

Levels of Awareness of Age-Related Gains and Losses Throughout Adulthood and Their Developmental Correlates

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Views of aging predict key developmental outcomes