the association between AARC gains and change in depressive symptoms; when AARC gains were low, fewer increases in depressive symptoms were reported when accommodation was high.

Longitudinal Associations Between Awareness of Age-Related Change and Depressive Symptoms

In line with our hypothesis, results underscored a small but significant effect of AARC losses on change in depressive symptoms. The perception of more age-related losses at T1 was linked to increases in depressive symptoms. This replicates the findings of one of the rare longitudinal studies in this area, although based on another construct of aging awareness, that is, subjective age (Spuling et al., 2013). As outlined earlier, the effect of AARC losses on change in depressive symptoms may be mediated by different cognitive, motivational, and behavioral pathways. Future studies should investigate the mediating role of these mechanisms.

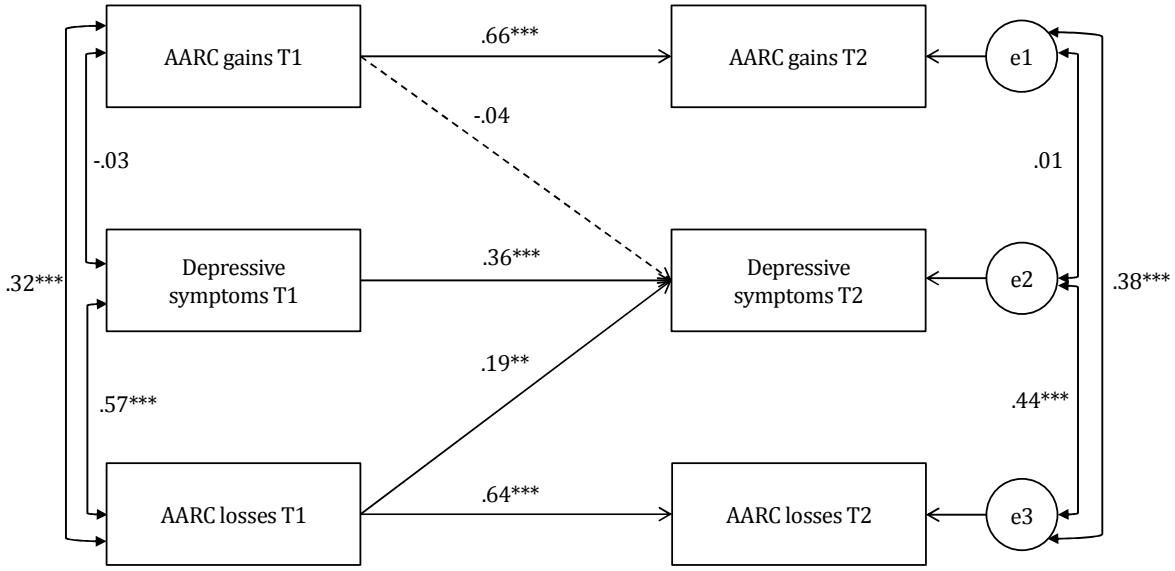


Figure 2.1. Longitudinal associations between Time 1 (T1, 2012) and Time 2 (T2, 2015) awareness of age-related change (AARC) and depressive symptoms.
Notes. e = manifest variable residual. Standardized coefficients reported. Dotted lines indicate non-significant paths. All analyses have been controlled for T1 age, sex, years of education, T1 physical health, and T1 neuroticism. All parameters reported have been adjusted by the full information maximum likelihood estimate.
$N = 423$. ** $p < .01$, *** $p < .001$.

The finding that AARC losses showed a stronger predictive power with regard to change in depressive symptoms than AARC gains is in line with our hypothesis and mirrors other findings (Brothers et al., 2016; Brothers et al., 2017). This negativity bias can be ascribed to the higher influential and contagious character of bad as compared with good events (Rozin & Royzman, 2001). The accumulation of losses reminds the individual that life is finite. Future time perspective, in turn, has an effect on well-being–related outcomes (Brothers et al., 2016). The differential role of AARC gains and AARC losses in terms of depressive symptoms highlights the need for a multidirectional perspective on life-span development (Diehl et al., 2014).

Although suggested by theoretical considerations and longitudinal findings (e.g., Bowling et al., 2005), we found no effect of depressive symptoms on change in AARC (compare with Spuling et al., 2013). This supports our hypothesis that the effect of AARC on change in depressive symptoms is stronger than the converse and mirrors the associations found between subjective aging and health outcomes (e.g., Sargent-Cox et al., 2012; Wurm et al., 2007). As the CES-D measures current levels of depressive symptomatology—which vary over time (Radloff, 1977)—it is possible that the observational interval has been too long to reveal significant effects of depressive symptoms on changes in AARC. Indeed, the cross-sectional correlations between AARC losses and depressive symptoms were significantly stronger than the bivariate associations across measurements. Future studies should consider shorter time intervals to explore the short-term effects of depressive symptoms on changes in AARC.

The Role of Calendar Age for the Effect of Awareness of Age-Related Change on Change in Depressive Symptoms

The associations between AARC and depressive symptoms were similar across the second half of the life span, suggesting that AARC gains and AARC losses play an equally important role in middle and late adulthood. It has to be taken into account that our sample included few very old adults (only 11.1% were 80 years and older at T1). The inclusion of more adults in advanced old age might have increased the probability of finding age effects.

Table 2.3. Hierarchical Multiple Regression of Change in Depressive Symptoms Between Time 1 (T1, 2012) and Time 2 (T2, 2015)

	Model 1		Model 2	
Steps	**β**	**ΔR^2**	**β**	**ΔR^2**
Control variables		.31***		.31***
Calendar age T1	-.06		-.04	
Sex	.04		.06	
Years of education	-.06		-.07	
Physical health T1	.03		.00	
Neuroticism T1	.14*		.00	
Baseline depressive symptoms		.09***		.09***
Depressive symptoms T1	.39***		.43***	
AARC		.02***		.02***
AARC gains T1	-.07		.00	
AARC losses T1	.21***		.16**	
Self-regulation		–		.05***
Assimilation T2	–		-.06	
Accommodation T2	–		-.24***	
Interaction terms: Calendar age		.00		–
AARC gains T1 × Age T1	.05		–	
AARC losses T1 × Age T1	.03		–	
Interaction terms: Self-regulation		–		.02*
AARC gains T1 × Assimilation T2	–		-.01	
AARC losses T1 × Assimilation T2	–		-.03	
AARC gains T1 × Accommodation T2	–		.12***	
AARC losses T1 × Accommodation T2	–		.03	
Total R^2		.43		.48
Adjusted R^2		.41		.47
F		30.57*** [10, 412]		27.17*** [14, 408]

Notes. AARC = awareness of age-related change. Coefficients reported refer to the last step. Dashes in cells indicate that the construct was not considered in the regression analysis. Physical health was operationalized as the SF-36 physical health component summary score. All metric predictors are based on the mean-centered variables. Degrees of freedom for the *F*-value are reported in parentheses. All parameters reported have been adjusted by the expectation maximization estimate.
$N = 423$. * $p < .05$, ** $p < .01$, *** $p < .001$.

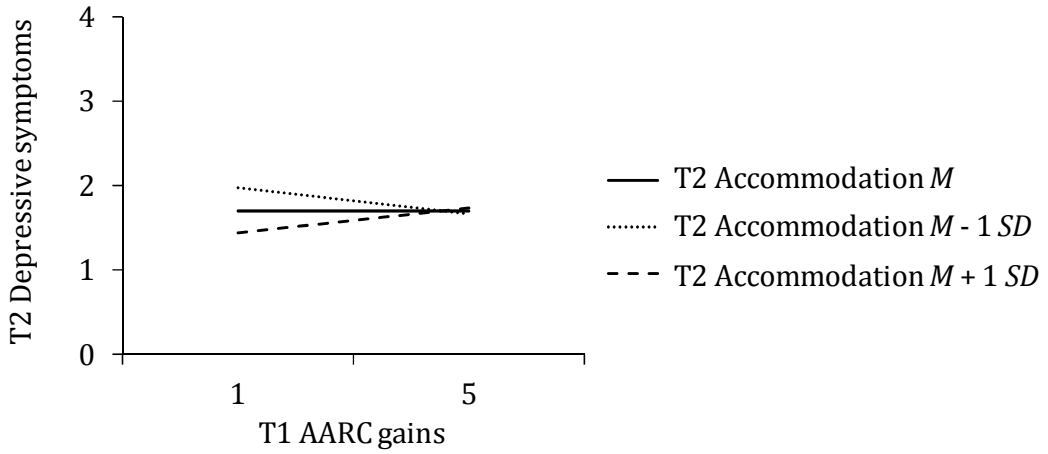


Figure 2.2. Longitudinal effect of Time 1 (T1, 2015) awareness of age-related change (AARC) gains on Time 2 (T2, 2015) depressive symptoms, moderated by T2 accommodation.
Notes. M = mean; *SD* = standard deviation. Unstandardized coefficients reported. Analyses have been controlled for T1 age, sex, years of education, T1 physical health, T1 neuroticism, and T1 depressive symptoms. Variables not included into the interaction are held constant at their mean. All parameters reported have been adjusted by the expectation maximization estimate.
N = 423.

The Role of Self-Regulation for the Interlinkage of Awareness of Age-Related Change and Change in Depressive Symptoms

The effect of AARC losses on change in depressive symptoms was stable across different levels of assimilation and accommodation, which points to a high robustness of this relation.

However, in the case of low perceived age-related gains, decreasing levels of depressive symptoms were reported when accommodative attempts were high. This finding supports our assumption that an individual's level of depressive symptoms depends on the fit between perceived resources and the preferred self-regulation strategy (Brandtstädter & Rothermund, 2002; Wrosch et al., 2004). AARC gains might not only reflect a person's perceived resource status per se, but can also represent the degree to which previously set goals have been achieved. When a person reports few and low age-related gains, he or she might feel a discrepancy between desired states (the goals set) and his or her current situation. An accommodative self-regulatory style then could help to reduce the felt discrepancy (Brandtstädter & Rothermund, 2002), thus ultimately reduc-

ing the risk of depressive symptoms.[10] However, due to the small increase in the amount of explained variance in depressive symptoms when adding the AARC × Self-regulation interaction terms, this effect should be interpreted with caution.

Unexpectedly, assimilation did not moderate the association between AARC and depressive symptoms (compare with Dunne et al., 2011). Brandtstädter and colleagues assume that assimilative attempts require a high resource status in order not to overburden the individual (Brandtstädter & Rothermund, 2002). However, a tenacious goal pursuit does not necessarily have to be reserved to resource-rich individuals. According to the *socioemotional selectivity theory* (e.g., Carstensen, 1995), increasing age and an approach of endings motivate a shift from information-related goals towards emotionally meaningful goals. Once these goals have been adopted, they can be pursued ambitiously as they are within the range of the remaining action possibilities. This theory is in line with Wrosch's and colleagues' postulate that disengagement from unattainable goals (comparable with accommodation) goes hand in hand with a subsequent re-engagement in new goals (comparable with assimilation) (Wrosch, Scheier, & Miller, 2013). Whereas goal disengagement capacities reduce psychological distress (Dunne et al., 2011), goal re-engagement capacities are associated with positive indicators of well-being, such as purpose in life (Wrosch et al., 2013).

Limitations and Future Research

The study has some limitations that have to be discussed. The sample was probably positively biased with regard to education or health. As such, caution is advisable when generalizing the results to other populations.

Self-regulation was only measured at T2. As assimilation and accommodation are considered as habitualized styles on a dispositional level (Brandtstädter & Renner, 1990), we assumed that they represent an individual's self-regulatory style for the entire study interval. However, they may also shift as a response to AARC from T1 to T2 (Wurm et al., 2013). Future studies should include longitudinal assessments of self-regulation.

The observational interval covered 2.5 years. Future studies should consider longer intervals to allow propositions about the long-term associations between AARC and depressive symptoms. Furthermore, microlongitudinal studies that investigate immediate

[10] We thank an anonymous reviewer for providing us with this idea.

linkages between AARC and depressive symptoms would allow understanding of dynamics and short-term fluctuations in the interplay between AARC and depressive symptoms.

Furthermore, AARC assesses the subjective perception of the aging process, which can differ from objective developments. Future research should include objective indicators of the aging process and explore the role of the discrepancy between objective and subjective aging processes in terms of depressive symptoms. One might assume, for example, that a positive perception of the aging process (i.e., perception of few age-related losses) despite negative objective changes may not solely be beneficial, but be a sign of a denial of the aging process, thereby hampering an adaptive handling of the changes.

In conclusion, this study is among the first examining longitudinal linkages between AARC and depressive symptoms. A central finding was that AARC losses had an effect on depressive symptoms 2.5 years later, controlling for baseline depressive symptoms, demographic variables, physical health, and neuroticism. This result highlights the need to target subjective aging experiences, particularly the negative ones, to maintain low levels of depressive symptoms.

3

Mindful vs. Mind Full: Processing Strategies Moderate the Association Between Subjective Aging Experiences and Depressive Symptoms

[1]Anne Josephine Dutt, [1]Hans-Werner Wahl, & [1]Fiona Sophia Rupprecht

[1]Department of Psychological Aging Research,
Heidelberg University, Germany

Dutt, A. J., Wahl, H.-W., & Rupprecht, F. S. (under revision). Mindful vs. Mind full: Processing strategies moderate the association between subjective aging experiences and depressive symptoms. *Psychology and Aging*.

Abstract

Recent evidence suggests that the longitudinal association between subjective aging experiences, that is, the way people perceive and evaluate their aging process, and well-being–related developmental outcomes depends on individual differences. We investigated the moderating role of two processing strategies, that is, mindfulness and negative repetitive thought (RT), for the association between subjective aging experiences and depressive symptoms in middle and old adulthood. Analyses were based on two measurements covering a 4.5-year interval (Time 1: 2012, *N* = 423 (40–98 years); Time 2: 2017, *N* = 299). Subjective aging experiences were operationalized as awareness of age-related gains and losses. Data were analyzed by means of a latent change score model based on a structural equation modeling approach. Mindfulness buffered the harmful effect of high levels of awareness of age-related losses on change in depressive symptoms. Conversely, negative RT exacerbated the detrimental effect of high levels of awareness of age-related losses and low levels of awareness of age-related gains on change in depressive symptoms. With regard to the interplay between awareness of age-related gains and mindfulness, effects were less robust, although the direction of findings was consistent with theoretical considerations. Effects were comparable across middle-aged and older adults. Subjective aging experiences are not operating in isolation, but always need to be considered in the context of the way individuals are cognitively dealing with them.

Keywords: Awareness of age-related change, Depressive symptoms, Processing strategies, Mindfulness, Negative repetitive thought

Introduction

Subjective aging experiences, that is, the way people perceive and evaluate their own aging process, are associated with well-being–related developmental outcomes on a longitudinal basis. Individuals with more negative subjective aging experiences have a higher likelihood of reporting more depressive symptoms (Han & Richardson, 2015; Spuling et al., 2013) and being less satisfied with their lives (Wurm et al., 2008).

Previous studies primarily focused on establishing an association between subjective aging experiences and well-being–related developmental outcomes. Although this approach is an important first step, it neglects that subjective aging experiences are not operating in isolation and that the effect of subjective aging experiences on well-being–related outcomes might depend on individual differences. Indeed, emerging evidence suggests that subjective aging experiences are not per se negative or positive; recent studies point to a moderating role of individual differences for the association between subjective aging experiences and well-being–related developmental outcomes. In particular, in a longitudinal study by Wurm and Benyamini (2014), participants viewing the aging process as associated with many physical losses were better able to maintain lower depressive symptoms when they scored high on dispositional optimism. Dutt, Gabrian, and Wahl (2016a) found that when the aging process was perceived as entailing few gains, less increase in depressive symptoms over 2.5 years was reported when the individual was able to flexibly adjust goals. Hence, recent work in the area suggests that the effect of subjective aging experiences on well-being–related outcomes is not necessarily set in stone, but should be investigated within a holistic approach, taking into account individual differences.

The current study takes up the idea of identifying moderators in the subjective aging–well-being association, but goes beyond the above-mentioned findings in that it explicitly addresses specific information processing strategies which may be able to moderate the effect of subjective aging experiences on well-being–related developmental outcomes. An important element of our approach is that we assume that it is not only the content of thoughts on one's aging that is crucial (i.e., subjective aging experiences per se), but instead the way an individual generally deals with contents that are of relevance for the self, such as positively or negatively toned thoughts related to one's aging (i.e., processing strategies). The decision to focus on processing strategies as moderators was driven by

two considerations, one theoretical and one more practically framed one. First, theoretical reasoning suggests that it is indeed necessary to distinguish between cognitive content and the processing of such content as they interact to amplify or reduce each other's impact on well-being–related developmental outcomes (Ciesla et al., 2011). Second, at the applied level, a number of psychosocial and psychotherapeutic treatments targets processing strategies (instead of cognitive contents) and this seems quite critical for positive outcomes (Geiger et al., 2016). For example, mindfulness-based interventions aim at changing the attitude an individual has toward unpleasant feelings and thoughts—rather than changing the feelings and thoughts in themselves (Gu, Strauss, Bond, & Cavanagh, 2015). Understanding the impact of such strategies on the subjective aging–well-being association thus may also be of great practical relevance.

We addressed this topic by implementing a longitudinal study to investigate the moderating role of two antagonistic processing strategies, that is, mindfulness and negative repetitive thought (RT), for the association between subjective aging experiences and depressive symptoms in middle and old age.

Subjective Aging Experiences: Focus on Awareness of Age-Related Change

The area of subjective aging has been dominated in the recent 20 years or so by the constructs of subjective age and attitude toward own aging (ATOA) (Diehl et al., 2014). Subjective age is understood as a global and unidimensional measure, capturing the age a person perceives to be (Rubin & Berntsen, 2006). ATOA is usually assessed as cognitive-affective evaluation of the aging process as a whole (Lawton, 1975). The field has been enriched by constructs that are more differentiated in nature, taking into account the heterogeneity and multidimensionality of aging (P. Baltes, 1987). For example, Steverink, Westerhof, Bode, and Dittmann-Kohli (2001) proposed that subjective aging experiences can be divided into experiences of physical decline, continuous growth, and social loss. The more recently introduced construct of awareness of age-related change (AARC) takes a similar approach, and also takes into account that aging fundamentally means psychologically experienced change over time (Diehl & Wahl, 2010). According to Diehl and Wahl (2010), AARC "[…] refers to all those experiences that make a person aware that his or her behavior, level of performance, or ways of experiencing his or her life have changed as a consequence of having grown older […]" (p. 340). AARC purposefully puts equal emphasis

on assessing awareness of positive (AARC gains) and negative (AARC losses) age-related changes and thus is strongly anchored in a concept of life-span development that relies on both gains and losses (P. Baltes, 1987). AARC has been found in emerging work as being able to explain variance in developmental outcomes such as well-being and health over and above subjective age and ATOA (Brothers et al., 2017).

Importantly, AARC captures changes in concrete behavioral everyday experiences, for example, in the physical, cognitive, and interpersonal domain. Hence, the evaluation of the aging process in terms of AARC requires a substantive, conscious, and explicit reflection on age-related information, resulting in a detailed cognitive representation of the aging process. In contrast, subjective age and ATOA can be expected to comprise rather implicit judgments which exist at a more abstract and pre-conscious level of cognitive processing (Wurm et al., 2017). As we were interested in investigating interactions between subjective aging experiences and the way such experiences are processed, we refer in this work to the AARC construct as it encompasses detailed and positively or negatively toned cognitive representations rooted in everyday life experiences, thus providing an appropriate target for processing strategies to unfold.[11]

Processing Strategies: Focus on Mindfulness and Negative Repetitive Thought

We assume that the effect of AARC on depressive symptoms as a major indication of well-being–related developmental outcomes depends on the way such aging–related thoughts are processed. We chose mindfulness and negative repetitive thought (RT) as potential moderators. This decision was driven by two considerations: First, we aimed to include both functional as well as dysfunctional strategies. Second, mindfulness and negative RT have been extensively studied, thus connecting our study well with previous research.

Mindfulness is a Buddhism–derived concept with a 2,500-year-old tradition (Kabat-Zinn, 2003). Most operational definitions converge in the idea that mindfulness is a two-component construct, comprising cognitive/attentional and acceptance-based/attitudinal elements (Bishop et al., 2004). The cognitive/attentional component is characterized by a constant present-moment awareness which includes the deliberate observation of the

[11] We thank an anonymous reviewer for providing us with this idea.

ongoing stream of thoughts, feelings, physical sensations, and other stimuli as they occur in the present moment. The acceptance-based/attitudinal component comprises the acceptance of one's experiences and an attitude of openness to these experiences rather than judging or ignoring them—particularly when they are unpleasant.

Despite conceptual overlap, mindfulness is different from related constructs. Although the present-moment awareness overlaps with the personality facet of openness to experience, the acceptance-based component of mindfulness is a feature unique to mindfulness. Openness to experience, in contrast, encompasses imagination, fantasy, and aesthetic interest—features which do not relate to mindfulness (Brown & Ryan, 2003). Mindfulness resembles accommodative coping (Brandtstädter & Rothermund, 2002) or compensatory secondary control strategies (Heckhausen, Wrosch, & Schulz, 2010) as all concepts encompass nonattachment to unpleasant stimuli (e.g., goal failure). In contrast to coping strategies, mindfulness does not comprise any form of behavioral coping aiming at alleviating the experienced unpleasant situation (i.e., flexible goal adjustment) but solely focuses on the processing of information. Mindfulness overlaps with optimism (Scheier & Carver, 1985) as both constructs imply a certain fundamental serenity in the face of obstacles. In contrast to optimism, mindfulness does not focus on future events, but is deeply rooted in the experience of the present moment and everyday experiences.

Mindfulness is associated with various positive outcomes, such as increased psychological well-being, improved behavioral regulation (Keng, Smoski, & Robins, 2011), better physical health, and better interpersonal relationships (Brown, Ryan, & Creswell, 2007). These salutary effects also apply to older adults (Fiocco & Mallya, 2015).

Although mindfulness can be cultivated by training (Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006), it contains dispositional and trait-like components (Sternberg, 2000) such that individuals differ in the degree to which they have endorsed a mindful attitude.

Mindfulness can be contrasted to dysfunctional processing strategies, such as *negative repetitive thought*. Negative RT involves thinking attentively, repetitively, or frequently about oneself and one's world (Segerstrom, Stanton, Alden, & Shortridge, 2003), thereby entailing a chronic cognitive representation of stressors (Brosschot, Gerin, & Thayer, 2006). Due to its high-level, abstract processing mode, negative RT is highly unconstructive (Watkins, 2008).

Negative RT constitutes an umbrella term encompassing different concepts. Rumination can be subsumed under this class of thinking styles (Segerstrom et al., 2003). Rumination is defined as "[…] a class of conscious thoughts that revolve around a common instrumental theme […]" (L. L. Martin & Tesser, 1996, p. 7) or as "[…] a stable, negative, broadly construed way of responding to discrepancies between current status and target status" (Smith & Alloy, 2009, p. 126). This conceptualization differs from depressive or dysphoric rumination (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), that is, a pattern of thoughts that focus the individual's attention on his or her depressive mood. Negative RT also comprises worry (Segerstrom et al., 2003). Although rumination and worry involve different content, with ruminative thoughts revolving around past experiences and worrisome thoughts anticipating future events, they share negative and recurrent thought processes (Watkins, Moulds, & Mackintosh, 2005). Furthermore, negative RT overlaps to some extent with established concepts in the self-regulatory area such as assimilative coping (Brandtstädter & Rothermund, 2002) or selective secondary control strategies (Heckhausen et al., 2010) as all these concepts comprise that the individual cognitively is attached to a problematic situation (e.g., thinking about discrepancies between desired and current states). However, whereas coping strategies manifest themselves in situations of goal failure, with the overarching and adaptive aim to attain this goal and to increase feelings of control, negative RT encompasses ruminating over stressors for its own sake. Hence, negative RT refers to all those processes that comprise the cognitive representation of a stressor and are characterized by a persistent, recurrent, perseverative, abstract, inflexible, uncontrollable, and unproductive thinking style.

Negative RT exacerbates feelings of uncontrollability and impairs problem-solving (Watkins & Moulds, 2005), thus extending physiological activation (Brosschot et al., 2006). Negative RT entails difficulties in mental and physical health (Watkins, 2008), which also applies to older adults (Brinker, 2013; Kraaij, Pruymboom, & Garnefski, 2002; Segerstrom, Roach, Evans, Schipper, & Darville, 2010).

Finally, negative RT can be understood as a habitualized processing style, with individuals differing in their disposition to ruminate stronger or weaker (Brinker & Dozois, 2009).

Processing Strategies as Moderators for the Association Between Awareness of Age-Related Change and Depressive Symptoms

We propose that subjective aging experiences (i.e., AARC) interact with processing strategies (i.e., mindfulness and negative RT) in the prediction of depressive symptoms. There are several pathways through which processing strategies might affect the AARC–depressive symptoms association.

Mindfulness as a moderator for the association between awareness of age-related change and depressive symptoms

First, in terms of the *cognitive/attentional component*, the pronounced present-moment awareness and consciousness of inner and outer experiences enhance flexible and adaptive behavioral interventions to cope with the stressors under question and reduce automatic or impulsive thoughts or unhealthy behavior patterns (Brown & Ryan, 2003). Indeed, a high present-moment awareness promotes executive functions, that is, the ability to organize and initiate adaptive problem-solving approaches (Short, Mazmanian, Oinonen, & Mushquash, 2016). In line with this consideration, *self-determination theory* suggests that an open awareness facilitates the choice of behaviors which are congruent with one's needs, thus enhancing well-being–related outcomes (Deci & Ryan, 1980). Transferred to subjective aging experiences, an individual who perceives the aging process as being associated with many losses and who encounters this experience with a mindful attitude might be better able to invest into adaptive prevention or treatment seeking behaviors (e.g., physical activity, visits to the doctor). This, in turn, may lead to increased functioning (e.g., Windle, 2014) and counteract the detrimental impacts of negatively toned AARC on depressive symptoms.

Second, in terms of the *acceptance-based/attitudinal component*, accepting and acknowledging aging as a natural part of life without judgment changes the subjective meaning of aging-related stress (Bishop et al., 2004). Such a *de-centered* perspective enhances adaptive emotion regulation, hence avoiding being overwhelmed by negative affect (Coffey & Hartman, 2008). Transferred to dealing with subjective aging experiences, a mindful attitude may protect an individual with negatively toned AARC against feelings of worthlessness, pessimism, and frustration.

Empirical findings support the assumption of a buffering effect of mindfulness against the harmful effect of stressful events, such as daily hassles (Bergomi, Ströhle,

Michalak, Funke, & Berking, 2013; Bränström, Duncan, & Moskowitz, 2011), low self-esteem (Michalak, Teismann, Heidenreich, Ströhle, & Vocks, 2011), or perceived discrimination (Brown-Iannuzzi, Adair, Payne, Richman, & Fredrickson, 2014) on depressive symptoms and negative affect. The benefits of mindfulness have also been shown to be evident in middle- and old-aged individuals (de Frias & Whyne, 2015).

Negative repetitive thought as a moderator for the association between awareness of age-related change and depressive symptoms

From a *motivational* perspective, excessively ruminating about personal inadequacies is guided by a desire for verifying one's self-view to maintain a consistent (even though negative) self-view (Swann, 1983). Hence, the rumination process is accompanied by a selective attention to those stimuli that reinforce this negative self-view, worsening the global self-evaluation. An individual who perceives many negative age-related changes and who starts brooding about these potential limitations will selectively attend to those stimuli that reinforce these negative thoughts. This may result in a vicious cycle which aggravates symptoms of depression.

According to the *perseverative cognition hypothesis*, the persistent and abstract cognitive representation of a stressor prolongs *physiological* activation, such as higher blood pressure and higher heart rate and cortisol levels (Brosschot et al., 2006). Thus, an individual who experiences age-related losses and who recurrently thinks about these shortcomings will find himself/herself in a prolonged state of physiological activation, which, in turn, should enhance feelings of distress.

At the *cognitive* level, the persistent and unproductive representation of a stressor increases feelings of uncontrollability (Brosschot et al., 2006) and helplessness (Nikčević, Caselli, Green, & Spada, 2014). Hence, when negative subjective aging experiences are processed recurrently, the individual will soon feel as being at the mercy of these loss experiences, amplifying depressive symptoms.

At the *behavioral* level, negative RT "paralyzes" the individual and absorbs resources, thereby inhibiting problem-solving (Watkins & Moulds, 2005). The individual is unable to flexibly cope with the stressors, but remains in a state of avoidance (Smith & Alloy, 2009). Such excessive but unproductive commitment to stressors is particularly crucial in the context of aging. When resources decline with increasing age, flexibly adjusting goals should be the method of choice to ensure an adequate fit between personal re-

sources and goals (Brandtstädter & Rothermund, 2002). An individual with negatively toned AARC persisting in negative thinking loops may stick at such cognitive content, being unable to cope with the situation via behavioral interventions, or to alleviate the feelings of inadequacies via flexible goal adjustment.

These mechanisms have been considered in several models of depressive etiology, such as the *diathesis–stress–model* (Ingram & Luxton, 2005) or the *cognitive catalyst model of depressive vulnerability* (Ciesla et al., 2011). These models postulate synergistic effects between negative cognitive content and processing styles, such that negative RT functions as a catalyst for the association between negative cognitive content and depressive symptoms.

The harmful effect of negative RT has also been shown empirically, with daily hassles or perceived stress (Genet & Siemer, 2012; McIntosh, Gillanders, & Rodgers, 2010; Nikčević et al., 2014), goal failure (Jones, Papadakis, Hogan, & Strauman, 2009), or actual:ideal self-discrepancies (Vergara-Lopez, Kyung, Detschner, & Roberts, 2014) as stressors. In general, high levels of trait negative RT amplified the deleterious effects of the stressors.

Relative importance of processing strategies in terms of gain–related vs. loss–related awareness of aging experiences

Negative information is in general processed more thoroughly than positive information and exerts a larger impact on psychological outcomes (Baumeister et al., 2001). This negativity bias also applies to the AARC construct, with AARC losses displaying stronger associations with depressive symptoms (Dutt et al., 2016a) or life satisfaction (Brothers et al., 2017) as compared with AARC gains. Accordingly, the moderating role of mindfulness and negative RT should be particularly pronounced for the association between AARC losses and depressive symptoms.

Research Aims and Hypotheses

This study examined the moderating role of processing strategies for the association between AARC and depressive symptoms using two measurement points covering a 4.5-year–interval in a sample of middle-aged and older adults. We assumed that the detrimental impact of low levels of awareness of age-related gains and high levels of awareness of age-related losses on depressive symptoms is buffered when levels of mindfulness are

high (Hypothesis 1). Conversely, we expected that the deleterious effect of low levels of awareness of age-related gains and high levels of awareness of age-related losses on depressive symptoms is amplified when levels of negative RT are high (Hypothesis 2). We expected that the moderating role of mindfulness and negative RT is stronger for the association between AARC losses and depressive symptoms as compared with the association between AARC gains and depressive symptoms (Hypothesis 3). Furthermore, theoretical considerations suggest changes in the normativity of age-related experiences across the life span (P. Baltes et al., 1980). For example, those older than 65 years of age have a higher likelihood of being retired and of experiencing functional or social losses. Therefore, we exploratorily tested for age effects.

Method

Study Design and Participants

Data collection was linked to a larger longitudinal survey (Diehl et al., 2013). Our analyses used the summer 2012 ("T1") and the spring 2017 ("T2") waves. Ethical approval for T2 was obtained by the research ethics committee of the Faculty of Behavioral and Cultural Studies at Heidelberg University. The observational interval covered on average 55.41 months (*SD* = 0.56 months). 423 persons participated at T1. The response rate for T2 was 71%, resulting in a sample size of 299 persons at T2. Main reasons for nonparticipation were no interest (55%), health problems (7%), or death (10%). Dropouts were significantly more common among men than among women, $\chi^2(1) = 6.85$, $p = .009$. Dropouts were significantly older than T2 participants, $t(421) = 3.84$, $p = .000$, $d = 0.41$. The selectivity effect for chronological age (Lindenberger et al., 2002) amounted to 0.12 standard deviations, indicating a small effect. T2 participants and dropouts did not differ on the remaining study variables, all *p*s > .05. Missing data analyses suggest a pattern of missing values on the main study variables which is missing-completely-at-random, $\chi^2(27) = 35.96$, $p = .116$. Thus, analyses were based on the 423 T1 participants. Missing data were replaced using the full information maximum likelihood (FIML) algorithm (Enders, 2001).

At T1, participants were between 40 and 98 years old (*M* = 62.94 years, *SD* = 11.84 years). Two thirds were women (64%). 61% were partnered or married. Education was

high, with an average of 11.53 years (*SD* = 1.95 years) of schooling, and with more than half of the participants (55%) having a general qualification for university entrance. 40% were retired. Descriptive information of the study variables is summarized in Table 3.1.

Measures

Awareness of age-related change

AARC was measured with a 50-item scale (Brothers et al., conditionally accepted). Each item is preceded by the item stem "With my increasing age, I realize that…" and comprises the description of a positive (gains) or negative (losses) experience in one out of five behavioral domains, that is, health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive and social-emotional functioning, and lifestyle and engagement. Gains and losses are assessed with 25 items each, representing evenly the five behavioral domains. An example for a positive aging experience (interpersonal relations) is "…that I am more open toward other people." An example for a negative aging experience (cognitive functioning) is "…that it is more difficult for me to learn new things." The scales were developed within a cross-cultural research collaboration, including U.S. focus groups and a German diary study. All items underwent a rigorous translation/back-translation process. Participants indicated their agreement on a 5-point Likert-scale, ranging from 1 *(not at all)* to 5 *(very much)*. Exploratory and confirmatory factor analyses support a two-factor structure, separating AARC gains and AARC losses (Brothers et al., conditionally accepted; Diehl et al., 2013). We refrain from reporting domain–specific results as the construction of domain–specific subscales was found to be less robust. The internal consistency for the mean scores was good (Cronbach's $\alpha = .92$ for T1 AARC gains and $\alpha = .92$ for T1 AARC losses). For latent modeling, we used a parceling approach to cluster the indicator variables (Little, Cunningham, Shahar, & Widaman, 2002). The five domain mean scores served as indicators for the AARC gains and AARC losses factors, respectively. We calculated a composite reliability index as an indicator of the internal consistency of the scale as proposed by Raykov (1997), which is estimated based on the factor loadings and error variances of the parcels. This composite reliability amounted to .85 for AARC gains and to .86 for AARC losses.

Table 3.1. Descriptive Information and Bivariate Associations Between the Key Study Constructs, assessed at Time 1 (T1, 2012) and Time 2 (T2, 2017)

	M (SD)	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**
1. AARC gains T1	3.09 (0.65)	–					
2. AARC losses T1	2.23 (0.61)	.32***	–				
3. Depressive symptoms T1	1.76 (0.51)	-.03	.57***	–			
4. Depressive symptoms T2	1.79 (0.52)	.00	.46***	.55***	–		
5. Mindfulness T2	2.95 (0.46)	.22***	-.13***	-.29***	-.36***	–	
6. Negative repetitive thought T2	3.50 (1.10)	.04	.35***	.41***	.54***	-.26***	–

Notes. M = mean; *SD* = standard deviation. All parameters reported have been adjusted by the full information maximum likelihood estimate.
N = 423. *** $p < .001$.

Depressive symptoms

The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) measures an individual's current level of depressive symptoms, ranging from no-to-severe depressive symptoms (Bowins, 2015). The 10-item version used here shows good reliability and validity in old adults (Irwin et al., 1999). An example for an item formulation is "My sleep was restless" (established German version: Kohlmann & Gerbershagen, 2006). The items were evaluated on the basis of the symptoms during the past week and judged on a 4-point Likert scale, ranging from 1 (*rarely or none of the time*) to 4 (*most or all of the time*). Depressive symptoms were assessed at T1 and T2 in order to model change in depressive symptoms over time as an outcome variable. The internal consistency was good, with Cronbach's $\alpha = .85$ at T1 and $\alpha = .84$ at T2. For latent modeling, we parceled the observed indicators into three parcels comprising 3-4 items such that item factor loadings were equally distributed across parcels (Little et al., 2002). The items within one parcel were aggregated to a mean score. The composite reliability amounted to .86 at T1 and .83 at T2.

Mindfulness

There is a large number of self-report scales which range in complexity from one factor to five (Brown et al., 2007). Our choice was based on three considerations: (1) availability of a psychometrically tested German version; (2) inclusion of items measuring the cognitive as well as the affective component of mindfulness; (3) manageable extent. The Freiburg Mindfulness Inventory (FMI; Walach et al., 2006) fulfills these criteria. The 14-item short-form shows good psychometric properties in populations without meditation experience (Walach et al., 2006). Examples for an item formulation are "I am open to the experience of the present moment" (presence-based component) or "I see my mistakes and difficulties without judging them" (acceptance-based component). The items were assessed on a 4-point Likert-scale, ranging from 1 *(rarely)* to 4 *(almost always)*. Confirmatory and Rasch–modelled factor analyses (Kohls, Sauer, & Walach, 2009; Sauer, Strobl, Walach, & Kohls, 2013) point to two textually distinct factors, that is, presence and acceptance. To assure comparability with other studies, we used a global mindfulness score. Cronbach's α amounted to .86. For latent modeling, the observed indicators were parceled into three parcels comprising 4-5 items with an equal distribution of item factor loadings (Little et al., 2002). The composite reliability amounted to .89.

Negative repetitive thought

Negative RT was assessed with the Ruminative Thought Style Questionnaire (Brinker & Dozois, 2009) which measures the tendency to think repetitively, recurrently, uncontrollably, and intrusively, independent of the valence, content, or temporal orientation of the thoughts. The 15-item version covers the four subcomponents problem–focused thoughts, counterfactual thinking, repetitive thoughts, and anticipatory thoughts (Tanner, Voon, Hasking, & Martin, 2013). Its German version shows good psychometric properties (Helmig, Meyer, & Bader, 2016). An example for an item formulation is "I can't stop thinking about some things." Respondents rated how well each statement describes them on a 7-point Likert-scale, ranging from 1 *(not at all)* to 7 *(very well)*. Cronbach's α was .90. For latent modeling, the observed indicators were parceled into three parcels comprising 5 items with an equal distribution of item factor loadings (Little et al., 2002). The composite reliability amounted to .91.

Control variables

T1 calendar age, sex, education, T1 physical health, and T1 neuroticism were used as control variables, as they have been shown to be associated with the study variables (e.g., Brothers et al., 2017; Latzman & Masuda, 2013). Physical health was operationalized as the SF-36 physical health component summary score, which comprises eight subscales (established German version: Bullinger et al., 1995). Cronbach's α ranged between .76 and .93 for the eight SF-36 subscales. Sex was coded as 0 *(male)* and 1 *(female)*. Education was operationalized as years of schooling. Neuroticism was assessed by the NEO five-factor inventory (established German version: Borkenau & Ostendorf, 2008). The items were rated on a 5-point Likert-scale, ranging from 1 *(strongly disagree)* to 5 *(strongly agree)*. The neuroticism subscale showed a good internal consistency (Cronbach's α = .85).

Data Analyses

A latent change score (LCS) model was tested within a structural equation modeling approach realized with the R packages lavaan (Rosseel, 2012) and semTools (semTools Contributors, 2016). Within the LCS model, the targeted outcome is the depressive symptoms latent change score Δ, which encompasses that part of T2 depressive symptoms (Y[2]) that is not predicted by T1 depressive symptoms (Y[1]), that is, change in depressive symptoms over time (Δ = Y[2] – Y[1]) (McArdle, 2009). Two models were tested to

assess independently the incremental predictive power of the AARC × Processing strategies interaction terms with regard to the prediction of change in depressive symptoms for each processing strategy. In each case, the structural model included five latent variables (T1 AARC gains, T1 AARC losses, T2 mindfulness/negative RT, T1 depressive symptoms, T2 depressive symptoms) with their respective manifest indicators and error terms. Latent change in depressive symptoms was modeled as LCS (McArdle, 2009) such that higher values on the LCS signalize an increase in depressive symptoms over time. For latent modeling of the AARC × Processing strategies interaction terms, an orthogonalizing technique as proposed by Little, Bovaird, and Widaman (2006) was applied. Two indicators (i.e., item parcels) of the first-order effect variables (i.e., the predictor and the moderator) were multiplied and the resulting product was then regressed onto all first-order effect indicators. The resulting residual was used as an indicator of the latent interaction variable. This procedure was applied for all possible combinations of first-order effect variables. Paths were then specified from AARC gains, AARC losses, mindfulness/negative RT, and the AARC gains × Mindfulness/Negative RT and AARC losses × Mindfulness/Negative RT interaction terms to the depressive symptoms LCS (Figure 3.1). The control variables (T1 age, sex, years of education, physical health, neuroticism [specified as manifest constructs]) were correlated with the main study variables to improve estimation of missing values (Graham, 2003) and the depressive symptoms LCS was regressed onto the control variables.

As depressive symptoms were assessed at two different measurement occasions, we tested for measurement invariance by specifying progressively stricter measurement models (Horn & McArdle, 1992). We first specified a measurement model with all paths set free (Model 1). Modification indices suggested a correlation between corresponding error terms across measurement occasions (e.g., Parcel 1 error at T1 with Parcel 1 error at T2) that we admitted. This model indicated that the same parcels load on depressive symptoms across the two measurement occasions (configural invariance). Model 1 was evaluated against a model with corresponding factor loadings set equal across measurement points (Model 2; weak factorial invariance/ metric invariance). This model, in turn, was evaluated against a model with corresponding factor loadings and parcel intercepts set equal across measurement points (Model 3; strong factorial invariance/ scalar invariance). Change in the χ^2 goodness-of-fit statistic was used as a criterion for testing meas-

urement invariance. A significant change in χ^2 was interpreted as a significant worsening of model fit. $\Delta\chi^2(df)$ amounted to 0.33(3) (p = .954) from Model 1 to Model 2 and to 6.61(3) (p = .086) from Model 2 to Model 3. Based on this result, we assumed strong factorial invariance across the two measurement points. The final measurement model (Model 3) for T1/T2 depressive symptoms yielded a good model fit, $\chi^2(11)$ = 15.19, comparative fit index (CFI) = .996, root mean square error of approximation (RMSEA) = .030, 90% confidence interval (CI) [.000, .063].

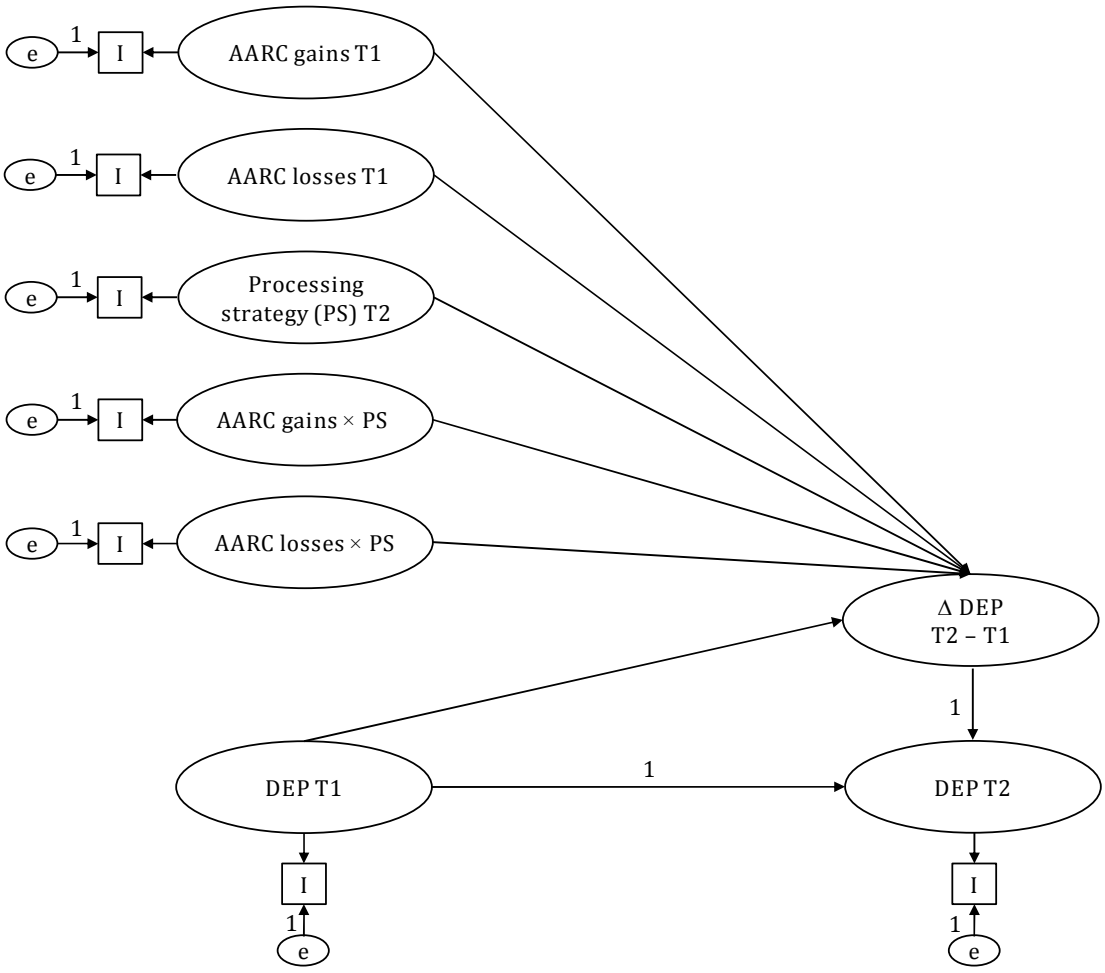


Figure 3.1. Latent change score model depicting change in depressive symptoms (DEP) from Time 1 (T1, 2012) to Time 2 (T2, 2017).
Notes. AARC = awareness of age-related change; e = manifest variable residual; I = manifest indicators modeled as item parcels. Analyses have been controlled for T1 age, sex, years of education, T1 physical health, and T1 neuroticism. For latent modeling of the AARC × Processing strategies interaction terms, an orthogonalizing technique as proposed by Little et al. (2006) was applied. Separate models were estimated for mindfulness and negative repetitive thought as moderators.

In order to investigate age effects between middle-aged (< 65 years; N = 255) and older (≥ 65 years; N = 168) adults, we tested for measurement invariance across age groups. We chose age 65 as cutoff for the formation of two distinct age groups, as this age is closely tied to legislative regulations in Germany, such as entry into retirement status, thus separating two life phases. Weak measurement invariance across age groups could be established across the two age groups for all latent study variables, except for the interaction terms involving negative RT. Hence, age group comparisons regarding interactions between AARC and negative RT need to be interpreted as preliminary.

Results

Descriptive Findings

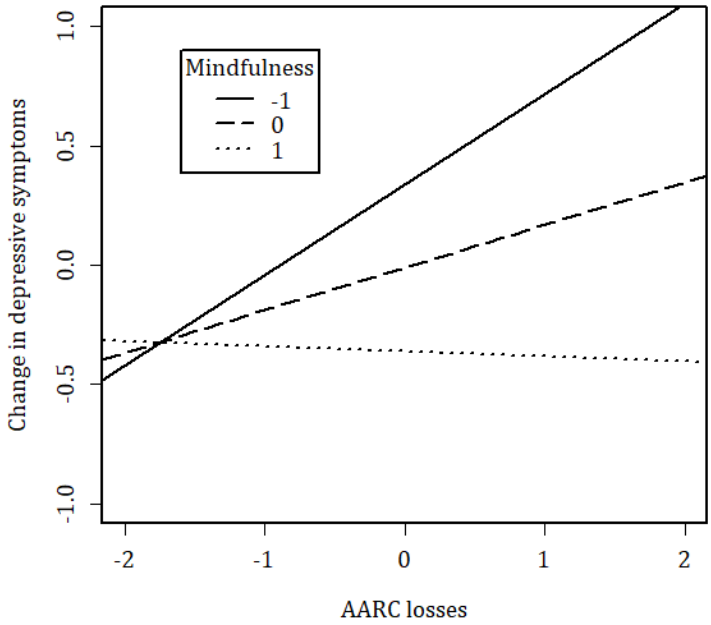
Bivariate correlations between the study constructs are displayed in Table 3.1. AARC losses at T1 were positively linked to depressive symptoms both at T1 and T2, whereas AARC gains at T1 were not linked to depressive symptoms, both within and across measurement points. Higher levels of T1 AARC losses were associated with lower levels of T2 mindfulness and higher levels of T2 negative RT. Conversely, higher levels of T1 AARC gains were associated with higher levels of T2 mindfulness, but were unrelated with levels of T2 negative RT. Depressive symptoms were negatively linked to mindfulness and positively linked to negative RT, both within and across measurement points.

Hypothesis 1—Mindfulness as a Moderator for the Association Between Awareness of Age-Related Change and Depressive Symptoms

The structural equation model including mindfulness as a moderator yielded an acceptable fit, $\chi^2(1239) = 2427.89$, CFI = .919, RMSEA = .048, 90% CI [.045, .050]. The regression weights for the prediction of change in depressive symptoms are displayed in Table 3.2 (Model 1). The inclusion of the AARC × Mindfulness interaction terms in the fifth step increased the amount of explained variance, $\Delta R^2 = .03$, $p = .003$.

The AARC losses × Mindfulness product term reached significance, β = -.11, standard error (SE) = .05, 95% CI [-.20, -.01], p = .041. Higher levels of AARC losses were less strongly linked to increases in depressive symptoms over the observational interval (i.e., higher depressive symptoms latent change scores) for individuals reporting high levels of mindfulness as compared with individuals reporting low levels of mindfulness (Figure 3.2A).

3.2A



3.2B

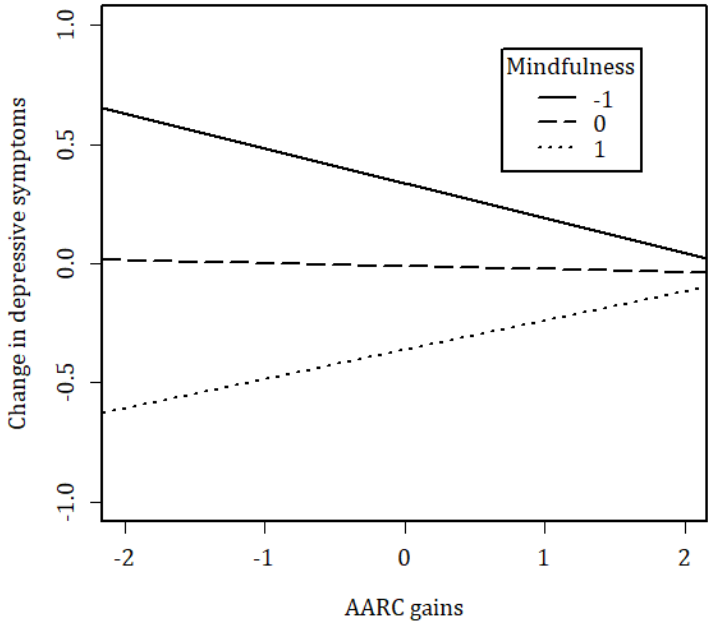


Figure 3.2. Longitudinal effect of Time 1 (T1, 2012) awareness of age-related change (AARC) on change in depressive symptoms, moderated by Time 2 (T2, 2017) mindfulness.
Notes. Higher depressive symptoms latent change scores signalize an increase in depressive symptoms over time. Analyses have been controlled for T1 age, sex, years of education, T1 physical health, and T1 neuroticism. All parameters reported have been adjusted by the full information maximum likelihood estimate. All variables have been mean-centered.
N = 423.

Table 3.2. Hierarchical Multiple Regression of Change in Depressive Symptoms Between T1 (2012) and T2 (2017), with Mindfulness (Model 1) and Negative Repetitive Thought (Model 2) as Moderators

	Model 1		Model 2	
Steps	**β (*SE*)**	**ΔR^2**	**β (*SE*)**	**ΔR^2**
Control variables		.05***		.05***
Calendar age T1	.03 (.06)		-.06 (.05)	
Sex	.07 (.05)		.01 (.04)	
Years of education	-.04 (.05)		-.05 (.04)	
Physical health T1	-.05 (.06)		-.10 (.05)	
Neuroticism T1	-.07 (.08)		.01 (.06)	
Baseline depressive symptoms		.36***		.36***
Depressive symptoms T1	-.64 (.04)***		-.68 (.03)***	
AARC		.12***		.15***
AARC gains T1	-.01 (.06)		-.07 (.05)	
AARC losses T1	.25 (.09)**		.17 (.08)*	
Processing strategies		.03***		.12***
Mindfulness T2	-.30 (.06)***		–	
Negative repetitive thought T2	–		.35 (.05)***	
Interaction terms		.03**		.05***
AARC gains T1 × Mindfulness T2	.07 (.05)		–	
AARC losses T1 × Mindfulness T2	-.11 (.05)*		–	
AARC gains T1 × Negative RT T2	–		-.13 (.05)*	
AARC losses T1 × Negative RT T2	–		.17 (.05)**	
Total R^2		.58		.72
F		51.72*** [11, 412]		96.31*** [11, 412]

Notes. AARC = awareness of age-related change; RT = repetitive thought; SE = standard error. Higher depressive symptoms latent change scores signalize an increase in depressive symptoms over time. Coefficients reported refer to the last step. Dashes in cells indicate that the construct was not considered in the analysis. Degrees of freedom for the *F*-value are reported in parentheses. All parameters reported have been adjusted by the full information maximum likelihood estimate.
$N = 423$. * $p < .05$, ** $p < .01$, *** $p < .001$.

With regard to awareness of age-related gains, the AARC gains × Mindfulness product term was not significant, β = .07, *SE* = .05, 95% CI [-.03, .17], *p* = .159. However, as is shown in Figure 3.2B, the pattern of associations resembles the patterns found for AARC losses, but the other way round. That is, weaker levels of AARC gains were less strongly linked to increases in depressive symptoms over the observational interval for individuals reporting high levels of mindfulness as compared with individuals reporting low levels of mindfulness. As the product term was not significant, this finding, although consistent with our hypothetical prediction, needs to be interpreted with caution.

The AARC × Mindfulness interaction terms uniquely contributed 3% to the total amount of explained variance in the depressive symptoms LCS (f^2 = 0.07), which can be considered a small effect (Cohen, 1988).

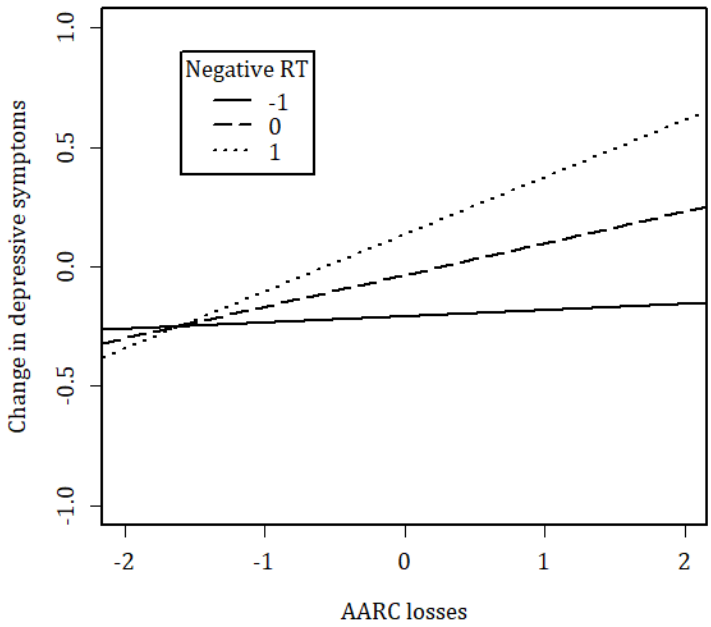
We also tested for differences between middle-aged (< 65 years; *N* = 255) and older (≥ 65 years; *N* = 168) adults. Based on the assumption of weak measurement invariance across age groups, we imposed equality constraints on the structural paths across age groups. Compared with the unconstrained model, there was no significant worsening of model fit, $\Delta\chi^2(11) = 11.23$, $p = .424$. Hence, the effects found can be considered similar across middle-aged and older adults.

Hypothesis 2—Negative Repetitive Thought as a Moderator for the Association Between Awareness of Age-Related Change and Depressive Symptoms

The structural equation model including negative RT as a moderator yielded an acceptable fit, $\chi^2(1239) = 2591.84$, CFI = .913, RMSEA = .051, 90% CI [.048, .054]. The regression weights for the prediction of change in depressive symptoms are displayed in Table 3.2 (Model 2). The inclusion of the AARC × Negative RT interaction terms in the fifth step increased the amount of explained variance, $\Delta R^2 = .05$, $p < .001$.

The AARC losses × Negative RT product term reached significance, β = .17, *SE* = .05, 95% CI [.07, .26], *p* = .001. Higher levels of AARC losses were more strongly linked to increases in depressive symptoms over the observational interval (i.e., higher depressive symptoms latent change scores) for individuals reporting high levels of negative RT as compared with individuals reporting low levels of negative RT (Figure 3.3A).

3.3A



3.3B

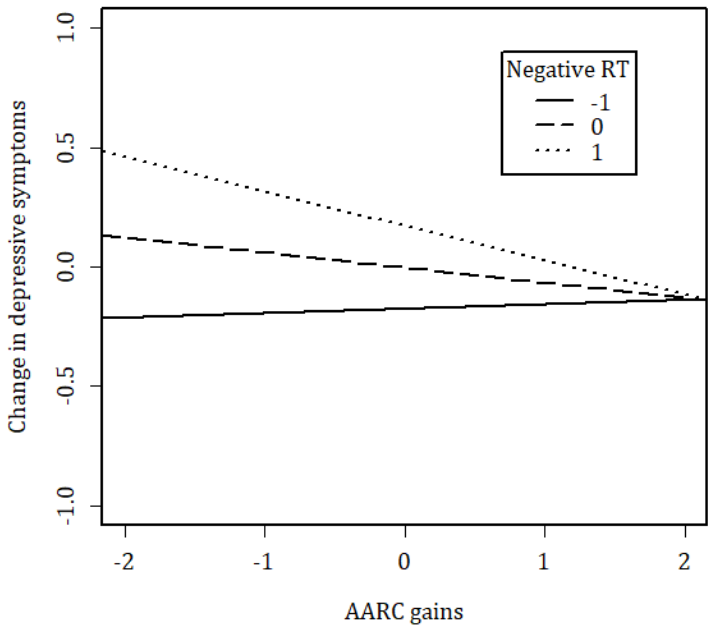


Figure 3.3. Longitudinal effect of Time 1 (T1, 2012) awareness of age-related change (AARC) on change in depressive symptoms, moderated by Time 2 (T2, 2017) negative repetitive thought (RT).
Notes. Higher depressive symptoms latent change scores signalize an increase in depressive symptoms over time. Analyses have been controlled for T1 age, sex, years of education, T1 physical health, and T1 neuroticism. All parameters reported have been adjusted by the full information maximum likelihood estimate. All variables have been mean-centered.
$N = 423$.

With regard to awareness of age-related gains, the AARC gains × Negative RT product term was significant, β = -.13, *SE* = .05, 95% CI [-.22, -.03], *p* = .010. The pattern of associations resembles the patterns found for AARC losses, but the other way round. Weaker levels of AARC gains were more strongly linked to increases in depressive symptoms over the observational interval for individuals reporting high levels of negative RT as compared with individuals reporting low levels of negative RT (Figure 3.3B).

The AARC × Negative RT interaction terms uniquely contributed 5% to the total amount of explained variance in the depressive symptoms LCS (f^2 = 0.18), which can be considered a medium effect (Cohen, 1988).

We again exploratorily tested for age effects. Based on the assumption of weak measurement invariance across age groups, we imposed equality constraints on the structural paths across age groups. Compared with the unconstrained model, there was no significant worsening of model fit, $\Delta\chi^2(11) = 9.63$, $p = .564$. Hence, the effects found can be considered similar across middle-aged and older adults.

Discussion

We examined the moderating role of mindfulness and negative RT for the association between AARC and change in depressive symptoms over 4.5 years. Our analyses suggest a buffering role of mindfulness against the harmful effect of high levels of awareness of age-related losses on change in depressive symptoms. Conversely, the detrimental effect of high levels of awareness of age-related losses and low levels of awareness of age-related gains on change in depressive symptoms was exacerbated for individuals with a negative and repetitive thinking style. With regard to the interplay between awareness of age-related gains and mindfulness, effects were less clear, although the direction of the findings was consistent with our expectations. Effects were comparable across middle-aged and older adults. Thus, findings were largely in accordance with our hypotheses.

Processing Strategies as a Moderator for the Association Between Awareness of Age-Related Change and Depressive Symptoms

Our findings suggest that negatively toned AARC is not per se deleterious, but it depends on the way such thoughts are processed and dealt with. When awareness of age-related losses was high, fewer increases in depressive symptoms were reported when

mindfulness was high or when negative RT was low. Regarding AARC gains, negative RT amplified the deleterious effect of low levels of awareness of age-related gains on change in depressive symptoms. As outlined above, the moderating role of processing strategies can be explained by different pathways, which will be illustrated exemplarily with regard to age-related loss experiences in the physical domain.

First, regarding mindfulness, attentively observing negative physical changes promotes flexible and adaptive behavioral responses (Deci & Ryan, 1980), such as engagement in medical treatments or physical activity, thereby attenuating the negative consequences of the physical decline (Windle, 2014). Moreover, accepting age-related loss experiences as a natural part of life (see also Erikson, 1950) helps to better get along with these aging experiences and to maintain low levels of depressive symptoms despite many perceived losses (Ranzijn & Luszcz, 1999).

Second, with regard to negative RT, brooding about perceived physical declines selectively directs an individual's attention to experiences which are consistent with this physical decline, thereby reinforcing the perception of physical losses (*motivational* pathway) (Swann, 1983). The individual will experience a higher blood pressure and cortisol levels (*physiological* pathway) (Brosschot et al., 2006) as well as feelings of overwhelm and frustration (*cognitive* pathway) (Nikčević et al., 2014). In the face of all these resource–absorbing processes, the individual feels unable to take action, for example, visiting a doctor or being physically active, to delay the physical decline or attenuate its negative consequences, but remains in a state of avoidance (*behavioral* pathway) (Smith & Alloy, 2009), which should ultimately exacerbate feelings of depressive symptoms. Further research is needed to investigate the role of these pathways.

We did not find a clear moderating role of mindfulness for the association between AARC gains and depressive symptoms, although the direction of effects was consistent with our expectations. This less clear effect in case of AARC gains may mirror our assumption that the effects would be particularly pronounced for AARC losses, because age-related loss experiences are per se more strongly related to developmental outcomes than age-related gain experiences (Brothers et al., 2017; Dutt et al., 2016a), thus offering a larger target for processing strategies to unfold their effect. Moreover, the non-significant interaction between AARC gains and mindfulness also needs to be interpreted against the background of the AARC construct. Per definition, AARC captures subjective aging experi-

ences in terms of *perceived changes* rather than absolute levels of experiences (Diehl & Wahl, 2010). Few AARC gains can imply two scenarios: First, the person experiences few positive experiences. Second, the amount of positive experiences is as high as it has always been, that is, no changes occurred. Accordingly, few AARC gains do not necessarily have to be equated with a poor resource status, making high levels of mindfulness necessary to get along with. Instead, low levels of AARC gains can be associated with low levels of depressive symptoms irrespective of mindfulness.

We did not find any age effects regarding the interaction between AARC and processing strategies, that is, effects were comparable in middle-aged and older adults. One could assume that processing strategies play a greater role in mid- and young-old-adulthood, where age-related losses are non-normative and thus considered more threatening (P. Baltes et al., 1980). Our sample included few very old adults (only 11.1% were 80 years and older at T1). The inclusion of more adults in advanced old age might have increased the probability of finding age effects.

Our decision to focus on the AARC construct was driven by the idea that AARC encompasses substantial cognitive representations rooted in everyday experiences, thus providing an appropriate basis for processing strategies to unfold. Indeed, and in line with this consideration, additional analyses based on the subjective age measure suggest *no* moderating role of mindfulness and negative RT for the effect of subjective age on depressive symptoms—maybe because the more abstract representations accompanying subjective age provide lesser target for processing strategies.

Limitations and Future Research

The sample was positively biased with regard to education or health. As such, caution is advisable when generalizing the results to other populations. Moreover, future studies should examine whether the results extend to clinical settings, for example, to patients suffering from major depressive disorder.

Mindfulness and negative RT have only been assessed at T2. Mindfulness and negative RT are conceptualized as containing dispositional components (Brinker & Dozois, 2009; Sternberg, 2000), so it is plausible that a person's level of mindfulness and negative RT reported at T2 is representative for the entire study interval. This assumption, however, is not verifiable with the present data and we cannot preclude actual changes in mind-

fulness and negative RT over time. For example, mindfulness can be cultivated by training (Walach et al., 2006). We did not assess whether the study participants underwent a mindfulness training between T1 and T2. Although mindfulness trainings are yet uncommon in non-clinical populations, we cannot preclude that a participant took part in a mindfulness training, thereby experiencing an increase in mindfulness from T1 to T2.

Processing strategies were investigated as moderators in the AARC–depressive symptoms association. Other patterns of interrelations are also conceivable. For example, processing strategies might function as a predictor of AARC; this association could partly be mediated by well-being. As such, the overall positive effects of mindfulness on well-being–related developmental outcomes (Keng et al., 2011) might promote a positive outlook on the aging process. In contrast, the harmful effects of negative RT in terms of well-being (Watkins, 2008) might foster a selective perception of age-related loss experiences. AARC, in turn, can then exert an effect on well-being–related outcomes (Dutt et al., 2016a), thus also functioning as a mediator. Regarding mindfulness, an interesting research question would be whether the well-being–enhancing effects of mindfulness promote higher AARC gains and lower AARC losses, or whether the conscious awareness rather facilitates the perception of *both* gains and losses. Indeed, and as was the case in this study, AARC gains and AARC losses are commonly positively correlated (Kaspar, Gabrian, Brothers, Wahl, & Diehl, in press; Miche, Wahl, et al., 2014), which suggests that individuals differ in their sensitivity to age-related changes, irrespective of their valence. Although this research question could not be tested with the current data as the processing strategies were not assessed prior to AARC, it should be on the agenda for future research.

There is a lack of consensus about the precise understanding of mindfulness (Grossman, 2008). Hence, mindfulness should only be interpreted against the background of the questionnaire used. The FMI is a widespread instrument and its items comprise the two commonly used facets of presence and acceptance (Bishop et al., 2004). However, to promote the synthesis of different mindfulness instruments, the findings should be replicated with other questionnaires.

The understanding of the mindfulness items depends on the verbal capabilities of the respondent (Grossman, 2008). Although the short-form of the FMI shows good psychometric properties in populations without meditation experience (Walach et al., 2006), we cannot be certain whether each item was interpreted in the same way by every partic-

ipant. Moreover, mindfulness scales rely on explicit knowledge and may thus only inaccurately capture the experiential quality of mindfulness (Malinowski, 2008). This may in part explain why the interaction between AARC gains and mindfulness did not reach significance. To overcome these difficulties, future studies should use interviews or qualitative data to fully display the complex character of the mindfulness construct.

Although the AARC losses × Mindfulness, AARC losses × Negative RT, and AARC gains × Negative RT interaction terms were significant, the change in explained variance in the depressive symptoms LCS was of a small to medium effect size. Hence, our findings need to be interpreted with caution and replication studies are necessary to be able to draw robust conclusions about the role mindfulness and negative RT play for the association between AARC and depressive symptoms.

This study sheds light on the role of processing strategies for the association between AARC and depressive symptoms. Nonetheless, other constructs, for example, personality traits (e.g., neuroticism) or locus of control are also conceivable as moderators and should be investigated in future research.

Future research should examine whether interventions tailoring mindfulness or negative RT encourage low levels of depressive symptoms in the face of many perceived losses or few gains accompanying the aging process. By translating our findings into practice, they contribute to the promotion of successful aging experiences.

In conclusion, this study examined the moderating role of processing strategies for the association between AARC and depressive symptoms. Mindfulness buffered the harmful effect of high levels of awareness of age-related losses on change in depressive symptoms over 4.5 years, controlling for demographic variables, physical health, and neuroticism. Conversely, negative RT exacerbated the detrimental effect of high levels of awareness of age-related losses and low levels of awareness of age-related gains on change in depressive symptoms. With regard to the interplay between awareness of age-related gains and mindfulness, effects were less robust, although the direction of the findings was consistent with theoretical considerations, that is, we found a trend that low levels of awareness of age-related gains are associated with lower increases in depressive symptoms when mindfulness is high. The interplay between AARC and processing strategies suggests that subjective aging experiences are not an isolated phenomenon, but need to be considered in the context of the way individuals are cognitively dealing with them.

4

Future Time Perspective and General Self-Efficacy Mediate the Association Between Awareness of Age-Related Losses and Depressive Symptoms

[1]Anne Josephine Dutt and [1]Hans-Werner Wahl

[1]Department of Psychological Aging Research,
Heidelberg University, Germany

Dutt, A. J., & Wahl, H.-W. (submitted). Future time perspective and general self-efficacy mediate the association between awareness of age-related losses and depressive symptoms. *European Journal of Ageing*.

Abstract

Perceiving one's own aging process as associated with many losses is linked to an increase in depressive symptoms. No study has yet investigated the pathways underlying this association. We examined the mediating role of future time perspective (FTP) and general self-efficacy (GSE) in the association between perceived age-related losses and depressive symptoms. Analyses were based on a sample of 40-to-98-year-old adults (Time 1: 2012, *N* = 423) that was assessed at two additional points covering 4.5 years (Time 2: 2015, *N* = 356; Time 3: 2017, *N* = 299). Perceived age-related losses were operationalized via the loss dimension of the Awareness of Age-Related Change instrument; FTP and GSE were assessed via established questionnaires. Data were analyzed by means of a structural equation model. A higher amount of perceived age-related losses dampened FTP and GSE 2.5 years later, which in turn increased the level of depressive symptoms a further 2 years later, controlling for baseline depressive symptoms, age, sex, and subjective health. Effects were comparable across middle-aged and older individuals. FTP and GSE are important resources for understanding how perceived age-related losses translate into depressive symptoms.

Keywords: Subjective aging experiences, Awareness of age-related losses, Future time perspective, General self-efficacy, Subjective well-being, Depressive symptoms

Introduction

Subjective aging experiences, that is, the way people perceive and evaluate their own aging process, are longitudinally associated with subjective well-being–related outcomes, such as life satisfaction (Wurm et al., 2008) and depressive symptoms (Dutt et al., 2016a; Spuling et al., 2013).

Efforts have been made to better understand the mediating pathways underlying this association, that is, through which mechanisms subjective aging experiences translate into well-being–related outcomes. For example, Brothers et al. (2016) found that perceiving one's aging process as being accompanied by many losses was related to lowered eudaimonic well-being (comprising autonomy, environmental mastery, personal growth, purpose in life, positive relations with others, and self-acceptance (Ryff, 1989)) via a reduced future time perspective. Wurm and colleagues' (2013) findings suggest that negative aging self-perceptions after a serious health event are associated with lowered life satisfaction through lower use of coping strategies. Stephan et al. (2011) found that the effect of felt age on life satisfaction is mediated by memory self-efficacy and subjective health. However, to our knowledge, no study has yet investigated the mediating pathways underlying the longitudinal association between subjective aging and *depressive symptoms*.

Depressive symptoms reveal considerable frequency in middle and late adulthood (Luppa et al., 2012) and exert adverse effects on health (Ho et al., 2014) and mortality (Gallo et al., 2005). Given the specific nature of depressive symptoms as possibly indicating mental illness, it seems questionable whether the above-reviewed findings regarding eudaimonic well-being and hedonic well-being can automatically be generalized to depressive symptoms. Therefore, we argue that additional research is needed to shed light on pathways in the subjective aging–depressive symptoms association. We examined in this paper the role of mediators in the association between subjective aging and depressive symptoms in middle and old adulthood based on a 4.5-year interval.

Subjective Aging: Focus on Awareness of Age-Related Losses

In terms of subjective aging, we refer to the construct of awareness of age-related change (AARC). AARC "[…] refers to all those experiences that make a person aware that his or her behavior, level of performance, or ways of experiencing his or her life have

changed as a consequence of having grown older […]" (Diehl & Wahl, 2010, p. 340). AARC captures perceived age-related gains (AARC gains) and losses (AARC losses) across different behavioral domains (e.g., physical, cognitive). The multidirectional character anchors the AARC construct in established life-span developmental psychology principles (P. Baltes, Lindenberger, & Staudinger, 2006) and distinguishes it from other subjective aging operationalizations, such as felt age (Diehl et al., 2014).

A consistent finding has been that AARC losses showed much stronger relations with developmental outcomes as compared with AARC gains (Brothers et al., 2017; Dutt et al., 2016a), which is in line with a meta-analysis showing that negative aging attitudes elicited a much greater effect on behavior than positive aging attitudes (Meisner, 2012). Accordingly, we focused in this study on the loss–related subscale of AARC.

Mediators in the Association Between Awareness of Age-Related Losses and Depressive Symptoms

We chose future time perspective (FTP) and general self-efficacy (GSE) as mediators in the association between AARC losses and depressive symptoms. This decision was driven by two considerations: First, there is already evidence on a mediating role of FTP and GSE in the association between subjective aging and well-being (Brothers et al., 2016; Stephan et al., 2011). These studies focused on life satisfaction and eudaimonic well-being; it remains unclear whether findings also apply to depressive symptoms. Moreover, previous studies were in parts cross-sectional, thus prohibiting causal conclusions. Second, FTP and GSE tap two main resource clusters, namely the perception of so-called energies (i.e., time) and of personal characteristics (i.e., competence) (Hobfoll, 1989). Considering both FTP and GSE thus allows investigating the mediating role of two distinct yet essential individual resources.

Future time perspective as a mediator in the association between awareness of age-related losses and depressive symptoms

FTP captures an individual's perception of his or her remaining lifetime. With growing age, an individual perceives future time as being increasingly limited (Lang & Carstensen, 2002).

Based on Brothers et al. (2016) who found that FTP mediates the association between AARC losses and eudaimonic well-being, we assumed a mediating role of FTP in the

association between AARC losses and depressive symptoms. First, AARC losses should impact FTP. Perceiving negative age-related changes might remind of being in the last phase of life and hence should be associated with a narrowing FTP (Brothers et al., 2016). Indeed, higher AARC losses have been shown to be associated with a limited FTP (Brothers et al., 2016). This association also applies for other subjective aging measures. Older adults who psychologically dissociated themselves from their age group perceived their future as more open-ended (Weiss & Lang, 2012).

Second, FTP can be expected to be related to depressive symptoms. A more limited FTP has been shown to be associated with higher depressive symptoms (Hoppmann, Infurna, Ram, & Gerstorf, 2017). This association might be explained by different behavioral pathways. A limited FTP is associated with lower use of adaptive coping strategies (B. Baltes, Wynne, Sirabian, Krenn, & De Lange, 2014) and less positive social exchanges (Windsor, Fiori, & Crisp, 2011). FTP also affects health behaviors (Stahl & Patrick, 2012). Health, in turn, is associated with depressive symptoms (G. M. Goodwin, 2008).

In the light of these findings, we assumed that high levels of perceived age-related losses narrow FTP, which in turn should increase the level of depressive symptoms.

General self-efficacy as a mediator in the association between awareness of age-related losses and depressive symptoms

GSE (Bandura, 1977) can be understood as the belief in one's competence to tackle difficult or novel tasks and to cope with adversity in challenging situations (Luszczynska, Gutiérrez-Doña, & Schwarzer, 2005). GSE tends to decline from age 50 or 60 on (Schieman & Campbell, 2001).

We assumed a mediating role of GSE in the association between AARC losses and depressive symptoms. First, AARC losses should impact GSE. According to Bandura (1977), self-efficacy derives from personal experiences of mastery; this link is strengthened when accomplishments are attributed to internal factors. Perceiving loss experiences across different behavioral domains and attributing them to age, that is, to an internal factor, can be understood as absence of mastery experiences and thus should dampen self-efficacy. The association between subjective aging experiences (related to AARC) and GSE has also been shown empirically. People who feel younger than their age are more likely to experience high GSE (Teuscher, 2009).

Second, GSE has been shown to be related to depressive symptoms (Steunenberg, Beekman, Deeg, & Kerkhof, 2006). This association can be explained by higher well-being–enhancing behaviors (e.g., health behaviors, adaptive coping) in individuals with high self-efficacy beliefs (Bandura, 1977; Jang, Haley, Small, & Mortimer, 2002).

Based on these considerations, we assumed that high levels of perceived age-related losses dampen GSE, which in turn should increase the level of depressive symptoms.

Research Aims and Hypotheses

This study examined FTP and GSE as mediators in the association between AARC losses and change in depressive symptoms in middle-aged and older adults using three measurement points covering 4.5 years. We assumed that the detrimental effect of AARC losses on change in depressive symptoms is mediated by FTP and GSE. Theoretical considerations suggest changes in the normativity of age-related experiences across the life span (P. Baltes et al., 1980). For example, those older than 65 years have a higher likelihood of being retired and of experiencing functional or social losses. Therefore, we exploratorily tested for age effects by contrasting the pattern of associations between middle-aged (< 65 years) and old-aged (≥ 65 years) adults.

Method

Study Design and Participants

Data were collected in 2012 (T1), 2015 (T2), and 2017 (T3). Ethical approval for T3 was obtained by the research ethics committee of the Faculty of Behavioral and Cultural Studies at Heidelberg University. The observational interval covered on average 30.18 months (*SD* = 0.50 months) between T1 and T2 and 55.41 months (*SD* = 0.56 months) between T1 and T3.

423 persons participated at T1, 356 persons participated at T2 (84%), 299 persons participated at T3 (71%). Main reasons for dropout from T1 to T2 were no interest (34%), health problems (9%), or death (6%). Main reasons for dropout from T1 to T3 were no interest (55%), health problems (7%), or death (10%). Regarding the T2 measurement, dropouts were older than T2 participants, $t(421) = 3.64$, $p = .000$, $d = 0.49$. Regarding the T3 measurement, dropouts were more common among men than among women, $\chi^2(1) = 6.85$, $p = .009$. Dropouts were older than T3 participants, $t(421) = 3.84$, $p = .000$,

d = 0.41. Participants and dropouts for T2 and T3, respectively, did not differ on the remaining study variables at T1, all *p*s > .05. Thus, analyses were based on the 423 T1 participants. Missing data were replaced using the saturated–model expectation maximization (EM) algorithm which outperforms other approaches in the reconstruction of the missing sample data (Gold & Bentler, 2000).

At T1, participants were between 40 and 98 years old (*M* = 62.94, *SD* = 11.84 years). Two thirds were women (64%). 61% were partnered or married. Education was high, with an average of 11.53 years (*SD* = 1.95 years) of schooling, and with more than half of the participants (55%) having a general qualification for university entrance. 40% were retired. 84% reported an average or above average subjective health status. Descriptive information of the study variables is summarized in Table 4.1.

Measures

Predictor: T1 awareness of age-related losses

AARC losses were measured with the 25-item loss–related subscale of the AARC questionnaire (Brothers et al., conditionally accepted). Each item is preceded by the item stem "With my increasing age, I realize that…" and comprises the description of a negative experience in one out of five behavioral domains, for example, health and physical functioning. The 25 items evenly represent the five behavioral domains. An example for a negative aging experience is "…that it is more difficult for me to learn new things" (cognitive functioning). The scales were developed within a cross-cultural research collaboration, including U.S. focus groups and a German diary study. All items underwent a rigorous translation/back-translation process. Participants indicated their agreement on a 5-point Likert-scale, ranging from 1 *(not at all)* to 5 *(very much)*. The internal consistency for the mean score was good (Cronbach's α = .92). For latent modeling, we parceled the indicator variables (Little et al., 2002). The five domain mean scores served as indicators for the AARC losses factor. We calculated a composite reliability index as an indicator of the internal consistency of the scale (Raykov, 1997), which is estimated based on the parcel factor loadings. This composite reliability amounted to .86.

Table 4.1. Descriptive Information and Bivariate Associations Between the Study Constructs, Assessed at Time 1 (T1, 2012), Time 2 (T2, 2015), and Time 3 (T3, 2017)

	M (SD)	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
1. Age T1	62.94 (11.84)	–							
2. Sex (percent women)	64.30	-.17***	–						
3. Self-rated health T1	3.24 (0.81)	-.14**	.00	–					
4. AARC losses T1	2.23 (0.61)	.26***	.04	-.51***	–				
5. Future time perspective T2	3.47 (1.08)	-.32***	.01	.32***	-.50***	–			
6. General self-efficacy T2	2.93 (0.45)	.06	-.06	.21***	-.33***	.47***	–		
7. Depressive symptoms T1	1.76 (0.51)	-.01	.19***	-.50***	.57***	-.28***	-.34***	–	
8. Depressive symptoms T3	1.81 (0.50)	.06	.14**	-.41***	.50***	-.37***	-.37***	.59***	–

Notes. AARC = awareness of age-related change; *M* = mean; *SD* = standard deviation. All parameters reported have been adjusted by the expectation maximization estimate.
N = 423. ** $p < .01$, *** $p < .001$.

Outcome: T3 depressive symptoms

The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) measures an individual's current level of depressive symptoms (established German version: Kohlmann & Gerbershagen, 2006). The 10-item version used here shows good psychometric properties in old adults (Irwin et al., 1999). The items were evaluated on the basis of the symptoms during the past week and judged on a 4-point Likert-scale, ranging from 1 (*rarely or none of the time*) to 4 (*most or all of the time*). The internal consistency was good (Cronbach's $\alpha = .86$). For latent modeling, items were parceled into three parcels comprising 3-4 items, with an equal distribution of factor loadings across parcels. Items within one parcel were aggregated to a mean score. The composite reliability amounted to .85.

Mediator: T2 future time perspective

FTP was operationalized by a 10-item scale developed by Carstensen and Lang (1996). An example for an item formulation is "My future seems infinite to me." The items were evaluated on a 7-point Likert-scale, ranging from 1 (*very untrue*) to 7 (*very true*). The scale yielded a good internal consistency (Cronbach's $\alpha = .88$). For latent modeling, items were parceled into three parcels comprising 3-4 items with an equal distribution of factor loadings. The composite reliability amounted to .92.

Mediator: T2 general self-efficacy

GSE was assessed using the General Self-Efficacy Scale by Schwarzer and Jerusalem (1995). Ten items assess a person's confidence to overcome difficult situations due to his or her own competence, for example, "I am confident that I could deal efficiently with unexpected events." Each statement was judged on a 4-point Likert-scale, ranging from 1 (*not at all true*) to 4 (*exactly true*). The internal consistency was good (Cronbach's $\alpha = .91$). For latent modeling, items were parceled into three parcels comprising 3-4 items with an equal distribution of item factor loadings. The composite reliability amounted to .92.

Control variables

T1 calendar age, sex, and T1 subjective health were used as control variables, as they have been shown to be associated with the study variables (Brothers et al., 2017; Schieman & Campbell, 2001). Sex was coded as 0 (*male*) and 1 (*female*). Subjective health

was operationalized as a rating of the present perceived health status on a 5-point Likert-scale, ranging from 1 (*bad*) to 5 (*very good*). Moreover, we controlled for baseline (T1) depressive symptoms which were assessed similar to T3 depressive symptoms (Cronbach's α = .85, composite reliability = .86).

Data Analyses

The mediator model was tested within a structural equation modeling approach realized with AMOS 24. The structural model included four latent variables, all observed manifest indicators, and error terms. Paths were specified from AARC losses to depressive symptoms, from AARC losses to FTP and GSE, and from FTP and GSE to depressive symptoms. We specified a covariance between the residuals of FTP and GSE (Luszczynska et al., 2005). The control variables (T1 age, sex, subjective health, depressive symptoms) were correlated with AARC losses. We also included paths from the covariates to the T2 mediators and T3 depressive symptoms. Path coefficients were estimated using the maximum likelihood procedure.

As depressive symptoms were assessed at two occasions, we tested for measurement invariance by specifying progressively stricter measurement models (Horn & McArdle, 1992). We first specified a measurement model with all paths set free (Model 1). Modification indices suggested a correlation between corresponding error terms across measurement occasions (e.g., Parcel 1 error at T1 with Parcel 1 error at T2) that we admitted. This model indicated that the same parcels load on depressive symptoms across measurements (configural invariance). Model 1 was evaluated against a model with corresponding factor loadings set equal across measurements (Model 2; weak factorial invariance). This model, in turn, was evaluated against a model with corresponding factor loadings and parcel intercepts set equal across measurements (Model 3; strong factorial invariance). A significant change in the χ^2 goodness-of-fit statistic was interpreted as a significant worsening of model fit. $\Delta\chi^2(df)$ amounted to 1.24(3) (p = .743) from Model 1 to Model 2 and to 6.49(3) (p = .090) from Model 2 to Model 3. We thus assumed strong factorial invariance across measurements. The final measurement model (Model 3) for T1/T3 depressive symptoms yielded a good fit, $\chi^2(11) = 23.88$, comparative fit index (CFI) = .991, root mean square error of approximation (RMSEA) = .053, 90% confidence interval (CI) [.023, .082].

We proceeded with the specification of measurement models for AARC losses, FTP, and GSE. In order to investigate age effects between middle-aged (< 65 years; N = 255) and older (≥ 65 years; N = 168) adults, we tested for measurement invariance across age groups. We chose age 65 as cutoff for the formation of two age groups, as this age is closely tied to legislative regulations in Germany, such as entry into retirement status, thus separating two life phases. Participants in the old-age group were significantly older, $t(312.50) = -26.09$, $p = .000$, $d = 2.69$, reported worse health, $t(394.47) = 2.74$, $p = .006$, $d = -0.26$, more AARC losses, $t(421) = -4.69$, $p = .000$, $d = 0.47$, and a more limited FTP, $t(421) = 6.49$, $p = .000$, $d = -0.65$, as compared with participants in the middle-age group. Men were more strongly represented in the old-age group as compared with the middle-age group, $\chi^2(1) = 11.05$, $p = .001$. We first specified a measurement model with all paths and intercepts set free between age groups (Model 1). This model fit the data well, $\chi^2(294) = 716.53$, CFI = .920, RMSEA = .058, 90% CI [.053, .064], with the same parcels loading on corresponding factors across age groups (configural invariance). Subsequently, we tested for weak and strong factorial invariance by constraining corresponding factor loadings (Model 2) and parcel intercepts (Model 3), respectively, as being equal between age groups. Model 1 and Model 2 did not differ in model fit, $\Delta\chi^2(10) = 9.06$, $p = .527$, suggesting weak factorial invariance. Partial strong factorial invariance was established once the following parcel intercepts were allowed to vary between age groups: AARC losses subdomains lifestyle and engagement, interpersonal relations, cognitive functioning, two GSE parcels, and one T3 depressive symptoms parcel. Although change in model fit was significant between this model and Model 2, $\Delta\chi^2(8) = 22.77$, $p = .004$, it needs to be considered that the χ^2 difference test tends to overestimate model differences in larger samples (Schermelleh-Engel, Moosbrugger, & Müller, 2003). Hence, we consulted another fit index to evaluate change in model fit, that is, the CFI, which is more independent from sample size (Cheung & Rensvold, 2002). Cheung & Rensvold (2002) proposed a critical value of .01 for the rejection of the null hypothesis of equal model fit. ΔCFI between Model 2 and the modified Model 3 amounted to .003, providing evidence for the assumption of partial strong invariance between age groups.

To test the mediating role of FTP and GSE for the AARC losses–depressive symptoms association, we investigated the role of the indirect effect within the multiple mediator model. We refrained from interpreting mediation effects as partial or full, as this classifica-

tion depends on the size of the total effect rather than on the importance of the mediator (Rucker, Preacher, Tormala, & Petty, 2011). Instead, the significance of the indirect effect was assessed using 95% bias-corrected bootstrapped confidence intervals based on 500 bootstrap samples (Preacher & Hayes, 2008). An indirect effect is statistically significant at the 5%-level if the 95% bootstrapped confidence interval does not contain 0. We report the proportion of the indirect to the total effect as a measure of effect size.

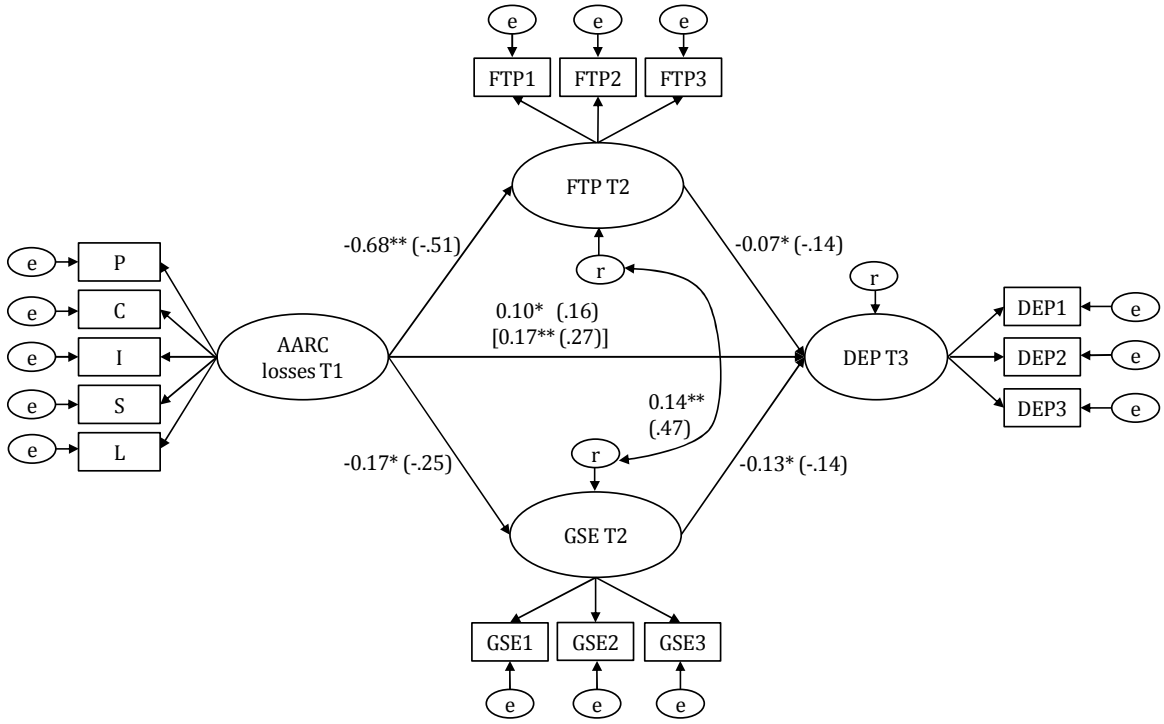


Figure 4.1. Structural equation model examining associations between Time 1 (T1, 2012) awareness of age-related losses (AARC losses), Time 2 (T2, 2015) future time perspective (FTP), T2 general self-efficacy (GSE), and Time 3 (T3, 2017) depressive symptoms (DEP).
Notes. e = manifest variable residual; r = latent variable residual; P – L = mean scale scores for the five AARC losses domains: Health and physical functioning (P), cognitive functioning (C), interpersonal relations (I), social-emotional/social-cognitive functioning (S), lifestyle and engagement (L); FTP1 – FTP3 = item parcels to indicate future time perspective; GSE1 – GSE3 = item parcels to indicate general self-efficacy; DEP1 – DEP3 = item parcels to indicate depressive symptoms. Standardized coefficients are reported in parentheses. The total effect is reported in brackets. All constructs were controlled for baseline depressive symptoms, age, sex, and baseline subjective health. Residual paths are constrained to 1. All parameters reported have been adjusted by the expectation maximization estimate.
$N = 423$. * $p < .05$, ** $p < .01$. The p-value for the path from FTP to DEP amounted to .05.

Results

Bivariate correlations between the study constructs are displayed in Table 4.1. T1 AARC losses were positively linked to T3 depressive symptoms and negatively associated with T2 FTP and GSE. FTP and GSE were negatively linked to depressive symptoms.

Within the multivariate analyses, the specified structural model yielded a satisfactory fit, $\chi^2(147) = 536.91$, CFI = .928, RMSEA = .079, 90% CI [.072, .087]. Overall, the model explained 47.6% of the variance in depressive symptoms (see Figure 4.1). The direct effect of AARC losses on FTP was significant, b = -0.68, 95% CI [-0.95, -0.46], β = -.51, p = .003, as was the direct effect of AARC losses on GSE, b = -0.17, 95% CI [-0.29, -0.04], β = -.25, p = .015. FTP and GSE, in turn, exerted a significant direct effect on depressive symptoms, b = -0.07, 95% CI [-0.14, 0.00], β = -.14, p = .050 for FTP, b = -0.13, 95% CI [-0.25, -0.02], β = -.14, p = .026 for GSE. Hence, the perception of one's aging process as associated with many losses lead to a reduction in perceived future time and general self-efficacy 2.5 years later, which in turn intensified depressive symptoms a further 2 years later, controlling for baseline depressive symptoms, age, sex, and baseline subjective health. The total effect of AARC losses on depressive symptoms was significant, b = 0.17, 95% CI [0.07, 0.29], β = .27, p = .003, but was lowered when FTP and GSE were included as mediators, b = 0.10, 95% CI [0.01, 0.22], β = .16, p = .046. The total indirect effect of AARC losses on depressive symptoms through the two mediators, that is, FTP and GSE, amounted to significance, b = 0.07, 95% CI [0.02, 0.14], β = .11, p = .008. This suggests that the effect of AARC losses on depressive symptoms was mediated via FTP and GSE, whereby 39% of the effect of AARC losses on depressive symptoms can be attributed to FTP and GSE. The complete indirect effect can be divided into components attributable to the mediational effect of FTP and GSE, respectively. The two specific indirect effects amounted to significance each, with b = 0.05, 95% CI [0.00, 0.11], β = .07, p = .049, 27% shared proportion to the total effect, for FTP, and b = 0.02, 95% CI [0.00, 0.05], β = .04, p = .024, 13% shared proportion to the total effect, for GSE. The difference between the two specific indirect effects was not significant, p = .370.

We next examined the specific indirect effects separately for each mediator within two separate single mediator models, with the other mediator removed from the model. The indirect effect through FTP amounted to significance, b = 0.07, 95% CI [0.03, 0.13],

$\beta = .11$, $p = .007$. Regarding GSE as a mediator, the indirect effect was significant, too, $b = 0.03$, 95% CI [0.01, 0.06], $\beta = .05$, $p = .009$. Hence, FTP and GSE, considered both in combination as well as alone, can be viewed as significant mediators in the longitudinal association between AARC losses and depressive symptoms.

We also tested for differences between middle-aged (< 65 years; $N = 255$) and older (≥ 65 years; $N = 168$) adults. Based on the assumption of partial strong invariance across age groups, we imposed equality constraints on the structural paths across age groups. Compared with the unconstrained model, there was no significant worsening of model fit, $\Delta\chi^2(5) = 10.46$, $p = .063$. Hence, it can be assumed that the effects were equivalent between middle-aged and older participants.

Discussion

We examined FTP and GSE as mediators in the association between perceived age-related losses and depressive symptoms based on a 4.5-year interval in adults aged 40 to 98 years at T1. Many perceived losses dampened FTP and GSE 2.5 years later, which in turn increased the level of depressive symptoms a further 2 years later. Effects were robust after controlling for baseline depressive symptoms, age, sex, and baseline subjective health. Effects were comparable in middle- and old-aged adults.

Future Time Perspective and General Self-Efficacy Mediate the Association Between Awareness of Age-Related Losses and Depressive Symptoms

Brothers et al. (2016) found that AARC losses were related to lowered eudaimonic well-being via a reduced FTP. In a cross-sectional study, Stephan et al. (2011) found that the effect of subjective age on life satisfaction is mediated by memory self-efficacy and subjective health. Our study adds to these findings in two ways: First, we focused on another important developmental outcome, that is, depressive symptoms. Second, by drawing on three measurement points, we were able to address the chronological sequence of AARC losses, FTP, GSE, and depressive symptoms.

The mediating role of FTP and GSE in the association between AARC losses and depressive symptoms can be illustrated exemplarily with regard to age-related loss experiences in the physical domain. An individual who is aware of negative physical changes (i.e., increased bodily pain) might interpret them as a sign of the aging process constantly mov-

ing ahead. In the light of this immediate confrontation with the unavoidable aging process, his or her FTP is dampened. Moreover, a person who encounters many physical declines accompanied by constraints in everyday life might start questioning his or her competence to efficiently deal with daily hassles, attenuating GSE. The reduced FTP and GSE should turn the individual into a state of avoidance, refraining from health behaviors, social contacts, or adaptive coping. At the end of the day, the individual will undergo an increase in depressive symptoms.

We exclusively focused on the loss component of AARC. As noted above, this decision was driven by the observation that perceived age-related losses have been shown to be longitudinally associated with depressive symptoms, whereas perceived age-related gains were unrelated to depressive symptoms (Dutt et al., 2016a). This is in line with Baumeister et al.'s (2001) general observation that negative events exert a stronger impact on developmental outcomes as compared with positive events (see also Meisner, 2012). As our research interest comprised a better understanding of the mechanisms underlying the association found between AARC and depressive symptoms, we concentrated on the loss component of AARC. We exploratorily repeated our analyses with AARC gains as a predictor. The association between AARC gains and depressive symptoms was not significant over the 4.5-year interval, b = -0.02, 95% CI [-0.10, 0.05], β = -.02, p = .692. Moreover, the indirect effect through FTP and GSE did not reach significance for the AARC gains–depressive symptoms association, b = -0.01, 95% CI [-0.05, 0.02], β = -.02, p = .375. Hence, the mediating role of FTP and GSE that we found in the association between AARC losses and depressive symptoms cannot be generalized to AARC gains.

We did not find any age effects regarding the mediating role of FTP and GSE, that is, effects were comparable across the second half of the life span. It has to be taken into account that our sample included few very old adults (only 11.1% were 80 years and older at T1). The inclusion of more adults in advanced old age might have increased the probability of finding age effects.

At the practical level, our results can contribute to the prevention and treatment of depressive disorders in the second half of life. Although the treatment of depressive symptoms requires interdisciplinary and multi-factorial therapeutic approaches, a better understanding of the mechanisms underlying the harmful association between perceived age-related losses and depressive symptoms could provide a starting point for the devel-

opment of interventions to overcome this detrimental relationship. When one is sensitive to the, for example, potentially hazardous effect of high AARC losses on GSE, an important therapeutic goal could be to purposefully provide the aging individual with experiences of mastery to maintain high levels of GSE despite many perceived losses. These, in turn, should reduce the risk of depressive symptoms. Future studies are needed to tailor such intervention programs.

Limitations and Future Research

The sample was positively biased with regard to education or health. As such, caution is advisable when generalizing the results to other populations. Although we controlled for baseline depressive symptoms, thus depicting change in depressive symptoms over 4.5 years, GSE was not assessed at T1; thus, we considered both mediators only at T2. Future investigations should examine how changes in the mediators entail changes in the outcome. FTP was operationalized as perceived extension of future time (Carstensen & Lang, 1996). Although this is a common understanding of FTP, conceptualizations of FTP also comprise other characteristics, such as the valence attached to future time or the opportunities/constraints thought of when making future plans (Rakowski, 1979). Future studies should take into account these components. By choosing FTP and GSE as mediators for the AARC losses–depressive symptoms association, we took into consideration resources of two central resource clusters, that is, so-called energies and personal characteristics (Hobfoll, 1989). Notwithstanding, other constructs, for example, health and physiological or physical activity, are also conceivable as mediators and should be investigated in future research (see also Stephan et al., 2011). Finally, recent research has made a great effort in integrating different subjective aging constructs, such as subjective age or attitude toward own aging (Lawton, 1975) into an overarching framework (Diehl et al., 2014). In order to extend this synthesis, future studies need to examine whether our findings generalize to other subjective aging constructs.

In conclusion, we found that the harmful effect of many perceived age-related losses on depressive symptoms over 4.5 years was mediated by FTP and GSE, controlling for baseline depressive symptoms, demographic variables, and subjective health. Our results suggest that the translation of subjective aging experiences into developmental outcomes is a complex and multistage phenomenon.

5

Feeling Sad Makes Us Feel Older: Effects of a Sad Mood Induction on Subjective Age

[1]Anne Josephine Dutt and [1]Hans-Werner Wahl

[1]Department of Psychological Aging Research,
Heidelberg University, Germany

Dutt, A. J., & Wahl., H.-W. (2017). Feeling sad makes us feel older: Effects of a sad-mood induction on subjective age. *Psychology and Aging, 32*, 412-418. doi:10.1037/pag0000179

Abstract

A mood-induction paradigm was implemented in a sample of 144 adults covering midlife and old age (40-80 years) to investigate associations between mood and subjective age. Sad or neutral mood was induced by texts and music pieces. Subjective age was operationalized as felt age relative to chronological age. Participants receiving the sad mood induction reported changes toward older felt ages from pre- to postinduction. Participants receiving the neutral mood induction reported comparable levels of subjective age at pre- and postinduction. Effects were comparable across middle- and older aged participants. Results suggest that sad affective states might dampen subjective age.

Keywords: Subjective age, Sad mood states, Negative affectivity, Mood induction

Introduction

Subjective age, that is, the age a person feels in relation to his or her chronological age, has been found to be associated with developmental outcomes, for example, physical and mental health and mortality (Spuling et al., 2013; Westerhof et al., 2014). Less is known, however, about the antecedents of subjective age (Kotter-Grühn, Kornadt, & Stephan, 2016). For example, Infurna and colleagues (Infurna, Gerstorf, Robertson, Berg, & Zarit, 2010) found in their cross-sectional analysis that older age, lower physical functioning, depressive symptoms, and lower mastery beliefs are related to feeling older. Our experimental study focused on sad mood as an antecedent and shaping force of subjective age. This decision was based on two considerations, one conceptual and one empirical argument. First, theoretical models suggest an effect of sad mood on subjective age. The evaluation of a person's subjective age stimulates an elaborate search for and processing of information (Diehl et al., 2014), triggering autobiographical memory research or evaluative judgments. According to the *associative network theory of memory and emotion* (Bower, 1981), priming processes facilitate the retrieval of memories consistent in emotional tone with a current mood.[12] The *feelings-as-information approach* (Schwarz & Clore, 1983) highlights the informational and heuristic value of moods for evaluative judgments. Moreover, a selective attention to and interpretation of information consistent with the ongoing mood can also be motivated by efforts of self-verification to bolster feelings of controllability (Swann, 1983). As a consequence, individuals in a sad mood should assess their aging process more negatively than individuals in a neutral mood. This should result in an older subjective age relative to chronological age.

Second, at the empirical level, subclinical depressive symptoms and feelings of sadness are quite common in old age (Kunzmann et al., 2013; Luppa et al., 2012). Longitudinal studies point to an effect of depressive symptoms on subjective age (Avidor et al., 2016; Ayalon et al., 2016; Bowling et al., 2005). However, findings remained somewhat mixed, as other studies did not find clear longitudinal associations between depressive symptoms or mental health and subjective age (Bergland et al., 2014; Spuling et al., 2013). With regard

[12] Some studies suggest that an induced sadness sometimes triggers mood–incongruent memories (Isen, 1985)—an effect which might be attributable to a desire for mood repair. But Parrott and Sabini (1990) found that participants inhibit this tendency in laboratory/experimental situations, where they have been asked to alter their mood, because the external attribution which is offered for the mood deterioration helps to tolerate the sad mood.

to the latter, it has to be taken into account that depressive symptoms show intraindividual variability over time (Hsu, 2012), which may disguise their effects on subjective age in the long run. Hence, the question whether depressive symptoms function as an antecedent of subjective age cannot entirely be explained with the existing longitudinal research. Therefore, a microlongitudinal study such as the one conducted by Kotter-Grühn et al. (2015) may be helpful. These authors, using a daily diary approach over nine consecutive days, found that daily changes in negative affect (but not in positive affect) explained day-to-day fluctuations in subjective age. Yet, an ecological momentary assessment study such as the one by Kotter-Grühn et al. (2015) has limitations in establishing a time-ordered, causal relationship between negative mood and subjective age.

Starting from the recent work of Kotter-Grühn et al. (2015) supporting a linkage between negative mood and older subjective age in daily aging, we believe that it is a particularly important research gap that the association between negative affectivity and subjective age has not been investigated experimentally. To date, experimental studies in the context of subjective age have focused on the manipulation of age stereotypes (Kotter-Grühn & Hess, 2012; Weiss & Lang, 2012) or the salience of aging experiences (Eibach et al., 2010; Hughes et al., 2013; Stephan et al., 2013). They found immediate effects of the experimental manipulation on subjective age, with negative primes inducing older felt ages. These findings suggest that subjective age is a highly dynamic and plastic construct (see also Kotter-Grühn et al., 2015). However, there is no study yet that has focused on the manipulation of negative mood to study effects on subjective age.

In the present study, we examined short-term effects of sad mood on subjective age in a sample covering midlife and old age and using a mood-induction paradigm. We hypothesized that the induction of a sad mood as compared with a neutral mood is associated with older subjective ages. As our study covers midlife and old age, hence two life phases with a number of differences (e.g., midlife higher in job involvement, old age higher in disease rate; see also Lachman, 2004), we also investigated age effects at an exploratory level. Moreover, we exploratorily tested for a potential moderating role of the personality construct of neuroticism, as neuroticism interacts with negative affect in producing mood-congruent memories and judgments (Rusting, 1999).

Method

Design and Procedure

Ethical approval was obtained by the research ethics committee of the Faculty of Behavioral and Cultural Studies at Heidelberg University. The design was a mixed 2 × 2 factorial design with mood induction (neutral vs. sad) as the between–subjects factor, and time (preinduction vs. postinduction) as the within–subjects factor. We spread the procedure over two days to reduce demand characteristics and not to overburden the participants. Participants first filled out a questionnaire at home, containing the preinduction measurement of subjective age (T1) as well as demographic and personality variables and a mood rating (Mood_0). Some days later (*M* = 2.08 days, *SD* = 2.19 days), they took part in a 30-min experimental session in the laboratory. During the session, participants first rated their current mood (Mood_1). They then were induced into the target mood and gave a second mood rating (Mood_2). They completed the postinduction measurement of subjective age (T2) and reported their mood state for a third time (Mood_3).

Table 5.1. Descriptive Statistics of Key Constructs

	Experimental condition	
	Neutral (*n* = 60) ***M*(*SD*) or %**	**Sad (*n* = 58)** ***M*(*SD*) or %**
Age	65.35 (9.40)	64.13 (9.37)
Sex (% women)	76.70	81.00
Years of education	11.72 (1.68)	11.07 (1.90)
Marital status (% married or partnered)	46.70	48.30
Retirement status (% retired)	68.30	55.20
T1 proportional subjective age-discrepancy score[a]	-0.10 (.08)	-0.15 (.11)
T2 proportional subjective age-discrepancy score[a]	-0.10 (.08)	-0.09 (.15)
T1 continuous measure of subjective age[b]	-15.74 (15.43)	-19.01 (14.27)
T2 continuous measure of subjective age[b]	-15.93 (14.20)	-11.05 (15.17)
Mood_0	26.80 (18.66)	28.38 (16.63)
Mood_1	25.70 (15.82)	24.47 (11.96)
Mood_2	24.43 (15.75)	60.11 (16.32)
Mood_3	23.74 (16.24)	32.60 (19.59)

Notes. M = mean; *SD* = standard deviation. [a]Operationalized as the discrepancy between felt age and chronological age, relative to chronological age. Higher subjective age scores indicate older felt ages. [b]Operationalized as a continuous rating from -50 *(feels much younger than chronological age)* to 50 *(feels much older than chronological age)*.

Sample

According to power analysis, a sample size of 104 persons is needed to detect a 2 × 2 within–between interaction of a small to medium effect size (f = .18) in a repeated-measures analysis of variance (ANOVA; α = .05, 1 – β = .95; Faul, Erdfelder, Lang, & Buchner, 2007). As reviews on mood induction show that some participants fail to respond to the target mood (M. Martin, 1990), we recruited more participants to compensate for mood nonresponders. Participants (N = 144) were randomly assigned to the two mood groups: 72 adults in the neutral group, M = 64.86 years, SD = 9.50 years, 75% women; 72 adults in the sad group, M = 63.39 years, SD = 9.89 years, 79% women. Prospective participants were excluded if they reported acute critical life events, such as a serious diagnosis or occupational problems. Only one participant met this criterion and was contacted a month later. We recruited participants aged 40 to 80 to ensure that they would be sensitive to aging experiences (Whitbourne & Collins, 1998) while at the same time reducing the probability of occurrence of severe illnesses. Despite random assignment, the neutral (M = -0.11) and sad (M = -0.15) groups differed on the T1 proportional subjective age-discrepancy score, $t(131.27) = 2.59$, p = .011, d = 0.43. The groups did not differ on the remaining study, personality, or demographic variables, nor did they differ on the T1 continuous measure of subjective age, all ps > .05.

Mood Induction

Following previous research (Fox, Knight, & Zelinski, 1998; Gerrards-Hesse, Spies, & Hesse, 1994), we used a combination of stories and music, coupled with a mood–specific instruction, to induce sad and neutral mood states. A pilot study with 10 middle-aged (52–63 years, M = 56.77 years, SD = 3.36 years, 50% women) and 10 old-aged (66–80 years, M = 74.08 years, SD = 4.77 years, 50% women) native speakers was conducted to select the stimuli that were most appropriate for eliciting the desired mood (neutral music: Bach's *Well-Tempered Clavier I, Prélude No. 1, C-Major, BWV 846* + Bach's *Well-Tempered Clavier II, Prélude No. 11, F-Major, BWV 880*; neutral text: documentation on an aircraft; sad music: Albinoni's *Adagio in G-Minor*; sad text: story about a mother who gives away her child). The stimuli did not contain any information associated with aging. The mood was induced by having the participants read the text, which took about 3–5 min. The matching 5-min music piece was played repeatedly throughout the whole session via headphones.

To reduce demand characteristics, the study was entitled "Does listening to music facilitate reading texts?" Participants in the neutral group were instructed to use the music to be able to better concentrate on the text (Drace, 2013). Participants in the sad group were instructed to use the music to be able to better empathize with the characters of the story (Rusting, 1999).

Measurement Instruments

Subjective age

Participants were asked to indicate in years the age they felt at this moment. A proportional subjective age-discrepancy score was calculated to obtain a measure of subjective age in proportion to chronological age (Rubin & Berntsen, 2006). Lower scores indicate that a participant feels younger than his or her calendar age (i.e., a value of -0.10 means that a participant feels 10% younger). To avoid that participants have internalized "their" subjective age number, rendering it immune to change, we also included a continuous measure of subjective age. Participants indicated on a 100-mm visual analogue scale whether they felt much younger (-50), the same (0) or older (50) than they are (Hughes et al., 2013). The correlation between the two measures was moderate to high (T1: r = .57, T2: r = .67).[13]

Mood

Mood was assessed with five items from the German Aging Semantic Differential (Gluth et al., 2010), that is, optimistic—pessimistic, satisfied—dissatisfied, expectant—resigned, hopeful—dejected, happy—sad, which were answered on a 100-mm visual analogue scale, with higher values signalizing more unfavorable mood states. The items were averaged to a global mood score (Cronbach's α: Mood_0: α = .92, Mood_1: α = .89, Mood_2: α = .95, Mood_3: α = .94). Filler items were added to reduce demand effects.

[13] One older woman in the sad mood group reported feeling 9 years old at postinduction. She thought herself back to her childhood, when she had experienced a situation comparable to the one described in the text she read. As this youthful felt age was based on mechanisms other than the ones we were interested in, we coded this item, as well as the corresponding continuous measure of subjective age, as missing value. One middle-aged woman in the sad mood group reported feeling 10 years old at postinduction. Maybe she wanted to express that she feels 10 years younger than her current age. However, as we were unsure about the concrete mechanisms that might explain this youthful felt age, we coded this item as missing value. No other cases were classified as outliers or extreme scores on the continuous measure of subjective age. Two cases were classified as extreme scores on the proportional subjective age-discrepancy score (i.e., feeling 52% younger at T1 and 44% older at T2, respectively). However, an exclusion of the two cases did not alter the results, so they were included into the sample.

Neuroticism

Neuroticism was assessed by the German version of the NEO Five-Factor Inventory (Borkenau & Ostendorf, 2008). The items were judged on a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*), Cronbach's α = .89.

Data Analyses

In the sad (neutral) mood condition, participants were classified as mood responders if they showed changes toward the negative semantic pole on the global mood score from pre- to postinduction of at least (less than) 10 percentage points (i.e., 10 millimeters). Within the sad and the neutral group, mood responders and mood nonresponders did not differ regarding the distribution of age, sex, depressive symptoms, neuroticism, Mood_0, Mood_1, or both T1 subjective age measures, all *p*s > .05. Analyses were based on the mood responders, that is, 60 adults in the neutral group and 58 adults in the sad group (see Table 5.1).

We examined changes in subjective age from pre- to postinduction by performing a 2 (mood group: sad vs. neutral) × 2 (time: preinduction vs. postinduction) mixed multivariate analysis of variance (MANOVA), with the subjective age measures as the within–subjects factors. When a significant effect was found in the omnibus MANOVA, univariate Bonferroni–adjusted ANOVAs were performed for each subjective age measure. Significant interactions were further explored using Bonferroni–adjusted *t*-tests.

Results

Manipulation Check

A 2 (mood group: sad vs. neutral) × 3 (time: preinduction vs. postinduction vs. follow-up) mixed ANOVA on the global mood score (Mood_1 vs. Mood_2 vs. Mood_3) revealed a main effect of time following a quadratic trend, $F(1, 116) = 185.43$, $p = .000$, $\eta_p^2 = .62$, η_p^2 90% confidence interval (CI) [.52, .68]. As the *F*-test is a one-sided test, a 90% = 100(1 – 2α)% two-sided confidence interval corresponds to a significance level of α = .05 (Steiger, 2004). The Time × Mood group interaction was significant and followed a quadratic trend, $F(1, 116) = 192.38$, $p = .000$, $\eta_p^2 = .62$, η_p^2 90% CI [.53, .69]. In the neutral group, Mood_1 did not differ from Mood_2, $t(59) = 1.53$, $p = .131$, and from Mood_3,

$t(59) = 2.08$, $p = .042$. In the sad group, there was a deterioration in mood from pre- to postinduction, $t(57) = -14.72$, $p = .000$, $d = 2.49$, as well as from preinduction to follow-up, $t(57) = -4.20$, $p = .000$, $d = 0.50$. Participants in the neutral and sad groups did not differ on the mood score at preinduction, $t(109.69) = 0.48$, $p = .633$, but reported a different mood at postinduction, $t(116) = -12.08$, $p = .000$, $d = 2.23$. The results indicate that our induction was successful. This effect, however, was short-lasting. At the end of the experiment, participants' mood in the sad group neutralized. However, the differences between the mood groups were still significant, $t(116) = -2.68$, $p = .008$, $d = 0.49$. The effect of the induction was comparable across middle-aged (40–65 years) and older (66–80 years) participants.

Effect of Mood on Subjective Age

In the omnibus MANOVA, we found a main effect of time, $V = .10$, $\Lambda = .91$, $F(2, 115) = 6.00$, $p = .003$, $\eta_p^2 = .10$, η_p^2 90% CI [.02, .18]. The Time × Mood group interaction was significant, $V = .10$, $\Lambda = .90$, $F(2, 115) = 6.28$, $p = .003$, $\eta_p^2 = .10$, η_p^2 90% CI [.02, .18].[14] Neither age group (40–65 years vs. 66–80 years) nor neuroticism (operationalized as a dichotomous variable based on a median-split) moderated this association.

Proportional subjective age-discrepancy score

We found a main effect of time, $F(1, 116) = 8.87$, $p = .004$, $\eta_p^2 = .07$, η_p^2 90% CI [.01, .15]. The Time × Mood group interaction was significant, $F(1, 116) = 8.43$, $p = .004$, $\eta_p^2 = .07$, η_p^2 90% CI [.01, .15].[14] In the neutral group, the pre- and postinduction subjective age scores were not different, $M = -0.10$ versus $M = -0.10$, $t(59) = -0.14$, $p = .891$. In the sad group, participants reported an older felt age in proportion to their chronological age from pre- to postinduction, $M = -0.15$ versus $M = -0.09$, $t(57) = -3.01$, $p = .004$, $d = 0.47$ (Figure 5.1A). Neither age group nor neuroticism moderated this association.[14] The effect of mood group on change in subjective age was mediated by change in mood from pre- to postinduction, $b_{\text{indirect effect}} = 0.10$, 95% bootstrapped CI [0.02, 0.22], $b/SD_{\text{subj.age}} = .89$.[14]

[14] The results were replicated when controlling for depressive symptoms, neuroticism, and physical health, as well as when including the mood nonresponders into the sample.

Continuous measure of subjective age

We found a main effect of time, $F(1, 116) = 10.37$, $p = .002$, $\eta_p^2 = .08$, η_p^2 90% CI [.02, .17]. The Time × Mood group interaction was significant, $F(1, 116) = 11.45$, $p = .001$, $\eta_p^2 = .09$, η_p^2 90% CI [.02, .18].[15] In the neutral group, the pre- and postinduction subjective age scores were not different, $M = -15.74$ versus $M = -15.93$, $t(59) = 0.18$, $p = .856$. In the sad group, participants reported an older felt age from pre- to postinduction, $M = -19.01$ versus $M = -11.05$, $t(57) = -3.65$, $p = .001$, $d = 0.54$ (Figure 5.1B). Neither age group nor neuroticism moderated this association.[15] The effect of mood group on change in subjective age was mediated by change in mood from pre- to postinduction, $b_{\text{indirect effect}} = 10.45$, 95% bootstrapped CI [3.21, 18.60], $b/SD_{\text{subj.age}} = .76$.[15]

Discussion

We examined short-term associations between mood and subjective age based on a mood-induction paradigm. Participants were induced into a neutral or sad mood and changes in subjective age were assessed. Participants in the sad group reported older felt ages at postinduction compared with preinduction. Participants in the neutral group reported comparable levels of subjective age at pre- and postinduction. The effect of mood group on subjective age changes was mediated by mood changes. The effect was comparable in middle- and old-aged participants as well as in participants low and high in neuroticism.

The short-term convertibility of subjective age is in line with other findings (e.g., Kotter-Grühn et al., 2015; Stephan et al., 2013). One might speculate whether subjective age operates at the state– or trait–level. According to theoretical considerations, subjective age experiences are shaped by psychological and socio–cultural forces; with increasing age, they become an integral part of a person's self-concept (Diehl et al., 2014). However, our findings show that subjective age, once "set", is not immune to changes in situational factors. Subjective age might underlie a dynamic equilibrium and revolve around a set point as a response to stimuli. Future experimental studies should include follow-up measurements to examine the dynamics in the interplay between mood and subjective age.

[15] The results were replicated when controlling for depressive symptoms, neuroticism, and physical health, as well as when including the mood nonresponders into the sample.

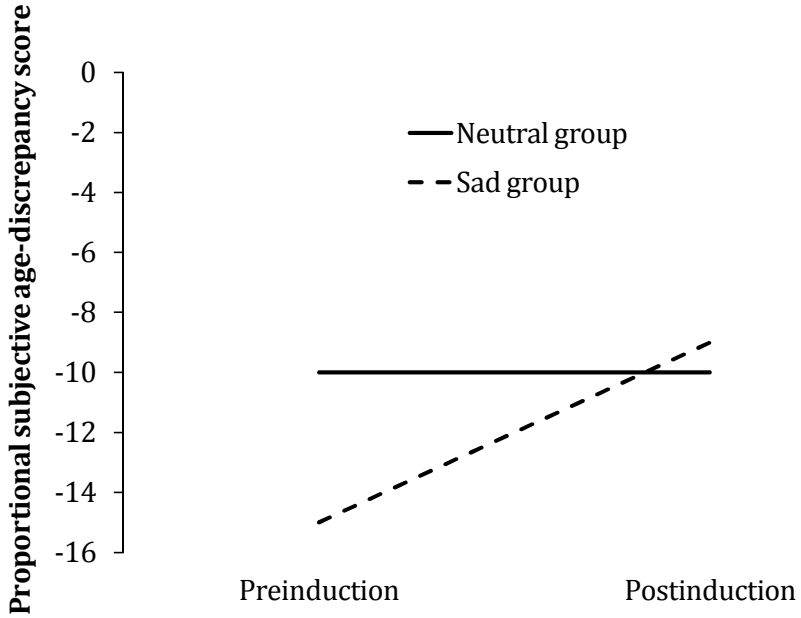
The effect of mood on subjective age was similar in terms of effect size across the two age groups. It has to be considered that the age groups in our sample were probably more similar to each other than is the case in a representative population (e.g., 49% of the participants in the middle-aged group were 60 years and older and 32% were retired). However, the absence of age effects regarding relations between subjective age and other constructs has also been found in previous research (Brothers et al., 2017). The inclusion of more adults covering a younger age range (i.e., 40–50 years) might have increased the probability to find age effects.

Similar to age, mood group effects were comparable in people high and low in neuroticism. One could assume that neurotic people feel more concerned by a sad mood, resulting in even older felt ages (Rusting, 1999). The artificial character of the laboratory might have enhanced an external attribution of the mood changes (Parrott & Sabini, 1990), thus preventing feelings of overwhelm in neurotic persons.

Regarding our experimental manipulation, it should be mentioned that although we successfully induced the desired mood in the majority of the participants, some participants did not respond to the induction (compare with Gerrards-Hesse et al., 1994; M. Martin, 1990). We can only speculate about the mechanisms explaining this. The text presented in the neutral group might, due to its informational character, have evoked feelings of cognitive overload, stimulating a negative self-view. Conversely, participants in the sad group might have had difficulty to get involved with the text due to the artificial character of the laboratory. The design should be replicated with other stimuli for the induction, for example, film clips. However, results were comparable with mood nonresponders included and excluded.

Further, participants' mood in the sad group followed a quadratic trend, that is, by the end of the experiment, their mood reapproached their preinduction mood (see also Kliegel, Jäger, & Phillips, 2007). Thus, our mood induction, although successful, was only short-lasting. Probably, both associative and priming processes as well as mood repair mechanisms may occur in response to sad mood states, but in a temporal sequence. These processes, in combination, return the individual to its initial affective equilibrium (Singer & Salovey, 1988). As the subjective age measures were presented immediately after the postinduction mood measurement, it can be assumed that the target mood was still present when the participants gave their response.

5.1A



5.1B

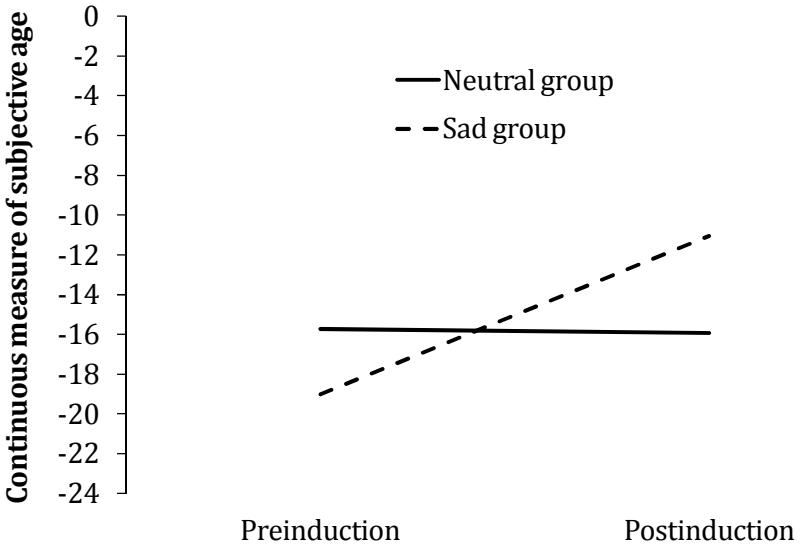


Figure 5.1. Change in subjective age from preinduction to postinduction.
Notes. The proportional subjective age-discrepancy score was operationalized as the discrepancy between felt age and chronological age, relative to chronological age, multiplied by 100 (i.e., percent feeling younger). Higher subjective age scores indicate older felt ages. The continuous measure of subjective age was operationalized as a continuous rating from -50 *(feels much younger than chronological age)* to 50 *(feels much older than chronological age)*.
N = 118.

Limitations and Future Research

As is often the case in convenience samples from university cities, our sample was probably biased with regard to education or health. Future studies should replicate the design to validate the results.

Although we tried our best to disguise our research intention, demand effects cannot entirely be ruled out, so results must be interpreted with caution. Our design could not differentiate whether the changes in subjective age were entirely attributable to the changes in mood, or whether the stimuli used to induce the mood served as a third variable, exercising effects on mood as well as on subjective age. Regarding the latter two points, future studies should reduce the laboratory character of the study.

The effect of mood on subjective age might be mediated by cognitive and motivational pathways, for example, priming effects. The investigation of mediating mechanisms was not an objective of this study, but should be on the agenda for future research.

Our study aimed at investigating mood effects on subjective age. Recent researchers have made a great effort in integrating different subjective aging constructs, that is, attitude toward own aging (Lawton, 1975) and awareness of age-related change (Diehl & Wahl, 2010), into an overarching framework (Diehl et al., 2014). To promote this synthesis, future studies should examine whether our findings generalize to other subjective aging constructs.

Experimental studies suggest that priming the salience of aging experiences has deleterious effects on subjective age (e.g., Eibach et al., 2010). Future studies should include examinations of whether an aging-related mood induction (instead of a mood induction disconnected from aging experiences, as used in this study) strengthens the effect of mood on subjective age.

As our research interest was on the investigation of short-term associations between sad mood and subjective age, we focused on the induction of a sad mood (compare with Kliegel et al., 2007; Kliegel et al., 2005; Knight et al., 2002; Poon & Knight, 2009). Moreover, reviews have revealed higher effectiveness in producing sad mood states than elated mood states (Westermann, Spies, Stahl, & Hesse, 1996). Still, future studies should also include elated mood states to consider a wider range of affective states.

In conclusion, this study is among the first to examine associations between mood and subjective age within an experimental mood-induction paradigm. A central finding was that the induction of a sad mood promoted a deterioration of subjective age as compared with the induction of a neutral mood. In practical terms, a better understanding of the antecedents of subjective age gains particular importance with regard to the promotion of successful aging experiences. Negative affective states might dampen subjective age—a finding which, due to the high prevalence of depressive symptoms and sad affective states in the second half of the life span (Kunzmann et al., 2013; Luppa et al., 2012), has to be taken seriously.

6

General Discussion

General Discussion: Chapter Overview

Summary and Synthesis of Findings

The aim of this dissertation was to contribute to the field of subjective aging research by addressing research questions regarding negative affectivity as an antecedent and outcome of subjective aging experiences as well as pathways underlying this association (see also Table 1.1 and Figure 1.2). In the following, for each of these research questions, findings of the present dissertation will be summarized and synthesized. Subsequently, the overarching strengths and limitations of the studies will be critically discussed. The section ends with an outlook on how the dissertation might enrich the development of theoretical models and of practical interventions.

Fundamental Associations Between Subjective Aging and Negative Affectivity

Depressive symptoms and negative affect as antecedents of awareness of age-related change and subjective age

The antecedents of subjective aging experiences were investigated in a twofold manner. First, Paper 1 examined long-term effects of depressive symptoms on perceived age-related gains and losses. Second, Paper 4 adopted an experimental paradigm to investigate the short-term malleability of subjective age as a response to a sad mood induction. Although both papers comprised negative affectivity–related antecedents of subjective aging experiences, they differed according to several criteria. First, whereas Paper 1 constituted a longitudinal study design covering a 2.5-year observational interval with questionnaires filled out at home, Paper 4 comprised an experimental paradigm realized within the laboratory to investigate short-term effects. Second, whereas negative affectivity was operationalized as depressive symptoms in Paper 1, it was understood as sad mood in Paper 4. And third, whereas subjective aging experiences were measured as AARC in Paper 1, Paper 4 targeted subjective age as an outcome variable.

The use of different study designs (i.e., longitudinal versus experimental) to explore negative affectivity as an antecedent of subjective aging experiences was based on methodological considerations. The longitudinal study design adopted in Paper 1 allows to draw conclusions about the timely ordering of AARC and depressive symptoms. This approach fits well with current work in the field of subjective aging experiences, as has been

shown in the literature review. However, the naturalistic study conditions accompanying the longitudinal study prohibit to control for possibly confounding factors. As such, the study does not allow to draw any conclusions about the origin of changes in AARC. For example, a change in AARC may be due to changes in depressive symptoms or due to changes in other factors, such as changed living conditions. This limitation is overcome with the experimental approach adopted in Paper 4. The randomization of study participants to different experimental groups and the standardization of the laboratory setting allow to control for confounding factors, thus establishing a high internal validity.

Findings across the two papers are mixed. Paper 1 did not find any longitudinal effect of depressive symptoms on change in AARC gains and AARC losses, respectively. Although this is in contrast to most studies published in this field, other authors, too, did not find any consistent effect of mental health or depressive symptoms on subjective aging experiences (Bergland et al., 2014; Bryant et al., 2016; Shenkin et al., 2014; Spuling et al., 2013).

The findings from Paper 4, however, underline the state-like character of subjective age. Results suggest that subjective age, in the short term, is a flexible and dynamic construct which is sensitive to internal and external stimuli. Participants receiving the sad mood induction reported older felt ages relative to chronological age over the course of the study period; no such changes were observed following the neutral mood induction. The effect of mood group on change in subjective age was mediated by mood changes. The effect was stable across different age groups as well as in people scoring high and low in neuroticism. A novelty of Paper 4 was its inclusion of a visual analogue scale to assess subjective age (Hughes et al., 2013), thus enriching common approaches where felt age is captured as a number (Rubin & Berntsen, 2006). Additional analyses not published within Paper 4 suggest that—in contrast to subjective age—AARC did *not* change from preinduction to postinduction. An explanation might be that instead of being rooted in concrete everyday experiences, subjective age encompasses a global evaluation of the aging process as a whole, which might display more plasticity in the short term as a response to immediate internal and external stimuli as compared with AARC. The heuristic character of the subjective age construct as compared with AARC might explain why it is more sensitive to changes in mood.

One methodological comment needs to be made with regard to Paper 4. At the preinduction measurement, the sad and neutral mood groups significantly differed on the proportional subjective age-discrepancy score, with the sad mood group displaying a lower average value as compared with the neutral mood group, despite randomized assignment of the study participants to the experimental groups. This situation raises two concerns. First, it may be questionable whether the randomized assignment was successful, although no obvious error regarding the randomization procedure could be identified. As such, the differences between the sad and the neutral mood group on the proportional subjective age-discrepancy score cannot be explained by any other variable included, that is, on all other study variables, participants showed similar average values across the two experimental groups. This suggests that participants in the sad and the neutral mood group probably originated from the same population. Second, it may be the case that the increase in felt age in the sad mood group rather constitutes a statistical phenomenon, that is, a regression to the mean. This objection can be addressed via two considerations. First, the increase in felt age in the sad mood group was also observed on the visual analogue scale measure of subjective age which was *not* affected by any preinduction differences between the sad and neutral mood groups. Second, when two age groups were studied separately (adults aged younger than 65 years versus adults aged older than 65 years), no preinduction differences on subjective age between the sad and neutral mood groups were evident in the old-aged group. Nevertheless, felt age increased in the sad group as compared with the neutral group within the age group-specific analyses, too. Taken together, it can be concluded that the increase in felt age in the sad group should probably not be attributed to a randomization problem or to a statistical phenomenon but rather suggests that participants actually felt older after the sad mood induction, although displaying younger felt ages at preinduction than the control group.

Depressive symptoms as outcomes of awareness of age-related change

Long-term effects of AARC on change in depressive symptoms were investigated based on a 2.5-year interval (Paper 1) as well as on a 4.5-year interval (Papers 2 and 3). The results highlight the pivotal role of perceived age-related losses in terms of depressive symptoms, thereby mirroring previous findings with other well-established subjective aging constructs (Han & Richardson, 2015; Spuling et al., 2013). As depressive symptoms, in turn, are linked to a range of other important developmental outcomes, such as health

(Ho et al., 2014; Noël et al., 2004), cognitive performance (Bunce et al., 2014; Montejo et al., 2014), social functioning (Furukawa et al., 2011; Kennedy et al., 2007; Szanto et al., 2012), and mortality (Cuijpers et al., 2014; Gallo et al., 2005; Zivin et al., 2015), this finding also seems relevant from a clinical viewpoint. It is also of importance that the effect of AARC losses on change in depressive symptoms 2.5 years later was stable across the entire second half of life (Paper 1).

Perceived age-related gains, however, were unrelated to change in depressive symptoms (Papers 1 and 2). This finding accords well with Baumeister et al.'s finding that "bad is stronger than good" (Baumeister et al., 2001). In particular, negative age-related changes may remind the individual that life is finite, thus being more diagnostically relevant than positive ones (Rozin & Royzman, 2001). Moreover, the non-significant association between AARC gains and depressive symptoms also needs to be interpreted against the background of the AARC construct. Per definition, AARC takes into consideration subjective aging experiences in terms of *perceived changes* rather than absolute levels of experiences (Diehl & Wahl, 2010). A person who reports few AARC gains might experience few positive experiences. However, few AARC gains can also signalize that the amount of positive experiences is as high as it has always been, that is, no changes occurred. Hence, few AARC gains do not necessarily have to be equated with a poor resource status, entailing higher levels of depressive symptoms. Instead, low levels of AARC gains can consistently be associated with low levels of depressive symptoms. The differential explanatory power of perceived age-related gains and losses in terms of depressive symptoms thus supports the need for a multidirectional understanding of subjective aging experiences, that is, gains and losses can be understood as two distinct phenomena and should be treated separately (see also findings on SPA; Bryant et al., 2016; Shenkin et al., 2014). However, it needs to be mentioned that perceived age-related gains interacted with accommodative self-regulation strategies (Paper 1) and with negative repetitive thought (Paper 2) in the prediction of depressive symptoms—these findings will be discussed in more detail within the scope of investigated pathways in the association between AARC and depressive symptoms.

Directionality of associations between awareness of age-related change and depressive symptoms

Cross-lagged panel analyses implemented within Paper 1 suggest that the association between AARC and depressive symptoms over 2.5 years is likely better understood as a unidirectional phenomenon. This result reflects findings by Spuling et al. (2013) who found that subjective age predicts change in depressive symptoms six years later, whereas the opposite direction of effects was not of any statistical significance. Moreover, the result is in line with findings on the association between subjective aging experiences and physical functioning, which has also been shown to be of unidirectional nature (Levy, Slade, & Kasl, 2002; Sargent-Cox et al., 2012; Wurm et al., 2007).

In conclusion, the findings suggest that AARC seems to constitute a rather robust construct able to play an important role regarding depressive symptoms in the second half of life. This robustness over time might be explained by the consideration that AARC is, in contrast to depressive symptoms, rooted in an aging person's self-concept and personal identity (Diehl et al., 2014; Westerhof et al., 2012).

Pathways Underlying the Association Between Subjective Aging and Negative Affectivity

Individual differences as moderators for the effect of awareness of age-related change on depressive symptoms

Paper 1 revealed that the longitudinal effect of AARC on change in depressive symptoms is moderated by self-regulation strategies. Concretely speaking, whereas AARC gains were unrelated to depressive symptoms at the bivariate level, both within and across measurement points (see also Paper 2), they showed meaningful associations with depressive symptoms when considered within the context of accommodative self-regulation strategies (Brandtstädter & Rothermund, 2002). That is, individuals who perceived few age-related gains reported lower increases in depressive symptoms over 2.5 years when they were able to flexibly adjust their goals. While low AARC gains might suggest that a person did not achieve his or her age-related goals, the ability to flexibly adjust his or her goals might help a person to deal with the situation.

However, it should be mentioned that the interaction between AARC gains and accommodation disappeared in additional and not yet published analyses based on a longer

observational interval (i.e., 4.5 years). Instead, within the 4.5-year interval, accommodation moderated the association between AARC *losses* and depressive symptoms, such that accommodation buffered the detrimental impact of many perceived age-related losses on change in depressive symptoms over time. These divergent findings may be best understood by taking the length of the observational period into consideration. As AARC gains were only weakly connected to depressive symptoms at the bivariate level, the moderating role of individual differences may become evident only over short time intervals, but may be blurred with the course of years. AARC losses, in some contrast, exert a much stronger impact on depressive symptoms as compared with AARC gains (see also Brothers et al., 2017 for associations of AARC with functional health and life satisfaction). A person who encounters many age-related losses will first and foremost have to regulate these losses, rather than setting and pursuing new goals. In this case, 2.5 years might have been too short to effectively implement new goals in terms of accommodative self-regulation strategies. Hence, the positive effects of a flexible goal adjustment to counteract the detrimental impact of AARC losses on depressive symptoms did not unfold within the 2.5-year interval, but became evident after 4.5 years.

Paper 1 explored the moderating role of general and global self-regulation strategies, which are of importance for a wide range of daily hassles, for the association between AARC and depressive symptoms. Paper 2 further tested the moderating role of individual differences by asking whether the association between AARC and change in depressive symptoms hinges on the *concrete handling* of the cognitive representation of the aging process. More precisely, Paper 2 explored the moderating role of mindfulness and negative repetitive thought for the association between AARC and change in depressive symptoms. Results showed that the detrimental impact of many perceived age-related losses or few perceived age-related gains on change in depressive symptoms 4.5 years later was exacerbated for individuals with a predisposition towards negative repetitive thinking loops. In contrast, mindfulness acted as a protection mechanism and buffered the harmful effect of AARC losses on change in depressive symptoms. With regard to the interplay between perceived age-related gains and mindfulness, effects were less robust, although the direction of the findings was consistent with theoretical considerations. Similar to what has been found with regard to fundamental associations between AARC and depressive symptoms (Paper 1), the role of mindfulness and negative repetitive thought for the asso-

ciation between AARC and depressive symptoms was comparable in middle-aged and older adults.

Results of Papers 1 and 2 mirror the findings of other research groups. For example, Wurm and Benyamini (2014) found that the detrimental impact of negative SPA on depressive symptoms is buffered for individuals scoring high on optimism. Mock and Eibach (2011) showed that the harmful effect of an older subjective age on negative affect is restricted to individuals with negative aging attitudes. These findings suggest, as hypothesized in this dissertation, that subjective aging experiences cannot be understood as an isolated phenomenon, but always need to be considered within the context of how they are dealt with.

Individual resources as mediators for the effect of awareness of age-related change on depressive symptoms

The nature of the association between AARC and depressive symptoms was further examined in Paper 3. Results showed that future time perspective and general self-efficacy mediate the association between perceived age-related losses and depressive symptoms over a 4.5-year observational interval. A higher amount of perceived age-related losses dampened future time perspective and general self-efficacy 2.5 years later, which in turn increased the level of depressive symptoms 2 years later. The effect was robust across the entire second half of life. These results are in line with recently published evidence. Brothers et al. (2016) found that the effect of AARC losses on well-being according to an eudaimonic understanding (Ryff, 1989) is mediated by future time perspective. Further, Stephan et al. (2011) showed that the association between subjective age and life satisfaction is mediated by memory self-efficacy. Taken together, these findings suggest that the translation of subjective aging experiences into psychological well-being takes place in several successive steps.

Strengths, Limitations, and Future Research Issues

The strengths and limitations specific to each paper of this dissertation were addressed in the respective discussion sections of the papers and shall not be reiterated here. Instead, the goal of this section is to address the overarching strengths and weaknesses which the four studies have in common.

Strengths

The research questions explored within this dissertation were addressed by making use of a variety of methods and of study designs. Papers 1–3 took a longitudinal approach with mailed questionnaires answered at home. As such, these studies presumably allow drawing conclusions with sufficient ecological validity, being rooted in the daily lives of the study participants. Moreover, these papers incorporated two to three measurement points, with a distance of 2.5 and 2 years, respectively. The measurement points suit the specific research questions quite well. Hence, the cross-lagged panel design realized within Paper 1 enabled the investigation of bidirectional associations between subjective aging experiences and depressive symptoms. The incorporation of three measurement points within Paper 3 allowed exploring a mediation chain based on needed data for such an analysis. Paper 4 constituted a different approach, that is, an experimental paradigm, in which a certain mood state was induced in the laboratory. This study exhibits high internal validity. Due to the highly controlled setting of a lab-based study, it allows drawing inferences about causal associations between mood and subjective age.

Further, Papers 1–3 worked with the same operationalization of subjective aging experiences and depressive symptoms. Subjective aging experiences were measured as perceived age-related gains and losses (Diehl & Wahl, 2010) and depressive symptoms were assessed as levels of anxiety or sadness experienced during the last week and ranging on a continuum from no-to-severe depressive symptoms (Radloff, 1977). These two constructs constitute the "frame" of each of the three papers and thus interlink them conceptually. Each paper has then been enriched by other constructs, according to the concrete research question (e.g., self-regulation strategies in Paper 1, mindfulness and negative repetitive thought in Paper 2, future time perspective and general self-efficacy in Paper 3). Thus the results of Papers 1–3 can directly be compared and combined into one overarching pattern of associations (see also Figure 1.2). First, they provide answers about fundamental associations between AARC and depressive symptoms, thus mirroring and enriching current knowledge on associations between more established subjective aging constructs, such as subjective age or ATOA, and depressive symptoms (e.g., Spuling et al., 2013). Second, the findings inform about pathways (moderators and mediators) underlying this association. As such pathways have barely been addressed in past research, the dissertation fills a research gap.

Papers 1–3 were based on a rather large data set with only few dropouts across the three measurement points. A flowchart displaying the flow of the participants across the 4.5 years is provided in the Appendix. *N* amounted to 423 at T1, to 356 at T2, and to 299 at T3. Hence, 84% of the original sample were reassessed at T2, and 71% were reassessed at T3. Participants and dropouts did not differ on most of the demographic and study variables. Most dropouts could be attributed to illness or mortality. The high response rate is probably due to the close communication with the participants, both during and between the inquiries. For example, the participants were provided with regular newsletters informing them about the current research projects of the Institute. After the questionnaires were mailed to the participants, reminder calls were made when the questionnaire did not return within two weeks. Moreover, a financial compensation was provided for those taking part in the surveys—though only few participants accepted this offer. The majority decided to donate the amount instead, which points to a high intrinsic motivation to participate in the study.

Another strength is that all papers encompassed a broad age range covering almost the entire second half of the life span. This idea was based on the proposition that adults as young as age 40 start becoming sensitive to age-related changes (Miche, Elsässer, et al., 2014; Whitbourne & Collins, 1998). The role of chronological age (i.e., developmental stage) was explicitly taken into consideration, either by incorporating it as a control variable in the analyses or by exploring whether the patterns of association differ across different age groups (i.e., chronological age as a moderator). The absence of any age effects suggests that the findings can be generalized to a broad age range within the investigated population.

Despite these strengths, the studies have a number of weaknesses which need to be tackled in future research.

Limitations and Future Research Issues

Operationalization of study constructs

All assessed constructs relied on self-report measures, that is, questionnaire data. This approach fits well in with the specific research questions, as they comprised the subjective representation of the aging process and negative affectivity, which can be best captured by asking participants how they feel. However, responses might have been biased

due to mechanisms of social desirability, self-deception, or cognitive impairment. The confrontation with aging- and well-being–related issues provided by the questionnaires might in itself have influenced the attitude an individual has towards these subjects. Future studies should combine self-assessment methods with more objective measures, such as biophysiological measures (e.g., heart rate, cortisol levels) or behavioral measures (e.g., physical activity). These measures are more robust against biases and may thus serve as a means for validating self-assessments.

The studies exclusively focused on the *subjective* representation of the aging process. The interaction between subjective and objective occurrences has not been taken into account. This is an important research gap. Although positive perceptions and evaluations of the aging process are in general adaptive, one could ask whether a too large discrepancy between subjective and objective aging experiences can be understood as a denial of the aging process. If an underestimation of the negative facets of the aging process means that an individual fails to tackle important and necessary (medical/ therapeutic) interventions, a (too) positive view on the aging process could sometimes even be counterproductive. Future research thus needs to consider the fit between objective and subjective aging experiences.

Each study included only one subjective aging measure. Papers 1–3 encompassed the AARC construct and Paper 4 revolved around subjective age. Although, as was clarified in the Introduction section, these operationalizations seem well-suited for the respective subject under question, current researchers make a strong argument for an integration of different subjective aging constructs (Diehl et al., 2014). In order to promote such a synthesis, future studies should also incorporate other subjective aging measures, such as ATOA (Lawton, 1975), and investigate whether and to what extent several measures are convergent or complementary to each other.

Perceived age-related gains and losses were considered independently from each other within the analyses (Papers 1 and 2). Although they were mutually controlled for, it would be interesting in future studies to investigate the role of the gain-loss–balance, either by calculating a discrepancy score between gains and losses or by taking into consideration the gain-loss–interaction.

The AARC construct used in Papers 1–3 was not decomposed into its domain-specific subscales, but instead, global and overarching subscales of perceived gains and

losses across all five behavioral domains were calculated. This decision was driven by the finding that the subscales have been shown to be only sparsely robust in exploratory and confirmatory factor analyses. That is, although the differential valence of aging experiences was mirrored in the gain- and loss-related subscales, the domain-specific character of the AARC construct was considered more at the theoretical and content-related level than at the empirical level.

AARC was measured with 194 items at T1 and with 50 items at T2 and T3. Although the same 50 items were used for the calculation of the subscales at each measurement point, it cannot be precluded that the different item numbers might have exerted a different impact on the response behavior. For example, the participants might have been irritated and overstrained by the high item number at T1, feeling pushed to their cognitive limits, and thereby might have evaluated their aging process more negatively as compared with T2 and T3. Indeed, the amount of perceived age-related losses decreased from T1 to T2. This is somewhat counterintuitive, as one would expect an accumulation of perceived losses with increasing age (Heckhausen et al., 1989). The methodological difficulties rooted in the divergent item numbers could provide an explanation for this counterintuitive finding.

This dissertation adopted a continuous, clinically non-relevant understanding of depressive symptoms (as used in Papers 1–3). Depressive symptoms were understood as a continuum ranging from a zero to high magnitude of depressive symptoms, rather than adopting a categorical or more clinical understanding (e.g., presence of a major depressive disorder). As the study population encompassed "normal-aging"[16] adults with, in general, no clinical background, this approach seemed well-suited here in order to take into account a variety of manifestations on well-being, including subsyndromal depressive symptoms. Moreover, according to Bowins (2015) depressive symptoms naturally operate on the basis of a continuum. Still, it would be interesting in future studies to examine how the findings extend to clinically relevant symptoms of depression (i.e., classifications of major depressive disorder; American Psychiatric Association, 2013).

[16] It is acknowledged that this term is somewhat evaluative, as it suggests that some developmental pathways are normal, whereas others are abnormal. It is not intended here to classify certain developments as good or bad. Instead, the term is used to express that the participants were unremarkable with regard to most developmental outcomes.

Depressive symptoms were assessed by asking individuals how they felt during the past week (Radloff, 1977). Although this measurement approach is widely established, it only constitutes a snapshot. The answers might have been biased due to current life events, for example, health, death of loved ones, or turbulence within one's family or workplace. Although the analyses controlled for current health status, the various other potential sources for bias were beyond the scope of this dissertation. Accordingly the reader has to bear in mind that the level of depressive symptoms reported might have been influenced by unknown third variables.

The dissertation focused on associations of subjective aging experiences with negative indicators of psychological well-being, that is, depressive symptoms and negative affect. The considerations behind this decision were elaborated in detail in the Introduction section. Indeed, a recent daily diary study found stronger associations between fluctuations in subjective age and fluctuations in negative affect as compared with positive affect (Kotter-Grühn et al., 2015). Nevertheless, it is not only important to understand how negative experiences (i.e., depressive symptoms, negative affect) can be avoided, but it is also of great relevance to know how positive ones (i.e., life satisfaction, positive affect) can be promoted. The concept of the so-called positive psychology has undergone a boost in the last decades (Araújo, Ribeiro, & Paúl, 2017) and future research should investigate whether the associations found between subjective aging experiences and depressive symptoms or negative affect can be generalized to life satisfaction, happiness, or positive affect.

Sample and study design

With regard to the study sample, the studies only included "normal-aging"[17] adults. As the participants were recruited "ad-hoc" in a University city with a high living standard, the sample was positively biased with regard to education and health. Hence, the results can only be generalized to this subgroup of the total population. Future studies should include other populations, such as clinical populations, adults living in nursing homes, or participants from non-industrialized countries or from countries with a different societal attitude toward old age (e.g., Asia) to find out whether the associations found between subjective aging and negative affectivity also apply to them. Moreover, the studies encompassed only few (Papers 1–3), if any (Paper 4) oldest-old adults. Future studies need to

[17] Please see the elaborations with regard to this term provided in the preceding Footnote.

include very old adults to investigate how subjective aging experiences manifest in a period of life characterized by high frailty, vulnerability, and multi-morbidity. The selectivity of the sample and the underrepresentation of very old adults might explain why all studies failed to find a moderating role of calendar age for the investigated patterns of association.

Regarding the longitudinal studies (Papers 1–3), the data were based on different measurements of the same population (T1–T2 versus T1–T3 versus T1–T2–T3). A 4.5-year observational interval cannot be put on the same level as a 2.5-year interval. As such, findings obtained for a shorter interval cannot automatically be transferred to a longer interval and vice versa (as has been discussed with regard to the moderating role of accommodative self-regulation for the association between AARC gains and losses, respectively, and depressive symptoms). That is, although Papers 1–3 spread out towards one overarching pattern of associations (see also Figure 1.2), caution is advised when combining the longitudinal findings which are based on different observational intervals.

When participants answered the AARC questionnaire at the second and third measurement point, they might have had a greater than average sensitivity to the subjective aging topic due to their confrontation with this issue within the preceding survey. For example, participants may have changed their attitude towards the aging process or started contemplating their aging process after having been confronted with this topic throughout the first survey. Hence, their answers in the following surveys might have been biased. Moreover, the measurements took place during different times of the year (T1 in summer, T2 in winter, T3 in winter/spring). The differing boundary conditions might have had an effect on the answering of the questions. However, as the research questions primarily concentrated on the relative values on the study constructs which are rather independent from such prevailing circumstances (supposed that all participants are affected in a comparable manner), this limitation did probably not alter the results to a notable extent.

Paper 4 investigated change in subjective age following a mood induction. The measurement of change in subjective age was only a snapshot, with the postinduction measurement taking place immediately after the mood induction. It remains unclear how long-lasting the change in subjective age was. For example, it may be assumed that participants returned to their baseline level of subjective age once the induced sad mood neutralized. Future studies should include more measurement points to explore the long-term modifiability of subjective age.

Moreover, the mood induction procedure realized within Paper 4 was carried out by the author of this dissertation who was supported by two student research assistants. The research assistants were extensively trained to give objective and standardized instructions to the study participants. Furthermore, the three persons involved in the implementation of the experiment were all female and of a similar age, so that it can be assumed that they were perceived by the study participants in a similar way. The participants were randomly assigned to one of the three investigators. Notwithstanding, the experimental session encompassed a social interaction, such that person-specific influences of the investigators cannot completely be precluded. A similar point needs to be made with regard to other external influences beyond the control of the researcher. As such, the effect of the mood induction might have been moderated by weather conditions or by the time of the day. Future studies should improve the standardization of the experimental procedure to rule out the effects of such external factors.

Pathways

The dissertation focused on the investigation of moderating and mediating pathways in the association between subjective aging experiences and negative affectivity (Papers 1–3). The papers thus enrich current findings on associations between subjective aging experiences and depressive symptoms and provide a better understanding of how and under which circumstances subjective aging experiences translate into depressive symptoms. However, the moderators (assimilative and accommodative self-regulation strategies, mindfulness, and negative repetitive thought) and mediators (future time perspective, general self-efficacy) included certainly should not be seen as exhaustive. Future research should take into account other variables as mediators or moderators, such as health (Stephan et al., 2011) or control beliefs (Levy, Slade, & Kasl, 2002).

Regarding the modifiability of subjective age as investigated in Paper 4, pathways explaining the dynamic interplay between mood and subjective age are still unknown. Although it was found that the association between mood group and change in subjective age was mediated by change in mood, it remains unclear how mood, in turn, translates into subjective age. As discussed in the Introduction section, several cognitive (e.g., priming effects) or motivational (e.g., self-verification) pathways are conceivable and should be tackled in future research.

Implications

Theoretical Level

Theory development with regard to awareness of age-related change

The research questions pursued within this dissertation have a number of implications with regard to theory development. An important aspect is the focus on the construct of AARC in Papers 1–3, which takes into account the heterogeneity of development. The AARC construct is a relatively new construct where profound empirical evidence on associations with developmental outcomes is still lacking. The findings gained within the dissertation provide a better understanding of the AARC construct and embed it within the nomological network of key variables in developmental psychology. More precisely, the results provide information about fundamental associations between AARC and depressive symptoms as well as about pathways (i.e., moderators and mediators) underlying this association (see also Figure 1.2).

Regarding *fundamental associations* with depressive symptoms, the results show that AARC is a promising construct which is able to explain variance in depressive symptoms in the long term over and above demographic and health control variables. Hence, these findings enrich current knowledge on fundamental associations between subjective aging experiences and negative affectivity, which are mainly based on more established subjective aging constructs, such as subjective age or ATOA (e.g., Spuling et al., 2013). The differential predictive power of AARC gains versus AARC losses in terms of depressive symptoms highlights the importance of considering the aging process as a multidirectional phenomenon. Age-related gains and losses should be considered as separate and distinct entities (see also Laidlaw et al., 2007; Steverink et al., 2001 for SPA) rather than treating them as two ends of the same continuum (as is done in the ATOA construct; Lawton, 1975).

Papers 1–3 further provide information about the *pathways* explaining how AARC translates into depressive symptoms (i.e., future time perspective and general self-efficacy as mediators) and suggest that AARC always needs to be considered within the context of individual differences (i.e., mindfulness and negative repetitive thought as moderators). The investigation of pathways in the association between subjective aging experiences

and depressive symptoms has been neglected in recent research (with a small number of exceptions; see Wurm & Benyamini, 2014), such that the dissertation fills a research gap.

Plasticity of subjective aging

Knowledge on fundamental associations between subjective aging experiences and negative affectivity is enriched by the experimental approach pursued in Paper 4. Paper 4 provides information about the short-term modifiability of subjective age. The mood effect on subjective age is in line with other experimental studies showing that subjective aging experiences can be transformed by internal and external stimuli in the laboratory, for example, through priming with aging experiences (Eibach et al., 2010; Gabrian & Wahl, 2017; Hughes et al., 2013; Stephan et al., 2013) or through a manipulation of age stereotypes and beliefs about the aging process (Hess & Hinson, 2006; Kotter-Grühn & Hess, 2012; Levy, 1996; Pinquart, 2002; Weiss & Freund, 2012; Weiss et al., 2016; Weiss & Lang, 2012).

However, we do not know whether and to what extent subjective aging experiences can be altered for the long term and outside the laboratory. Some studies point to positive effects of interventions (i.e., physical activity, attribution retraining, age stereotype manipulation) on subjective aging (Brothers & Diehl, 2017; Klusmann, Evers, Schwarzer, & Heuser, 2012; Levy, Pilver, Chung, & Slade, 2014; Sarkisian, Prohaska, Davis, & Weiner, 2007), whereas other studies found only weak support for a beneficial effect of interventions targeting subjective aging experiences (Craciun et al., 2014; Wolff, Warner, Ziegelmann, & Wurm, 2014).

These findings raise the question whether subjective aging experiences operate at the state- or trait-like level. Diehl et al. (2014) assume that subjective aging experiences become an integral part of a person's self-concept and identity and should thus be stable over time (see also Westerhof et al., 2012). Nevertheless, the above-cited studies point to a certain plasticity of subjective aging, at least in the laboratory. Combining the empirical findings and theoretical considerations leads to the assumption that subjective aging may be understood as a dynamic equilibrium which fluctuates around a set point as a response to internal and external stimuli. This idea is in line with the results of this dissertation. Subjective age was shown to depend upon a person's immediate mood state (Paper 4), but perceived age-related gains and losses were independent from depressive symptoms in the long term and outside the laboratory (Paper 1).

New perspectives on life-span development beyond chronological age

Given their pivotal role with regard to psychological well-being, perceived age-related changes should also be incorporated into life-span developmental regulation theories, such as self-regulation theories (P. Baltes, 1997; Brandtstädter & Rothermund, 2002; Heckhausen et al., 2010) or *socioemotional selectivity theory* (Carstensen et al., 1999). Up to now, these theories consider chronological age as a major motivational force for the dominance of one self-regulation strategy over the other or for the organization of one's social network. However, chronological age per se may be a too-generally-framed "cause" when it comes to the explanation of change in developmental regulation. Given that aging is not only associated with shrinking resources but also includes positive developments (P. Baltes, 1987), it must not necessarily be the simple passing of time but instead the perceived resource status which triggers changes in developmental regulation (Dutt et al., 2016b). Emerging empirical evidence suggests that the subjective representation of the aging process has an effect on the preferred self-regulation strategy (Dutt et al., 2016b; Wurm et al., 2013). Instead of mere chronological age, the subjective perception of the aging process might gain an important explanatory role for trajectories of developmental regulation and should thus be taken into consideration within prominent life-span developmental regulation models (Diehl et al., 2014).

The AARC construct explained variance in depressive symptoms over and above chronological age. Moreover, in all studies, effects were robust across the entire second half of the life span. The latter finding could be attributed to methodological issues, for example, to the selectivity of the study sample or the underrepresentation of very old adults. However, in combination with the negligible predictive power of chronological age with regard to psychological well-being, the results indeed may suggest that the role of chronological age should not be over-estimated. Aging research will be enriched by taking new perspectives on the aging process, which are broader in nature as compared with the mere passage of time (Staudinger, 2015).

Practical Level

Certainly, and despite recent comprehensive efforts, our knowledge of the subjective representation of the aging process is still far from being exhaustive. Before deriving profound practical implications, more research needs to be done to replicate and validate the

current findings, to apply them to other (clinical) populations, and to better understand the mechanisms linking subjective aging to its correlates (Kotter-Grühn et al., 2016). However, restraining research to its ivory tower is seldom fruitful, so we should aim at transferring research findings into practice sooner or later. As such, based on the results of this dissertation, starting points for potential interventions will be discussed.

The findings suggest that a negative outlook on the aging process exerts a potentially hazardous effect on psychological well-being in the long term. Moreover, a person's subjective age might be vulnerable to experiences of negative affectivity. This association needs to be unfolded within a psycho-educational approach. Particularly health care providers (e.g., psychotherapists) need to be aware about the pivotal role of subjective aging experiences in terms of psychological well-being. They may want to consider targeting this detrimental chain of associations within preventive and reactive therapeutic interventions.

An important aspect needs to be considered regarding practical interventions. The perception of many age-related losses can stem from two scenarios (Dutt et al., in press). First, the individual overestimates the amount of experienced age-related losses and underestimates the amount of experienced age-related gains, resulting in an overly pessimistic outlook on his or her aging process. Second, the individual has a poor resource status at the objective level and accurately judges this resource status, leading to a realistic outlook on his or her aging process.

The first scenario might be harmful. The unjustifiable over-attribution of symptoms (e.g., health problems, feelings of loneliness) to "old age", accompanied by the idea that these symptoms are uncontrollable, inevitable, and irreversible, predicts poorer health, health behaviors, and mortality (J. S. Goodwin, Black, & Satish, 1999; Keller, Leventhal, Prohaska, & Leventhal, 1989; Levy, Ashman, & Slade, 2009; Prohaska, Keller, Leventhal, & Leventhal, 1987; Sarkisian, Lee-Henderson, & Mangione, 2003; Stewart, Chipperfield, Perry, & Weiner, 2012). In such a case, subjective aging experiences should be targeted *directly*, for example, through an attribution retraining where the aging individual learns that negative time-related changes do not necessarily have to be linked to the process of growing older, thus being uncontrollable and irreversible (Sarkisian et al., 2007). The primary aim of such a training program might be to refine a person's sense to objectively and realistically classify and interpret experienced time-related changes.

The second scenario (i.e., a negative but realistic outlook on the aging process) raises a number of ethical concerns. What is wrong about realistically acknowledging the signs of growing older? If we targeted these realistic, though negative, views, it would signal that we condemn signs of aging. This could in turn be counterproductive as it reinforces the stigma of growing old (Kotter-Grühn, 2015). Instead, in this case it seems to be more appropriate to target subjective aging experiences *indirectly* through their mediators and moderators linking them to depressive symptoms. That is, the aging person should learn how to better cope with the realistic outlook on the aging process and how to strengthen resilience capacities. For example, the person could participate in a mindfulness training to learn how to accept the negative signs of growing older instead of ruminating about age-related losses and feeling as being at the mercy of the aging process. Furthermore, adjusting goals and ambitions to the reduced resource status (i.e., accommodation) may help avoiding feelings of frustration, overstrain, and helplessness. In addition, interventions can be provided which enhance a person's general self-efficacy and his or her outlook on the future time in order to avoid the translation of negative subjective aging experiences into depressive symptoms.

Moreover, as discussed in the second scenario, it has to be born in mind that subjective aging experiences might—at least to some extent—be rooted in objective aging experiences. The AARC construct with its strong behavioral focus is a perfect example to demonstrate this association. Hence, when talking about subjective aging experiences, we always need to ask how we can positively alter objective aging experiences, which can then translate into positive subjective aging experiences (e.g., promotion of health, cognition, interpersonal relations).

Taken together, the conceptualization and evaluation of such intervention programs certainly should be on the agenda for future research.

Conclusion

Progress in the field of medicine and technology contributed to an addition of "years to life." But successful aging also implies the addition of "life to years." Such a psychological approach involves the promotion of high levels of psychological well-being and of a positive outlook on the aging process. This dissertation aimed at enriching this intriguing aging science area by investigating associations between subjective aging experiences and de-

pressive symptoms and negative affect, respectively, thus filling existent research gaps. A strong focus laid on the inclusion of the recently introduced concept of AARC. Results suggest that perceived age-related losses are longitudinally associated with depressive symptoms; this association is unidirectional. AARC losses seem to translate into depressive symptoms by a narrowing future time perspective and by decreases in general self-efficacy. The harmful effect of a negative aging perception on depressive symptoms is exacerbated by a negative repetitive thinking style, but can be buffered by adopting a mindful outlook towards life. Perceived age-related gains seem to be unrelated to depressive symptoms at a bivariate level, but in the case of low levels of accommodation or high levels of negative repetitive thought, few perceived gains are linked to higher levels of depressive symptoms. Regarding short-term associations between subjective aging and well-being, an experimental study suggests that negative affect translates into older felt ages.

Subjective aging experiences seem to play a pivotal role in terms of successful aging. The results of this dissertation highlight the need for an integration of subjective aging experiences into theories of life-span developmental psychology. Given the overarching aim to promote successful aging experiences, the findings lay the foundation for the development of practical interventions.

The dissertation made an attempt to overcome the frequently occurring single-edged view on aging, with chronological age seen as an important determinant of development; instead, a heterogeneous and multidirectional understanding of the aging process was advocated. Such a view critically challenges the widespread idea of the aging process as being primarily accompanied by losses. In strong contrast, late-life development has been considered in this work as a multifaceted phenomenon, characterized by pronounced dynamics and variability and thus incorporating gains and losses until old age.

References

Abele, A. E., & Gendolla, G. H. E. (1999). Satisfaction judgments in positive and negative moods: Effects of concurrent assimilation and contrast producing processes. *Personality and Social Psychology Bulletin, 25*, 883-895. doi:10.1177/0146167299025007010

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. Washington, DC: American Psychiatric Association.

Araújo, L., Ribeiro, O., & Paúl, C. (2017). Hedonic and eudaimonic well-being in old age through positive psychology studies: A scoping review. *Anales de Psicología, 33*, 568-577. doi:10.6018/analesps.33.3.265621

Avidor, S., Levin, Y., & Solomon, Z. (2016). Guilt as a mediator between depressive symptoms and subjective age: A 17-year longitudinal study of Israeli ex-prisoners of war. *American Journal of Orthopsychiatry*, Advance online publication. doi:10.1037/ort0000212

Ayalon, L., Palgi, Y., Avidor, S., & Bodner, E. (2016). Accelerated increase and decrease in subjective age as a function of changes in loneliness and objective social indicators over a four-year period: Results from the Health and Retirement Study. *Aging & Mental Health, 20*, 743-751. doi:10.1080/13607863.2015.1035696

Bak, P. M., & Brandtstädter, J. (1998). Flexible Zielanpassung und hartnäckige Zielverfolgung als Bewältigungsressourcen: Hinweise auf ein Regulationsdilemma [Flexible goal adjustment and tenacious goal pursuit as coping resources: Hints to a regulatory dilemma]. *Zeitschrift für Psychologie mit Zeitschrift für angewandte Psychologie, 206*, 235-249.

Baltes, B., Wynne, K., Sirabian, M., Krenn, D., & De Lange, A. (2014). Future time perspective, regulatory focus, and selection, optimization, and compensation: Testing a longitudinal model. *Journal of Organizational Behavior, 35*, 1120-1133. doi:10.1002/job.1970

Baltes, P. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology, 23*, 611-626. doi:10.1037/0012-1649.23.5.611

Baltes, P. (1997). On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist, 52*, 366-380. doi:10.1037/0003-066X.52.4.366

Baltes, P., Lindenberger, U., & Staudinger, U. M. (2006). Life span theory in developmental psychology. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology: Theoretical models of human development* (6 ed., Vol. 1, pp. 569-664). Hoboken, NJ: John Wiley & Sons Inc.

Baltes, P., Reese, H. W., & Lipsitt, L. P. (1980). Life-span developmental psychology. *Annual Review of Psychology, 31*, 65-110. doi:10.1146/annurev.ps.31.020180.000433

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191-215. doi:10.1037/0033-295X.84.2.191

Barak, B., & Schiffman, L. G. (1981). Cognitive age: A nonchronological age variable. *Advances in Consumer Research, 8*, 602-606.

Barak, B., & Stern, B. (1986). Subjective age correlates: A research note. *The Gerontologist, 26*, 571-578. doi:10.1093/geront/26.5.571

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5*, 323-370. doi:10.1037/1089-2680.5.4.323

Beekman, A. T. F., Copeland, J. R. M., & Prince, M. J. (1999). Review of community prevalence of depression in later life. *The British Journal of Psychiatry, 174*, 307-311. doi:10.1192/bjp.174.4.307

Bergland, A., Nicolaisen, M., & Thorsen, K. (2014). Predictors of subjective age in people aged 40–79 years: A five-year follow-up study. The impact of mastery, mental, and physical health. *Aging & Mental Health, 18*, 653-661. doi:10.1080/13607863.2013.869545

Bergomi, C., Ströhle, G., Michalak, J., Funke, F., & Berking, M. (2013). Facing the dreaded: Does mindfulness facilitate coping with distressing experiences? A moderator analysis. *Cognitive Behaviour Therapy, 42*, 21-30. doi:10.1080/16506073.2012.713391

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., . . . Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*, 230-241. doi:10.1093/clipsy.bph077

Blaney, P. H. (1986). Affect and memory: A review. *Psychological Bulletin, 99*, 229-246. doi:10.1037/0033-2909.99.2.229

Borkenau, P., & Ostendorf, F. (2008). *NEO Fünf-Faktoren Inventar (NEO-FFI); nach Costa und McCrae [NEO Five-Factor Inventory (NEO-FFI); by Costa and McCrae]*. Göttingen; Bern; Wien: Hogrefe.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*, 129-148. doi:10.1037/0003-066X.36.2.129

Bowins, B. (2015). Depression: Discrete or continuous? *Psychopathology, 48*, 69-78. doi:10.1159/000366504

Bowling, A., & Dieppe, P. (2005). What is successful ageing and who should define it? *British Medical Journal, 331*, 1548-1551. doi:10.1136/bmj.331.7531.1548

Bowling, A., See-Tai, S., Ebrahim, S., Gabriel, Z., & Solanki, P. (2005). Attributes of age-identity. *Ageing & Society, 25*, 479-500. doi:10.1017/S0144686X05003818

Brandtstädter, J., & Renner, G. (1990). Tenacious goal pursuit and flexible goal adjustment: Explication and age-related analysis of assimilative and accommodative strategies of coping. *Psychology and Aging, 5*, 58-67. doi:10.1037/0882-7974.5.1.58

Brandtstädter, J., & Rothermund, K. (2002). The life-course dynamics of goal pursuit and goal adjustment: A two-process framework. *Developmental Review, 22*, 117-150. doi:10.1006/drev.2001.0539

Bränström, R., Duncan, L. G., & Moskowitz, J. T. (2011). The association between dispositional mindfulness, psychological well-being, and perceived health in a Swedish population-based sample. *British Journal of Health Psychology, 16*, 300-316. doi:10.1348/135910710X501683

Brinker, J. K. (2013). Rumination and reminiscence in older adults: Implications for clinical practice. *European Journal of Ageing, 10*, 223-227. doi:10.1007/s10433-013-0271-y

Brinker, J. K., & Dozois, D. J. A. (2009). Ruminative thought style and depressed mood. *Journal of Clinical Psychology, 65*, 1-19. doi:10.1002/jclp.20542

Brose, A., Lindenberger, U., & Schmiedek, F. (2013). Affective states contribute to trait reports of affective well-being. *Emotion, 13*, 940-948. doi:10.1037/a0032401

Brosschot, J. F., Gerin, W., & Thayer, J. F. (2006). The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. *Journal of Psychosomatic Research, 60*, 113-124. doi:10.1016/j.jpsychores.2005.06.074

Brothers, A., & Diehl, M. (2017). Feasibility and efficacy of the AgingPlus Program: Changing views on aging to increase physical activity. *Journal of Aging and Physical Activity, 25*, 402-411. doi:10.1123/japa.2016-0039

Brothers, A., Gabrian, M., Wahl, H.-W., & Diehl, M. (2016). Future time perspective and awareness of age-related change: Examining their role in predicting psychological well-being. *Psychology and Aging, 31*, 605-617. doi:10.1037/pag0000101

Brothers, A., Gabrian, M., Wahl, H.-W., & Diehl, M. (conditionally accepted). A new multi-dimensional questionnaire to assess awareness of age-related change (AARC). *The Gerontologist*.

Brothers, A., Miche, M., Wahl, H.-W., & Diehl, M. (2017). Examination of associations among three distinct subjective aging constructs and their relevance for predicting developmental correlates. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 72B*, 547-560. doi:10.1093/geronb/gbv085

Brown-Iannuzzi, J. L., Adair, K. C., Payne, B. K., Richman, L. S., & Fredrickson, B. L. (2014). Discrimination hurts, but mindfulness may help: Trait mindfulness moderates the relationship between perceived discrimination and depressive symptoms. *Personality and Individual Differences, 56*, 201-205. doi:10.1016/j.paid.2013.09.015

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*, 822-848. doi:10.1037/0022-3514.84.4.822

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry, 18*, 211-237. doi:10.1080/10478400701598298

Bryant, C., Bei, B., Gilson, K.-M., Komiti, A., Jackson, H., & Judd, F. (2016). Antecedents of attitudes to aging: A study of the roles of personality and well-being. *The Gerontologist, 56*, 256-265. doi:10.1093/geront/gnu041

Bullinger, M., Kirchberger, I., & Ware, J. (1995). Der deutsche SF-36 Health Survey: Übersetzung und psychometrische Testung eines krankheitsübergreifenden Instruments zur Erfassung der gesundheitsbezogenen Lebensqualität [The German SF-36 health survey: Translation and psychometric testing of a generic instrument for the assessment of health-related quality of life]. *Zeitschrift für Gesundheitswissenschaften, 3*, 21-36.

Bülow, M. H., & Söderqvist, T. (2014). Successful ageing: A historical overview and critical analysis of a successful concept. *Journal of Aging Studies, 31*, 139-149. doi:10.1016/j.jaging.2014.08.009

Bultena, G. L., & Powers, E. A. (1978). Denial of aging: Age identification and reference group orientations. *Journal of Gerontology, 33*, 748-754. doi:10.1093/geronj/33.5.748

Bunce, D., Batterham, P. J., Christensen, H., & Mackinnon, A. J. (2014). Causal associations between depression symptoms and cognition in a community-based cohort of older adults. *The American Journal of Geriatric Psychiatry, 22*, 1583-1591. doi:10.1016/j.jagp.2014.01.004

Carstensen, L. L. (1995). Evidence for a life-span theory of socioemotional selectivity. *Current Directions in Psychological Science, 4*, 151-156. doi:10.1111/1467-8721.ep11512261

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist, 54*, 165-181. doi:10.1037/0003-066X.54.3.165

Carstensen, L. L., & Lang, F. R. (1996). *Future Time Perspective Scale*. Unpublished manuscript, Stanford University.

Cheng, S.-T. (2014). Defining successful aging: The need to distinguish pathways from outcomes. *International Psychogeriatrics, 26*, 527-531. doi:10.1017/S1041610213001713

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*, 233-255. doi:10.1207/S15328007SEM0902_5

Choi, N. G., & DiNitto, D. M. (2014). Felt age and cognitive-affective depressive symptoms in late life. *Aging & Mental Health, 18*, 833-837. doi:10.1080/13607863.2014.886669

Choi, N. G., DiNitto, D. M., & Kim, J. (2014). Discrepancy between chronological age and felt age: Age group difference in objective and subjective health as correlates. *Journal of Aging and Health, 26*, 458-473. doi:10.1177/0898264314523449

Chui, H., Gerstorf, D., Hoppmann, C. A., & Luszcz, M. A. (2015). Trajectories of depressive symptoms in old age: Integrating age-, pathology-, and mortality-related changes. *Psychology and Aging, 30*, 940-951. doi:10.1037/pag0000054

Ciesla, J. A., Felton, J. W., & Roberts, J. E. (2011). Testing the cognitive catalyst model of depression: Does rumination amplify the impact of cognitive diatheses in response to stress? *Cognition and Emotion, 25*, 1349-1357. doi:10.1080/02699931.2010.543330

Ciesla, J. A., & Roberts, J. E. (2007). Rumination, negative cognition, and their interactive effects on depressed mood. *Emotion, 7*, 555-565. doi:10.1037/1528-3542.7.3.555

Coffey, K. A., & Hartman, M. (2008). Mechanisms of action in the inverse relationship between mindfulness and psychological distress. *Complementary Health Practice Review, 13*, 79-91. doi:10.1177/1533210108316307

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2 ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cosco, T. D., Prina, A. M., Perales, J., Stephan, B. C. M., & Brayne, C. (2014a). Operational definitions of successful aging: A systematic review. *International Psychogeriatrics, 26*, 373-381. doi:10.1017/S1041610213002287

Cosco, T. D., Prina, A. M., Perales, J., Stephan, B. C. M., & Brayne, C. (2014b). Whose 'successful ageing'? Lay- and researcher-driven conceptualisations of ageing well. *The European Journal of Psychiatry, 28*, 124-130. doi:10.4321/S0213-61632014000200006

Craciun, C., Wolff, J. K., Wurm, S., Warner, L. M., Greco, A., Monzani, D., & Bazillier, C. (2014). Changing self-perceptions on aging to enhance personal resources for the promotion of physical activity in older people: A pilot study to test the effectiveness of an evidence-based intervention in 4 countries (France, Germany, Italy, Romania). *The European Health Psychologist, 16*, 26-32.

Cuijpers, P., Vogelzangs, N., Twisk, J., Kleiboer, A., Li, J., & Penninx, B. W. (2014). Comprehensive meta-analysis of excess mortality in depression in the general community versus patients with specific illnesses. *The American Journal of Psychiatry, 171*, 453-462. doi:10.1176/appi.ajp.2013.13030325

de Frias, C. M., & Whyne, E. (2015). Stress on health-related quality of life in older adults: The protective nature of mindfulness. *Aging & Mental Health, 19*, 201-206. doi:10.1080/13607863.2014.924090

Deci, E. L., & Ryan, R. M. (1980). Self-determination theory: When mind mediates behavior. *Journal of Mind and Behavior, 1*, 33-43.

Diehl, M., & Wahl, H.-W. (2010). Awareness of age-related change: Examination of a (mostly) unexplored concept. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 65B*, 340-350. doi:10.1093/geronb/gbp110

Diehl, M., & Wahl, H.-W. (2015). *Annual review of gerontology and geriatrics: Subjective aging: New developments and future directions* (Vol. 35). New York, NY: Springer Publishing.

Diehl, M., Wahl, H.-W., Barrett, A. E., Brothers, A. F., Miche, M., Montepare, J. M., . . . Wurm, S. (2014). Awareness of aging: Theoretical considerations on an emerging concept. *Developmental Review, 34*, 93-113. doi:10.1016/j.dr.2014.01.001

Diehl, M., Wahl, H.-W., Brothers, A., & Miche, M. (2013). *Project "Awareness of age-related change: A cross-cultural collaboration"*. Unpublished data, Colorado State University.

Diehl, M., Wahl, H.-W., Brothers, A., & Miche, M. (2015). Subjective aging and awareness of aging: Toward a new understanding of the aging self. In M. Diehl & H.-W. Wahl (Eds.), *Annual review of gerontology and geriatrics: Subjective aging: New developments and future directions* (Vol. 35, pp. 1-28). New York, NY: Springer Publishing.

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125*, 276-302. doi:10.1037/0033-2909.125.2.276

Djernes, J. K. (2006). Prevalence and predictors of depression in populations of elderly: A review. *Acta Psychiatrica Scandinavica, 113*, 372-387. doi:10.1111/j.1600-0447.2006.00770.x

Drace, S. (2013). Evidence for the role of affect in mood congruent recall of autobiographic memories. *Motivation and Emotion, 37*, 623-628. doi:10.1007/s11031-012-9322-5

Dunne, E., Wrosch, C., & Miller, G. E. (2011). Goal disengagement, functional disability, and depressive symptoms in old age. *Health Psychology, 30*, 763-770. doi:10.1037/a0024019

Dutt, A. J., Gabrian, M., & Wahl, H.-W. (2016a). Awareness of age-related change and depressive symptoms in middle and late adulthood: Longitudinal associations and the role of self-regulation and calendar age. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, Advance online publication. doi:10.1093/geronb/gbw095

Dutt, A. J., Gabrian, M., & Wahl, H.-W. (2016b). Developmental regulation and awareness of age-related change: A (mostly) unexplored connection. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, Advance online publication. doi:10.1093/geronb/gbw084

Dutt, A. J., Wahl, H.-W., & Diehl, M. (in press). Awareness of aging processes. In O. Braddick (Ed.), *Oxford Research Encyclopedia of Psychology* (forthcoming). New York, NY: Oxford University Press.

Eibach, R. P., Mock, S. E., & Courtney, E. A. (2010). Having a "senior moment": Induced aging phenomenology, subjective age, and susceptibility to ageist stereotypes. *Journal of Experimental Social Psychology, 46*, 643-649. doi:10.1016/j.jesp.2010.03.002

Enders, C. K. (2001). A primer on maximum likelihood algorithms availaible for use with missing data. *Structural Equation Modeling, 8*, 128-141. doi:10.1207/S15328007SEM0801_7

Erikson, E. H. (1950). *Childhood and society*. New York, NY: Norton & Company.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191. doi:10.3758/BF03193146

Fiocco, A. J., & Mallya, S. (2015). The importance of cultivating mindfulness for cognitive and emotional well-being in late life. *Journal of Evidence-Based Complementary & Alternative Medicine, 20*, 35-40. doi:10.1177/2156587214553940

Forgas, J. P. (1995). Mood and judgment: The affect infusion model (AIM). *Psychological Bulletin, 117*, 39-66. doi:10.1037/0033-2909.117.1.39

Fox, L. S., Knight, B. G., & Zelinski, E. M. (1998). Mood induction with older adults: A tool for investigating effects of depressed mood. *Psychology and Aging, 13*, 519-523. doi:10.1037/0882-7974.13.3.519

Freeman, A. T., Santini, Z. I., Tyrovolas, S., Rummel-Kluge, C., Haro, J. M., & Koyanagi, A. (2016). Negative perceptions of ageing predict the onset and persistence of depression and anxiety: Findings from a prospective analysis of the Irish Longitudinal Study on Ageing (TILDA). *Journal of Affective Disorders, 199*, 132-138. doi:10.1016/j.jad.2016.03.042

Furukawa, T. A., Azuma, H., Takeuchi, H., Kitamura, T., & Takahashi, K. (2011). 10-year course of social adjustment in major depression. *International Journal of Social Psychiatry, 57*, 501-508. doi:10.1177/0020764010371273

Gabrian, M., Dutt, A. J., & Wahl, H.-W. (2017). Subjective time perceptions and aging well: A review of concepts and empirical research - A mini-review. *Gerontology, 63*, 350-358. doi:10.1159/000470906

Gabrian, M., & Wahl, H.-W. (2017). Being slower, feeling older? Experimentally induced cognitive aging experiences have limited impact on subjective age. *European Journal of Ageing, 14*, 179-188. doi:10.1007/s10433-016-0400-5

Gallo, J. J., Bogner, H. R., Morales, K. H., Post, E. P., Have, T. T., & Bruce, M. L. (2005). Depression, cardiovascular disease, diabetes, and two-year mortality among older, primary-care patients. *The American Journal of Geriatric Psychiatry, 13*, 748-755. doi:10.1176/appi.ajgp.13.9.748

Geiger, P. J., Boggero, I. A., Brake, C. A., Caldera, C. A., Combs, H. L., Peters, J. R., & Baer, R. A. (2016). Mindfulness-based interventions for older adults: A review of the effects on physical and emotional well-being. *Mindfulness, 7*, 296-307. doi:10.1007/s12671-015-0444-1

Gendron, T. L., Inker, J., & Welleford, A. (2017). "How old do you feel?" The difficulties and ethics of operationalizing subjective age. *The Gerontologist*, Advance online publication. doi:10.1093/geront/gnx098

Genet, J. J., & Siemer, M. (2012). Rumination moderates the effects of daily events on negative mood: Results from a diary study. *Emotion, 12*, 1329-1339. doi:10.1037/a0028070

Gerrards-Hesse, A., Spies, K., & Hesse, F. W. (1994). Experimental inductions of emotional states and their effectiveness: A review. *British Journal of Psychology, 85*, 55-78. doi:10.1111/j.2044-8295.1994.tb02508.x

Gluth, S., Ebner, N. C., & Schmiedek, F. (2010). Attitudes toward younger and older adults: The German Aging Semantic Differential. *International Journal of Behavioral Development, 34*, 147-158. doi:10.1177/0165025409350947

Gold, M. S., & Bentler, P. M. (2000). Treatments of missing data: A Monte Carlo comparison of RBHDI, iterative stochastic regression imputation, and expectation-maximization. *Structural Equation Modeling, 7*, 319-355. doi:10.1207/S15328007SEM0703_1

Goldsmith, R. E., & Heiens, R. A. (1992). Subjective age: A test of five hypotheses. *The Gerontologist, 32*, 312-317. doi:10.1093/geront/32.3.312

Goodwin, G. M. (2008). Depression and associated physical diseases and symptoms. *Dialogues in Clinical Neuroscience, 8*, 259-265.

Goodwin, J. S., Black, S. A., & Satish, S. (1999). Aging versus disease: The opinions of older black, Hispanic, and non-Hispanic white Americans about the causes and treatment of common medical conditions. *Journal of the American Geriatrics Society, 47*, 973-979. doi:10.1111/j.1532-5415.1999.tb01293.x

Graham, J. W. (2003). Adding missing-data-relevant variables to FIML-based structural equation models. *Structural Equation Modeling, 10*, 80-100. doi:10.1207/S15328007SEM1001_4

Grossman, P. (2008). On measuring mindfulness in psychosomatic and psychological research. *Journal of Psychosomatic Research, 64*, 405-408. doi:10.1016/j.jpsychores.2008.02.001

Gu, J., Strauss, C., Bond, R., & Cavanagh, K. (2015). How do mindfulness-based cognitive therapy and mindfulness-based stress reduction improve mental health and wellbeing? A systematic review and meta-analysis of mediation studies. *Clinical Psychology Review, 37*, 1-12. doi:10.1016/j.cpr.2015.01.006

Haase, C. M., Heckhausen, J., & Wrosch, C. (2013). Developmental regulation across the life span: Toward a new synthesis. *Developmental Psychology, 49*, 964-972. doi:10.1037/a0029231

Han, J., & Richardson, V. E. (2015). The relationships among perceived discrimination, self-perceptions of aging, and depressive symptoms: A longitudinal examination of age discrimination. *Aging & Mental Health, 19*, 747-755. doi:10.1080/13607863.2014.962007

Havighurst, R. J. (1961). Successful aging. *The Gerontologist, 1*, 8-13. doi:10.1093/geront/1.1.8

Heckhausen, J., Dixon, R. A., & Baltes, P. (1989). Gains and losses in development throughout adulthood as perceived by different adult age groups. *Developmental Psychology, 25*, 109-121. doi:10.1037/0012-1649.25.1.109

Heckhausen, J., Wrosch, C., & Schulz, R. (2010). A motivational theory of life-span development. *Psychological Review, 117*, 32-60. doi:10.1037/a0017668

Helmig, S., Meyer, A. H., & Bader, K. (2016). Validierung einer deutschen Version des Ruminative Thought Style Questionnaire (RTS-D) [Validation of a German Version of the Ruminative Thought Style Questionnaire (RTS-D)]. *Zeitschrift für Klinische Psychologie und Psychotherapie, 45*, 49-60. doi: 10.1026/1616-3443/a000345

Henderson, K. V., Goldsmith, R. E., & Flynn, L. R. (1995). Demographic characteristics of subjective age. *Journal of Social Psychology, 135*, 447-457. doi:10.1080/00224545.1995.9712214

Hess, T. M., & Hinson, J. T. (2006). Age-related variation in the influences of aging stereotypes on memory in adulthood. *Psychology and Aging, 21*, 621-625. doi:10.1037/0882-7974.21.3.621

Ho, C. S. H., Feng, L., Fam, J., Mahendran, R., Kua, E. H., & Ng, T. P. (2014). Coexisting medical comorbidity and depression: Multiplicative effects on health outcomes in older adults. *International Psychogeriatrics, 26*, 1221-1229. doi:10.1017/S1041610214000611

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist, 44*, 513-524. doi:10.1037/0003-066X.44.3.513

Hoppmann, C. A., Infurna, F. J., Ram, N., & Gerstorf, D. (2017). Associations among individuals' perceptions of future time, individual resources, and subjective well-being in old age. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 72B*, 388-399. doi:10.1093/geronb/gbv063

Horn, J. L., & McArdle, J. J. (1992). A practical and theoretical guide to measurement invariance in aging research. *Experimental Aging Research, 18*, 117-144.

Hsu, H. C. (2012). Group-based trajectories of depressive symptoms and the predictors in the older population. *International Journal of Geriatric Psychiatry, 27*, 854-862. doi:10.1002/gps.2796

Hubley, A. M., & Russell, L. B. (2009). Prediction of subjective age, desired age, and age satisfaction in older adults: Do some health dimensions contribute more than others? *International Journal of Behavioral Development, 33*, 12-21. doi:10.1177/0165025408099486

Hughes, M. L., Geraci, L., & De Forrest, R. L. (2013). Aging 5 years in 5 minutes: The effect of taking a memory test on older adults' subjective age. *Psychological Science, 24*, 2481-2488. doi:10.1177/0956797613494853

Hughes, M. L., & Lachman, M. E. (2016). Social comparisons of health and cognitive functioning contribute to changes in subjective age. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, Advance online publication. doi:10.1093/geronb/gbw044

Huta, V., & Ryan, R. M. (2010). Pursuing pleasure or virtue: The differential and overlapping well-being benefits of hedonic and eudaimonic motives. *Journal of Happiness Studies, 11*, 735-762. doi:10.1007/s10902-009-9171-4

Infurna, F. J., Gerstorf, D., Robertson, S., Berg, S., & Zarit, S. H. (2010). The nature and cross-domain correlates of subjective age in the oldest old: Evidence from the OCTO Study. *Psychology and Aging, 25*, 470-476. doi:10.1037/a0017979

Ingram, R. E., & Luxton, D. D. (2005). Vulnerability-stress models. In B. L. Hankin & J. R. Z. Abela (Eds.), *Development of psychopathology: A vulnerability-stress perspective* (pp. 32-46). Thousand Oaks, CA: Sage Publications.

Irwin, M. R., Artin, K. H., & Oxman, M. N. (1999). Screening for depression in the older adult: Criterion validity of the 10-item Center for Epidemiological Studies Depression Scale (CES-D). *Achives of Internal Medicine, 159*, 1701-1704. doi:10.1001/archinte.159.15.1701

Isen, A. M. (1985). Asymmetry of happiness and sadness in effects on memory in normal college students: Comment on Hasher, Rose, Zacks, Sanft, and Doren. *Journal of Experimental Psychology: General, 114*, 388-391. doi:10.1037/0096-3445.114.3.388

Jang, Y., Haley, W. E., Small, B. J., & Mortimer, J. A. (2002). The role of mastery and social resources in the associations between disability and depression in later life. *The Gerontologist, 42*, 807-813. doi:10.1093/geront/42.6.807

Jones, N. P., Papadakis, A. A., Hogan, C. M., & Strauman, T. J. (2009). Over and over again: Rumination, reflection, and promotion goal failure and their interactive effects on depressive symptoms. *Behaviour Research and Therapy, 47*, 254-259. doi:10.1016/j.brat.2008.12.007

Jorm, A. F. (2000). Does old age reduce the risk of anxiety and depression? A review of epidemiological studies across the adult life span. *Psychological Medicine, 30*, 11-22. doi:10.1017/S0033291799001452

Jylhä, P., & Isometsä, E. (2006). The relationship of neuroticism and extraversion to symptoms of anxiety and depression in the general population. *Depression and Anxiety, 23*, 281-289. doi:10.1002/da.20167

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*, 144-156. doi:10.1093/clipsy/bpg016

Kahana, E., & Kahana, B. (1996). Conceptual and empirical advances in understanding aging well through proactive adaptation. In V. L. Bengtson (Ed.), *Adulthood and aging: Research on continuities and discontinuities* (pp. 18-40). New York, NY: Springer Publishing.

Kaspar, R., Gabrian, M., Brothers, A., Wahl, H.-W., & Diehl, M. (in press). Measuring awareness of age-related change: Development of a 10-item short form for use in large-scale surveys. *The Gerontologist*.

Kastenbaum, R., Derbin, V., Sabatini, P., & Artt, S. (1972). The ages of me: Toward personal and interpersonal definitions of functional aging. *The International Journal of Aging and Human Development, 3*, 197-211.

Keller, M. L., Leventhal, H., Prohaska, T. R., & Leventhal, E. A. (1989). Beliefs about aging and illness in a community sample. *Research in Nursing & Health, 12*, 247-255. doi:10.1002/nur.4770120407

Keng, S.-L., Smoski, M. J., & Robins, C. J. (2011). Effects of mindfulness on psychological health: A review of empirical studies. *Clinical Psychology Review, 31*, 1041-1056. doi:10.1016/j.cpr.2011.04.006

Kennedy, N., Foy, K., Sherazi, R., McDonough, M., & McKeon, P. (2007). Long-term social functioning after depression treated by psychiatrists: A review. *Bipolar Disorders, 9*, 25-37. doi:10.1111/j.1399-5618.2007.00326.x

Keyes, C. L. M., & Westerhof, G. J. (2012). Chronological and subjective age differences in flourishing mental health and major depressive episode. *Aging & Mental Health, 16*, 67-74. doi:10.1080/13607863.2011.596811

Khalaila, R., & Litwin, H. (2014). Changes in health behaviors and their associations with depressive symptoms among Israelis aged 50+. *Journal of Aging and Health, 26*, 401-421. doi:10.1177/0898264313516997

Kite, M. E., Stockdale, G. D., Whitley, B. E., & Johnson, B. T. (2005). Attitudes toward younger and older adults: An updated meta-analytic review. *Journal of Social Issues, 61*, 241-266. doi:10.1111/j.1540-4560.2005.00404.x

Kleinspehn-Ammerlahn, A., Kotter-Grühn, D., & Smith, J. (2008). Self-perceptions of aging: Do subjective age and satisfaction with aging change during old age? *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 63B*, 377-385. doi:10.1093/geronb/63.6.P377

Kliegel, M., Jäger, T., & Phillips, L. H. (2007). Emotional development across adulthood: Differential age-related emotional reactivity and emotion regulation in a negative mood induction procedure. *The International Journal of Aging & Human Development, 64*, 217-244. doi:10.2190/U48Q-0063-3318-1175

Kliegel, M., Jäger, T., Phillips, L. H., Federspiel, E., Imfeld, A., Keller, M., & Zimprich, D. (2005). Effects of sad mood on time-based prospective memory. *Cognition and Emotion, 19*, 1199-1213. doi:10.1080/02699930500233820

Klusmann, V., Evers, A., Schwarzer, R., & Heuser, I. (2012). Views on aging and emotional benefits of physical activity: Effects of an exercise intervention in older women. *Psychology of Sport and Exercise, 13*, 236-242. doi:10.1016/j.psychsport.2011.11.001

Knight, B. G., & Durbin, K. (2015). Aging and the effects of emotion on cognition: Implications for psychological interventions for depression and anxiety. *PsyCh Journal, 4*, 11-19. doi:10.1002/pchj.84

Knight, B. G., Maines, M. L., & Robinson, G. S. (2002). The effects of sad mood on memory in older adults: A test of the mood congruence effect. *Psychology and Aging, 17*, 653-661. doi:10.1037/0882-7974.17.4.653

Kohlmann, T., & Gerbershagen, H. U. (2006). Freie deutschsprachige Version der Center for Epidemiologic Studies Depression Scale (CES-D) [German version of the Center for Epidemiologic Studies Depression Scale (CES-D)]. Retrieved from http://www.drktg.de/mz/pdf/downloads/CES-D.pdf

Kohls, N., Sauer, S., & Walach, H. (2009). Facets of mindfulness - Results of an online study investigating the Freiburg mindfulness inventory. *Personality and Individual Differences, 46*, 224-230. doi:10.1016/j.paid.2008.10.009

Kotter-Grühn, D. (2015). Changing negative views of aging: Implications for intervention and translational research. In M. Diehl & H.-W. Wahl (Eds.), *Annual review of gerontology and geriatrics: Subjective aging: New developments and future directions* (Vol. 35, pp. 167-186). New York, NY: Springer.

Kotter-Grühn, D., & Hess, T. M. (2012). The impact of age stereotypes on self-perceptions of aging across the adult lifespan. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 67B*, 563-571. doi:10.1093/geronb/gbr153

Kotter-Grühn, D., Kleinspehn-Ammerlahn, A., Gerstorf, D., & Smith, J. (2009). Self-perceptions of aging predict mortality and change with approaching death: 16-year longitudinal results from the Berlin Aging Study. *Psychology and Aging, 24*, 654-667. doi:10.1037/a0016510

Kotter-Grühn, D., Kornadt, A. E., & Stephan, Y. (2016). Looking beyond chronological age: Current knowledge and future directions in the study of subjective age. *Gerontology, 62*, 86-93. doi:10.1159/000438671

Kotter-Grühn, D., Neupert, S. D., & Stephan, Y. (2015). Feeling old today? Daily health, stressors, and affect explain day-to-day variability in subjective age. *Psychology & Health, 30*, 1470-1485. doi:10.1080/08870446.2015.1061130

Kraaij, V., Pruymboom, E., & Garnefski, N. (2002). Cognitive coping and depressive symptoms in the elderly: A longitudinal study. *Aging & Mental Health, 6*, 275-281. doi:10.1080/13607860220142387

Kunzmann, U., Richter, D., & Schmukle, S. C. (2013). Stability and change in affective experience across the adult life span: Analyses with a national sample from Germany. *Emotion, 13*, 1086-1095. doi:10.1037/a0033572

Lachman, M. E. (2004). Development in midlife. *Annual Review of Psychology, 55*, 305-331. doi:10.1146/annurev.psych.55.090902.141521

Laidlaw, K., Power, M. J., & Schmidt, S. (2007). The attitudes to ageing questionnaire (AAQ): Development and psychometric properties. *International Journal of Geriatric Psychiatry, 22*, 367-379. doi:10.1002/gps.1683

Lang, F. R., & Carstensen, L. L. (2002). Time counts: Future time perspective, goals, and social relationships. *Psychology and Aging, 17*, 125-139. doi:10.1037/0882-7974.17.1.125

Latzman, R. D., & Masuda, A. (2013). Examining mindfulness and psychological inflexibility within the framework of Big Five personality. *Personality and Individual Differences, 55*, 129-134. doi:10.1016/j.paid.2013.02.019

Lawton, M. P. (1975). The Philadelphia Geriatric Center Morale Scale: A revision. *Journal of Gerontology, 30*, 85-89. doi:10.1093/geronj/30.1.85

Lerner, R. M., & Busch-Rossnagel, N. A. (1981). *Individuals as producers of their development: A life-span perspective*. New York, NY: Academic Press.

Levy, B. R. (1996). Improving memory in old age through implicit self-stereotyping. *Journal of Personality and Social Psychology, 71*, 1092-1107. doi:10.1037/0022-3514.71.6.1092

Levy, B. R. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current Directions in Psychological Science, 18*, 332-336. doi:10.1111/j.1467-8721.2009.01662.x

Levy, B. R., Ashman, O., & Slade, M. D. (2009). Age attributions and aging health: Contrast between the United States and Japan. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 64B*, 335-338. doi:10.1093/geronb/gbp002

Levy, B. R., & Bavishi, A. (2016). Survival advantage mechanism: Inflammation as a mediator of positive self-perceptions of aging on longevity. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, Advance online publication. doi:10.1093/geronb/gbw035

Levy, B. R., & Myers, L. M. (2004). Preventive health behaviors influenced by self-perceptions of aging. *Preventive Medicine: An International Journal Devoted to Practice and Theory, 39*, 625-629. doi:10.1016/j.ypmed.2004.02.029

Levy, B. R., Pilver, C., Chung, P. H., & Slade, M. D. (2014). Subliminal strengthening: Improving older individuals' physical function over time with an implicit-age-stereotype intervention. *Psychological Science, 25*, 2127-2135. doi:10.1177/0956797614551970

Levy, B. R., Slade, M. D., & Kasl, S. V. (2002). Longitudinal benefit of positive self-perceptions of aging on functional health. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 57B*, 409-417. doi:10.1093/geronb/57.5.P409

Levy, B. R., Slade, M. D., Kunkel, S. R., & Kasl, S. V. (2002). Longevity increased by positive self-perceptions of aging. *Journal of Personality and Social Psychology, 83*, 261-270. doi:10.1037/0022-3514.83.2.261

Liang, J., & Bollen, K. A. (1983). The structure of the Philadelphia Geriatric Center Morale Scale: A reinterpretation. *Journal of Gerontology, 38*, 181-189. doi:10.1093/geronj/38.2.181

Lindenberger, U., Singer, T., & Baltes, P. (2002). Longitudinal selectivity in aging populations: Separating mortality-associated versus experimental components in the Berlin Aging Study (BASE). *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 57B*, P474-P482. doi:10.1093/geronb/57.6.P474

Little, T. D., Bovaird, J. A., & Widaman, K. F. (2006). On the merits of orthogonalizing powered and product terms: Implications for modeling interactions among latent variables. *Structural Equation Modeling, 13*, 497-519. doi:10.1207/s15328007sem1304_1

Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling, 9*, 151-173. doi:10.1207/S15328007SEM0902_1

Luppa, M., Sikorski, C., Luck, T., Ehreke, L., Konnopka, A., Wiese, B., . . . Riedel-Heller, S. G. (2012). Age- and gender-specific prevalence of depression in latest-life: Systematic review and meta-analysis. *Journal of Affective Disorders, 136*, 212-221. doi:10.1016/j.jad.2010.11.033

Luszczynska, A., Gutiérrez-Doña, B., & Schwarzer, R. (2005). General self-efficacy in various domains of human functioning: Evidence from five countries. *International Journal of Psychology, 40*, 80-89. doi:10.1080/00207590444000041

Malinowski, P. (2008). Mindfulness as psychological dimension: Concepts and applications. *The Irish Journal of Psychology, 29*, 155-166. doi:10.1080/03033910.2008.10446281

Martens, M. P., & Haase, R. F. (2006). Advanced applications of structural equation modeling in counseling psychology research. *The Counseling Psychologist, 34*, 878-911. doi:10.1177/0011000005283395

Martin, L. L., & Tesser, A. (1996). Some ruminative thoughts. In R. S. Wyer, Jr. (Ed.), *Ruminative thoughts* (pp. 1-47). Mahwah, NJ: Lawrence Erlbaum Associates.

Martin, M. (1990). On the induction of mood. *Clinical Psychology Review, 10*, 669-697. doi:10.1016/0272-7358(90)90075-L

McArdle, J. J. (2009). Latent variable modeling of differences and changes with longitudinal data. *Annual Review of Psychology, 60*, 577-605. doi:10.1146/annurev.psych.60.110707.163612

McCulloch, B. J. (1991). A longitudinal investigation of the factor structure of subjective well-being: The case of the Philadelphia Geriatric Center Morale Scale. *Journal of Gerontology, 46*, 251-258. doi:10.1093/geronj/46.5.P251

McIntosh, E., Gillanders, D., & Rodgers, S. (2010). Rumination, goal linking, daily hassles and life events in major depression. *Clinical Psychology & Psychotherapy, 17*, 33-43. doi:10.1002/cpp.611

Meisner, B. A. (2012). A meta-analysis of positive and negative age stereotype priming effects on behavior among older adults. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 67B*, 13-17. doi:10.1093/geronb/gbr062

Michalak, J., Teismann, T., Heidenreich, T., Ströhle, G., & Vocks, S. (2011). Buffering low self-esteem: The effect of mindful acceptance on the relationship between self-esteem and depression. *Personality and Individual Differences, 50*, 751-754. doi:10.1016/j.paid.2010.11.029

Miche, M., Elsässer, V. C., Schilling, O. K., & Wahl, H.-W. (2014). Attitude toward own aging in midlife and early old age over a 12-year period: Examination of measurement equivalence and developmental trajectories. *Psychology and Aging, 29*, 588-600. doi:10.1037/a0037259

Miche, M., Wahl, H.-W., Diehl, M., Oswald, F., Kaspar, R., & Kolb, M. (2014). Natural occurrence of subjective aging experiences in community-dwelling older adults. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 69B*, 174-187. doi:10.1093/geronb/gbs164

Mock, S. E., & Eibach, R. P. (2011). Aging attitudes moderate the effect of subjective age on psychological well-being: Evidence from a 10-year longitudinal study. *Psychology and Aging, 26*, 979-986. doi:10.1037/a0023877

Montejo, P., Montenegro, M., Fernández-Blázquez, M. A., Turrero-Nogués, A., Yubero, R., Huertas, E., & Maestú, F. (2014). Association of perceived health and depression with older adults' subjective memory complaints: Contrasting a specific questionnaire with general complaints questions. *European Journal of Ageing, 11*, 77-87. doi:10.1007/s10433-013-0286-4

Montepare, J. M. (1996). An assessment of adults' perceptions of their psychological, physical, and social ages. *Journal of Clinical Geropsychology, 2*, 117-128.

Montepare, J. M. (2009). Subjective age: Toward a guiding lifespan framework. *International Journal of Behavioral Development, 33*, 42-46. doi:10.1177/0165025408095551

Murray, C. J., & Lopez, A. D. (1997). Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *The Lancet, 349*, 1436-1442. doi:10.1016/S0140-6736(96)07495-8

Nikčević, A. V., Caselli, G., Green, D., & Spada, M. M. (2014). Negative recurrent thinking as a moderator of the relationship between perceived stress and depressive symptoms. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 32*, 248-256. doi:10.1007/s10942-014-0192-5

Noël, P. H., Williams, J. W., Jr., Unützer, J., Worchel, J., Lee, S., Cornell, J., . . . Hunkeler, E. (2004). Depression and comorbid illness in elderly primary care patients: Impact on multiple domains of health status and well-being. *Annals of Family Medicine, 2*, 555-562. doi:10.1370/afm.143

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*, 400-424. doi:10.1111/j.1745-6924.2008.00088.x

Öberg, P., & Tornstam, L. (2001). Youthfulness and fitness - Identity ideals for all ages? *Journal of Aging & Identity, 6*, 15-29. doi:10.1023/A:1009524612420

Palgi, Y., Ayalon, L., Avidor, S., & Bodner, E. (2017). Changes in positive and negative affect as predictors of change in felt age: Results from the Health and Retirement Study. *The Journal of Positive Psychology, 12*, 605-612. doi:10.1080/17439760.2016.1221121

Parrott, W. G., & Sabini, J. (1990). Mood and memory under natural conditions: Evidence for mood incongruent recall. *Journal of Personality and Social Psychology, 59*, 321-336. doi:10.1037/0022-3514.59.2.321

Peters, G. R. (1971). Self-conceptions of the aged, age identification, and aging. *The Gerontologist, 11*, 69-73. doi:10.1093/geront/11.4_Part_2.69

Phelan, E. A., Anderson, L. A., LaCroix, A. Z., & Larson, E. B. (2004). Older adults' views of 'successful aging' - How do they compare with researchers' definitions? *Journal of the American Geriatrics Society, 52*, 211-216. doi:10.1111/j.1532-5415.2004.52056.x

Pinquart, M. (2002). Good news about the effects of bad old-age stereotypes. *Experimental Aging Research, 28*, 317-336. doi:10.1080/03610730290080353

Pinquart, M., & Sörensen, S. (2001). Gender differences in self-concept and psychological well-being in old age: A meta-analysis. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 56B*, 195-213. doi:10.1093/geronb/56.4.P195

Poon, C. Y. M., & Knight, B. G. (2009). Influence of sad mood and old age schema on older adults' attention to physical symptoms. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 64B*, 41-44. doi:10.1093/geronb/gbn025

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879-891. doi:10.3758/BRM.40.3.879

Prohaska, T. R., Keller, M. L., Leventhal, E. A., & Leventhal, H. (1987). Impact of symptoms and aging attribution on emotions and coping. *Health Psychology, 6*, 495-514. doi:10.1037/0278-6133.6.6.495

Pruchno, R. A., Wilson-Genderson, M., & Cartwright, F. (2010). A two-factor model of successful aging. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 65B*, 671-679. doi:10.1093/geronb/gbq051

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385-401. doi:10.1177/014662167700100306

Rakowski, W. (1979). Future time perspective in later adulthood: Review and research directions. *Experimental Aging Research, 5*, 43-88. doi:10.1080/03610737908257187

Ranzijn, R., & Luszcz, M. (1999). Acceptance: A key to wellbeing in older adults? *Australian Psychologist, 34*, 94-98. doi:10.1080/00050069908257435

Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied Psychological Measurement, 21*, 173-184. doi:10.1177/01466216970212006

Riedel-Heller, S. G., Busse, A., & Angermeyer, M. C. (2006). The state of mental health in old-age across the 'old' European Union - A systematic review. *Acta Psychiatrica Scandinavica, 113*, 388-401. doi:10.1111/j.1600-0447.2005.00632.x

Riegel, K. F., & Riegel, R. M. (1960). A study on changes of attitudes and interests during later years of life. *Vita Humana, 3*, 177-206.

Robertson, D. A., & Kenny, R. A. (2016). 'I'm too old for that' - The association between negative perceptions of aging and disengagement in later life. *Personality and Individual Differences, 100*, 114-119. doi:10.1016/j.paid.2016.03.096

Robertson, D. A., King-Kallimanis, B. L., & Kenny, R. A. (2016). Negative perceptions of aging predict longitudinal decline in cognitive function. *Psychology and Aging, 31*, 71-81. doi:10.1037/pag0000061

Rosenthal, R. (1994). Parametric measures of effect size. In H. Cooper & L. V. Hedges (Eds.), *The handbook of research synthesis* (pp. 231-244). New York, NY: Russell Sage Foundation.

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1-36. doi:10.18637/jss.v048.i02

Rowe, J. W., & Kahn, R. L. (1987). Human aging: Usual and successful. *Science, 237*, 143-149. doi:10.1126/science.3299702

Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review, 5*, 296-320. doi:10.1207/S15327957PSPR0504_2

Rubin, D. C., & Berntsen, D. (2006). People over forty feel 20% younger than their age: Subjective age across the lifespan. *Psychonomic Bulletin & Review, 13*, 776-780. doi:10.3758/BF03193996

Rucker, D. D., Preacher, K. J., Tormala, Z. L., & Petty, R. E. (2011). Mediation analysis in social psychology: Current practices and new recommendations. *Social and Personality Psychology Compass, 5*, 359-371. doi:10.1111/j.1751-9004.2011.00355.x

Rusting, C. L. (1999). Interactive effects of personality and mood on emotion-congruent memory and judgment. *Journal of Personality and Social Psychology, 77*, 1073-1086. doi:10.1037/0022-3514.77.5.1073

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*, 1069-1081. doi:10.1037/0022-3514.57.6.1069

Sanjuan, P., & Magallares, A. (2015). Coping strategies as mediator variables between explanatory styles and depressive symptoms. *Anales de Psicología, 31*, 447-451. doi:10.6018/analesps.31.2.173391

Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2012). The relationship between change in self-perceptions of aging and physical functioning in older adults. *Psychology and Aging, 27*, 750-760. doi:10.1037/a0027578

Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2014). Longitudinal change of self-perceptions of aging and mortality. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 69B*, 168-173. doi:10.1093/geronb/gbt005

Sarkisian, C. A., Lee-Henderson, M. H., & Mangione, C. M. (2003). Do depressed older adults who attribute depression to 'old age' believe it is important to seek care? *Journal of General Internal Medicine, 18*, 1001-1005. doi:10.1111/j.1525-1497.2003.30215.x

Sarkisian, C. A., Prohaska, T. R., Davis, C., & Weiner, B. (2007). Pilot test of an attribution retraining intervention to raise walking levels in sedentary older adults. *Journal of the American Geriatrics Society, 55*, 1842-1846. doi:10.1111/j.1532-5415.2007.01427.x

Sauer, S., Strobl, C., Walach, H., & Kohls, N. (2013). Rasch-Analyse des Freiburger Fragebogens zur Achtsamkeit. [Rasch analysis of the Freiburg Mindfulness Inventory]. *Diagnostica, 59*, 86-99. doi:10.1026/0012-1924/a000084

Schafer, M. H., & Shippee, T. P. (2010a). Age identity in context: Stress and the subjective side of aging. *Social Psychology Quarterly, 73*, 245-264. doi:10.1177/0190272510379751

Schafer, M. H., & Shippee, T. P. (2010b). Age identity, gender, and perceptions of decline: Does feeling older lead to pessimistic dispositions about cognitive aging? *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 65B*, 91-96. doi:10.1093/geronb/gbp046

Scheier, M. F., & Carver, C. S. (1985). Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychology, 4*, 219-247. doi:10.1037/0278-6133.4.3.219

Schelling, H. R., & Martin, M. (2008). Einstellungen zum eigenen Altern: Eine Alters- oder eine Ressourcenfrage? [Attitudes toward one's own aging: A question of age or a question of resources?]. *Zeitschrift für Gerontologie und Geriatrie, 41*, 38-50. doi:10.1007/s00391-007-0451-5

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research, 8*, 23-74.

Schieman, S., & Campbell, J. E. (2001). Age variations in personal agency and self-esteem: The context of physical disability. *Journal of Aging and Health, 13*, 155-185. doi:10.1177/089826430101300201

Schnall, S., & Laird, J. D. (2003). Keep smiling: Enduring effects of facial expressions and postures on emotional experience and memory. *Cognition and Emotion, 17*, 787-797. doi:10.1080/02699930302286

Schwarz, N. (2001). Feelings as information: Implications for affective influences on information processing. In L. L. Martin & G. L. Clore (Eds.), *Theories of mood and cognition: A user's guidebook* (pp. 159-176). Mahwah, NJ: Lawrence Erlbaum Associates.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513-523. doi:10.1037/0022-3514.45.3.513

Schwarzer, R., & Jerusalem, M. (1995). Generalised Self-Efficacy Scale. In J. Weinman, S. Wright, & M. Johnston (Eds.), *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp. 35–37). Windsor, UK: Nfer-Nelson.

Segel-Karpas, D., Palgi, Y., & Shrira, A. (2017). The reciprocal relationship between depression and physical morbidity: The role of subjective age. *Health Psychology, 36*, 848-851. doi:10.1037/hea0000542

Segerstrom, S. C., Roach, A. R., Evans, D. R., Schipper, L. J., & Darville, A. K. (2010). The structure and health correlates of trait repetitive thought in older adults. *Psychology and Aging, 25*, 505-515. doi:10.1037/a0019456

Segerstrom, S. C., Stanton, A. L., Alden, L. E., & Shortridge, B. E. (2003). A multidimensional structure for repetitive thought: What's on your mind, and how, and how much? *Journal of Personality and Social Psychology, 85*, 909-921. doi:10.1037/0022-3514.85.5.909

Seidler, A. L., & Wolff, J. K. (2017). Bidirectional associations between self-perceptions of aging and processing speed across 3 years. *GeroPsych: The Journal of Gerontopsychology and Geriatric Psychiatry, 30*, 49-59. doi:10.1024/1662-9647/a000165

semTools Contributors. (2016). semTools: Useful tools for structural equation modeling. R package version 0.4-14. Retrieved from http://cran.r-project.org/web/packages/semTools/index.html

Sexton, E., King-Kallimanis, B. L., Morgan, K., & McGee, H. (2014). Development of the Brief Ageing Perceptions Questionnaire (B-APQ): A confirmatory factor analysis approach to item reduction. *BMC Geriatrics, 14*(44), 1-11. doi:10.1186/1471-2318-14-44.

Shenkin, S. D., Laidlaw, K., Allerhand, M., Mead, G. E., Starr, J. M., & Deary, I. J. (2014). Life course influences of physical and cognitive function and personality on attitudes to aging in the Lothian Birth Cohort 1936. *International Psychogeriatrics, 26*, 1417-1430. doi:10.1017/S1041610214000301

Short, M. M., Mazmanian, D., Oinonen, K., & Mushquash, C. J. (2016). Executive function and self-regulation mediate dispositional mindfulness and well-being. *Personality and Individual Differences, 93*, 97-103. doi:10.1016/j.paid.2015.08.007

Siebert, J. S., Wahl, H.-W., & Schröder, J. (2016). The role of attitude toward own aging for fluid and crystallized functioning: 12-year evidence from the ILSE study. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, Advance online publication. doi:10.1093/geronb/gbw050

Singer, J. A., & Salovey, P. (1988). Mood and memory: Evaluating the Network Theory of Affect. *Clinical Psychology Review, 8*, 211-251. doi:10.1016/0272-7358(88)90060-8

Smith, J. M., & Alloy, L. B. (2009). A roadmap to rumination: A review of the definition, assessment, and conceptualization of this multifaceted construct. *Clinical Psychology Review, 29*, 116-128. doi:10.1016/j.cpr.2008.10.003

Sowdon, J. (2001). Is depression more prevalent in old age? *Australian and New Zealand Journal of Psychiatry, 35*, 782-787. doi:10.1046/j.1440-1614.2001.00968.x

Spuling, S. M., Miche, M., Wurm, S., & Wahl, H.-W. (2013). Exploring the causal interplay of subjective age and health dimensions in the second half of life: A cross-lagged panel analysis. *Zeitschrift für Gesundheitspsychologie, 21*, 5-15. doi:10.1026/0943-8149/a000084

Stahl, S. T., & Patrick, J. H. (2012). Adults' future time perspective predicts engagement in physical activity. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 67B*, 413-416. doi:10.1093/geronb/gbr118

Staudinger, U. M. (2015). Images of aging: Outside and inside perspectives. In M. Diehl & H.-W. Wahl (Eds.), *Annual review of gerontology and geriatrics: Subjective aging: New developments and future directions* (Vol. 35, pp. 187-210). New York, NY: Springer.

Steiger, J. H. (2004). Beyond the F test: Effect size confidence intervals and tests of close fit in the analysis of variance and contrast analysis. *Psychological Methods, 9*, 164-182. doi:10.1037/1082-989X.9.2.164

Stephan, Y., Caudroit, J., & Chalabaev, A. (2011). Subjective health and memory self-efficacy as mediators in the relation between subjective age and life satisfaction among older adults. *Aging & Mental Health, 15*, 428-436. doi:10.1080/13607863.2010.536138

Stephan, Y., Chalabaev, A., Kotter-Grühn, D., & Jaconelli, A. (2013). 'Feeling younger, being stronger': An experimental study of subjective age and physical functioning among older adults. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 68B*, 1-7. doi:10.1093/geronb/gbs037

Stephan, Y., Sutin, A. R., Caudroit, J., & Terracciano, A. (2016). Subjective age and changes in memory in older adults. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 71B*, 675-683. doi:10.1093/geronb/gbv010

Sternberg, R. J. (2000). Images of mindfulness. *Journal of Social Issues, 56*, 11-26. doi:10.1111/0022-4537.00149

Steunenberg, B., Beekman, A. T. F., Deeg, D. J. H., & Kerkhof, A. J. F. M. (2006). Personality and the onset of depression in late life. *Journal of Affective Disorders, 92*, 243-251. doi:10.1016/j.jad.2006.02.003

Steverink, N., Westerhof, G. J., Bode, C., & Dittmann-Kohli, F. (2001). The personal experience of aging, individual resources, and subjective well-being. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 56B*, P364-P373. doi:10.1093/geronb/56.6.P364

Stewart, T. L., Chipperfield, J. G., Perry, R. P., & Weiner, B. (2012). Attributing illness to 'old age': Consequences of a self-directed stereotype for health and mortality. *Psychology & Health, 27*, 881-897. doi:10.1080/08870446.2011.630735

Swann, W. B., Jr. (1983). Self-verification: Bringing social reality into harmony with the self. In J. Suls & A. G. Greenwald (Eds.), *Psychological perspectives on the self* (Vol. 2, pp. 33-66). Hillsdale, NJ: Lawrence Erlbaum Associates.

Szanto, K., Dombrovski, A. Y., Sahakian, B. J., Mulsant, B. H., Houck, P. R., Reynolds, C. F., III, & Clark, L. (2012). Social emotion recognition, social functioning, and attempted suicide in late-life depression. *The American Journal of Geriatric Psychiatry, 20*, 257-265. doi:10.1097/JGP.0b013e31820eea0c

Tanner, A., Voon, D., Hasking, P., & Martin, G. (2013). Underlying structure of ruminative thinking: Factor analysis of the Ruminative Thought Style Questionnaire. *Cognitive Therapy and Research, 37*, 633-646. doi:10.1007/s10608-012-9492-1

Teuscher, U. (2009). Subjective age bias: A motivational and information processing approach. *International Journal of Behavioral Development, 33*, 22-31. doi:10.1177/0165025408099487

Uotinen, V., Rantanen, T., Suutama, T., & Ruoppila, I. (2006). Change in subjective age among older people over an eight-year follow-up: 'Getting older and feeling younger?'. *Experimental Aging Research, 32*, 381-393. doi:10.1080/03610730600875759

Vahia, I. V., Thompson, W. K., Depp, C. A., Allison, M., & Jeste, D. V. (2012). Developing a dimensional model for successful cognitive and emotional aging. *International Psychogeriatrics, 24*, 515-523. doi:10.1017/S1041610211002055

Vergara-Lopez, C., Kyung, Y., Detschner, A., & Roberts, J. E. (2014). Testing the cognitive catalyst model with idiographic content: Rumination moderates the association between self-discrepancies and depressive symptoms. *Journal of Experimental Psychopathology, 5*, 351-362. doi:10.5127/jep.038313

Wahl, H.-W., Siebert, J., & Taubert, B. (2017). Theories of successful aging. In N. A. Pachana (Ed.), *Enyclopedia of geropsychology* (pp. 1931-1940). New York, NY: Springer.

Walach, H., Buchheld, N., Buttenmüller, V., Kleinknecht, N., & Schmidt, S. (2006). Measuring mindfulness - The Freiburg Mindfulness Inventory (FMI). *Personality and Individual Differences, 40*, 1543-1555. doi:10.1016/j.paid.2005.11.025

Ware, J., Kosinski, M., & Keller, S. D. (1996). A 12-item short-form health survey: Construction of scales and preliminary tests of reliability and validity. *Medical Care, 34*, 220-233. doi:10.2307/3766749

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*, 163-206. doi:10.1037/0033-2909.134.2.163

Watkins, E. R., & Moulds, M. (2005). Distinct modes of ruminative self-focus: Impact of abstract versus concrete rumination on problem solving in depression. *Emotion, 5*, 319-328. doi:10.1037/1528-3542.5.3.319

Watkins, E. R., Moulds, M., & Mackintosh, B. (2005). Comparisons between rumination and worry in a non-clinical population. *Behaviour Research and Therapy, 43*, 1577-1585. doi:10.1016/j.brat.2004.11.008

Weiss, D., & Freund, A. M. (2012). Still young at heart: Negative age-related information motivates distancing from same-aged people. *Psychology and Aging, 27*, 173-180. doi:10.1037/a0024819

Weiss, D., Job, V., Mathias, M., Grah, S., & Freund, A. M. (2016). The end is (not) near: Aging, essentialism, and future time perspective. *Developmental Psychology, 52*, 996-1009. doi:10.1037/dev0000115

Weiss, D., & Lang, F. R. (2009). Thinking about my generation: Adaptive effects of a dual age identity in later adulthood. *Psychology and Aging, 24*, 729-734. doi:10.1037/a0016339

Weiss, D., & Lang, F. R. (2012). "They" are old but "I" feel younger: Age-group dissociation as a self-protective strategy in old age. *Psychology and Aging, 27*, 153-163. doi:10.1037/a0024887

Westerhof, G. J., Miche, M., Brothers, A. F., Barrett, A. E., Diehl, M., Montepare, J. M., . . . Wurm, S. (2014). The influence of subjective aging on health and longevity: A meta-analysis of longitudinal data. *Psychology and Aging, 29*, 793-802. doi:10.1037/a0038016

Westerhof, G. J., Whitbourne, S. K., & Freeman, G. P. (2012). The aging self in a cultural context: The relation of conceptions of aging to identity processes and self-esteem in the United States and the Netherlands. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 67B*, 52-60. doi:10.1093/geronb/gbr075

Westerhof, G. J., & Wurm, S. (2015). Longitudinal research on subjective aging, health, and longevity: Current evidence and new directions for research. In M. Diehl & H.-W. Wahl (Eds.), *Annual review of gerontology and geriatrics: Subjective aging: New developments and future directions* (Vol. 35, pp. 145-165). New York, NY: Springer.

Westermann, R., Spies, K., Stahl, G., & Hesse, F. W. (1996). Relative effectiveness and validity of mood induction procedures: A meta-analysis. *European Journal of Social Psychology, 26*, 557-580. doi:10.1002/(SICI)1099-0992(199607)26:4<557::AID-EJSP769>3.0.CO;2-4

Whitbourne, S. K., & Collins, K. J. (1998). Identity processes and perceptions of physical functioning in adults: Theoretical and clinical implications. *Psychotherapy: Theory, Research, Practice, Training, 35*, 519-530. doi:10.1037/h0087666

Wilkes, R. E. (1992). A structural modeling approach to the measurement and meaning of cognitive age. *Journal of Consumer Research, 19*, 292-301. doi:10.1086/209303

Windle, G. (2014). Exercise, physical activity and mental well-being in later life. *Reviews in Clinical Gerontology, 24*, 319-325. doi:10.1017/S0959259814000173

Windsor, T. D., Fiori, K. L., & Crisp, D. A. (2011). Personal and neighborhood resources, future time perspective, and social relations in middle and older adulthood. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 67B*, 423-431. doi:10.1093/geronb/gbr117

Wolff, J. K., Warner, L. M., Ziegelmann, J. P., & Wurm, S. (2014). What do targeting positive views on ageing add to a physical activity intervention in older adults? Results from a randomised controlled trial. *Psychology & Health, 29*, 915-932. doi:10.1080/08870446.2014.896464

Wrosch, C., Dunne, E., Scheier, M. F., & Schulz, R. (2006). Self-regulation of common age-related challenges: Benefits for older adults' psychological and physical health. *Journal of Behavioral Medicine, 29*, 299-306. doi:10.1007/s10865-006-9051-x

Wrosch, C., Scheier, M. F., & Miller, G. E. (2013). Goal adjustment capacities, subjective well-being, and physical health. *Social and Personality Psychology Compass, 7*, 847-860. doi:10.1111/spc3.12074

Wrosch, C., Schulz, R., & Heckhausen, J. (2004). Health stresses and depressive symptomatology in the elderly: A control-process approach. *Current Directions in Psychological Science, 13*, 17-20. doi:10.1111/j.0963-7214.2004.01301005.x

Wurm, S., & Benyamini, Y. (2014). Optimism buffers the detrimental effect of negative self-perceptions of ageing on physical and mental health. *Psychology & Health, 29*, 832-848. doi:10.1080/08870446.2014.891737

Wurm, S., Diehl, M., Kornadt, A. E., Westerhof, G. J., & Wahl, H.-W. (2017). How do views on aging affect health outcomes in adulthood and late life? Explanations for an established connection. *Developmental Review, 46*, 27-43. doi:10.1016/j.dr.2017.08.002

Wurm, S., Tesch-Römer, C., & Tomasik, M. J. (2007). Longitudinal findings on aging-related cognitions, control beliefs, and health in later life. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 62B*, P156-P164. doi:10.1093/geronb/62.3.P165

Wurm, S., Tomasik, M. J., & Tesch-Römer, C. (2008). Serious health events and their impact on changes in subjective health and life satisfaction: The role of age and a positive view on ageing. *European Journal of Ageing, 5*, 117-127. doi:10.1007/s10433-008-0077-5

Wurm, S., Tomasik, M. J., & Tesch-Römer, C. (2010). On the importance of a positive view on ageing for physical exercise among middle-aged and older adults: Cross-sectional and longitudinal findings. *Psychology & Health, 25*, 25-42. doi:10.1080/08870440802311314

Wurm, S., Warner, L. M., Ziegelmann, J. P., Wolff, J. K., & Schüz, B. (2013). How do negative self-perceptions of aging become a self-fulfilling prophecy? *Psychology and Aging, 28*, 1088-1097. doi:10.1037/a0032845

Zivin, K., Yosef, M., Miller, E. M., Valenstein, M., Duffy, S., Kales, H. C., . . . Kim, H. M. (2015). Associations between depression and all-cause and cause-specific risk of death: A retrospective cohort study in the Veterans Health Administration. *Journal of Psychosomatic Research, 78*, 324-331. doi:10.1016/j.jpsychores.2015.01.014

List of Tables

List of Figures

List of Abbreviations

AARC	Awareness of Age-Related Change
ANOVA	Analysis of variance
ATOA	Attitude Toward Own Aging
BCa	Bias-corrected and accelerated [bootstrap approach]
CES-D	Center for Epidemiologic Studies Depression Scale
CFI	Comparative fit index
CI	Confidence interval
df	Degrees of freedom
EM	Expectation maximization
FIML	Full information maximum likelihood
FMI	Freiburg Mindfulness Inventory
FTP	Future time perspective
GSE	General self-efficacy
LCS	Latent change score
M	Mean
MANOVA	Multivariate analysis of variance
RMSEA	Root mean square error of approximation
RT	Repetitive thought
SD	Standard deviation
SE	Standard error
SF-36	Short Form-36 questionnaire
SPA	Self-perceptions of aging
T1	Time 1 (First measurement point)
T2	Time 2 (Second measurement point)
T3	Time 3 (Third measurement point)

Description of Personal Contribution for the Publications of this Thesis

I. Publication

Awareness of age-related change and depressive symptoms in middle and late adulthood: Longitudinal associations and the role of self-regulation and calendar age

A. J. Dutt developed the theoretical framework and research questions, collected the 2015 data, analyzed the data, and wrote the article. The 2012 data were collected by M. Gabrian. The work was supervised by H.-W. Wahl.

II. Publication

Mindful vs. Mind full: Processing strategies moderate the association between subjective aging experiences and depressive symptoms

A. J. Dutt developed the theoretical framework and research questions, collected the 2017 data, analyzed parts of the data and supervised F. S. Rupprecht in conducting the latent change score analysis, and wrote the article. The work was supervised by H.-W. Wahl.

III. Publication

Future time perspective and general self-efficacy mediate the association between awareness of age-related losses and depressive symptoms

A. J. Dutt developed the theoretical framework and research questions, collected the 2015 and 2017 data, analyzed the data, and wrote the article. The work was supervised by H.-W. Wahl.

IV. Publication

Feeling sad makes us feel older: Effects of a sad mood induction on subjective age

A. J. Dutt developed the theoretical framework and research questions, designed the experiment, collected parts of the data and trained two research assistants to administer the experiment, analyzed the data, and wrote the article. The work was supervised by H.-W. Wahl.

Appendix

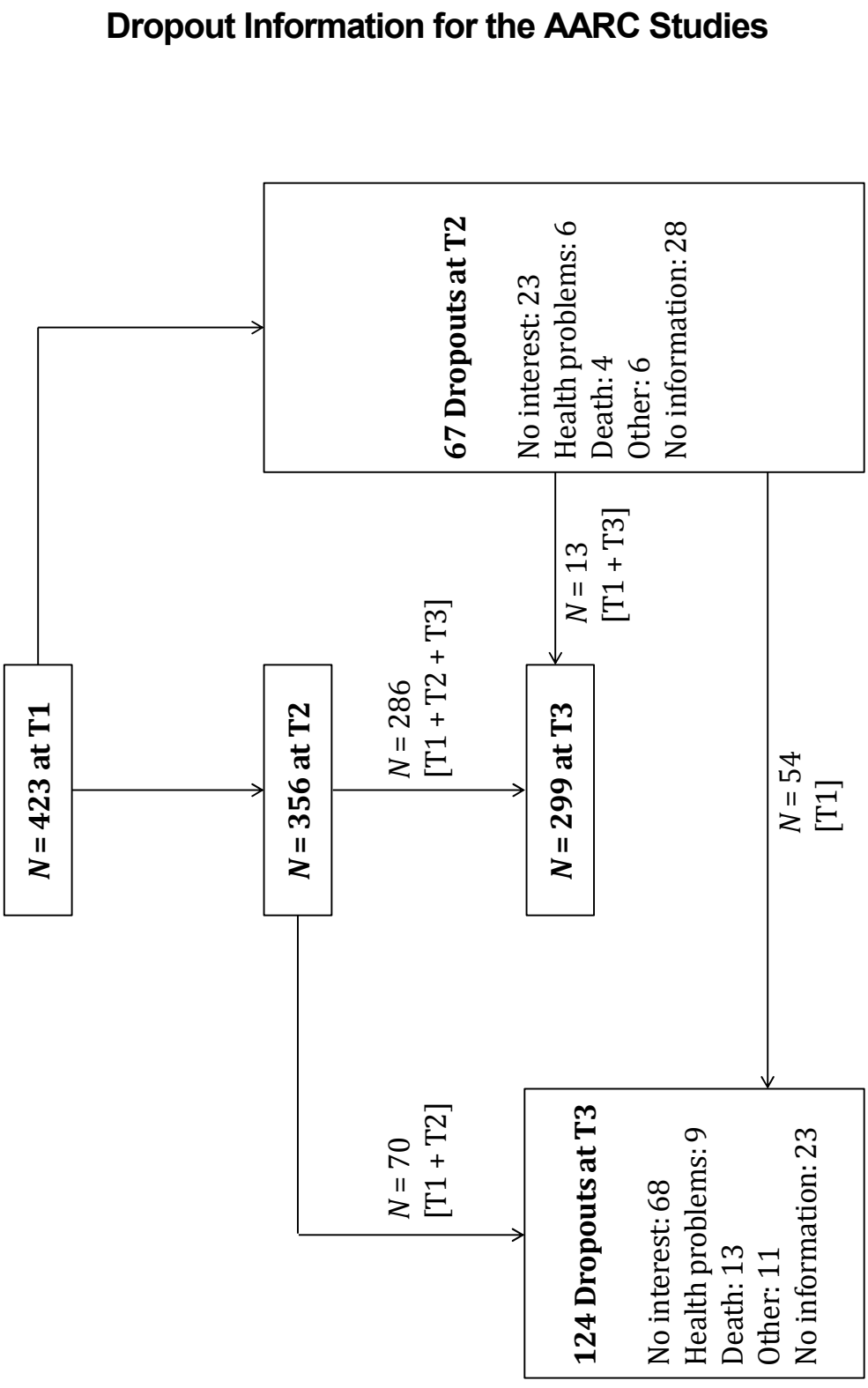


Figure A.1. Illustration of the sample dropout across the three measurement points within the awareness of age-related change (AARC) studies.

UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386

**FAKULTÄT FÜR VERHALTENS-
UND EMPIRISCHE KULTURWISSENSCHAFTEN**

Promotionsausschuss der Fakultät für Verhaltens- und Empirische Kulturwissenschaften der Ruprecht-Karls-Universität Heidelberg
Doctoral Committee of the Faculty of Behavioural and Cultural Studies, of Heidelberg University

Erklärung gemäß § 8 (1) c) der Promotionsordnung der Universität Heidelberg für die Fakultät für Verhaltens- und Empirische Kulturwissenschaften
Declaration in accordance to § 8 (1) c) of the doctoral degree regulation of Heidelberg University, Faculty of Behavioural and Cultural Studies

Ich erkläre, dass ich die vorgelegte Dissertation selbstständig angefertigt, nur die angegebenen Hilfsmittel benutzt und die Zitate gekennzeichnet habe.
I declare that I have made the submitted dissertation independently, using only the specified tools and have correctly marked all quotations.

Erklärung gemäß § 8 (1) d) der Promotionsordnung der Universität Heidelberg für die Fakultät für Verhaltens- und Empirische Kulturwissenschaften
Declaration in accordance to § 8 (1) d) of the doctoral degree regulation of Heidelberg University, Faculty of Behavioural and Cultural Studies

Ich erkläre, dass ich die vorgelegte Dissertation in dieser oder einer anderen Form nicht anderweitig als Prüfungsarbeit verwendet oder einer anderen Fakultät als Dissertation vorgelegt habe.
I declare that I did not use the submitted dissertation in this or any other form as an examination paper until now and that I did not submit it in another faculty.

Vorname Nachname
First name Family name: Anne Josephine Dutt

Datum, Unterschrift
Date, Signature: 09.01.2018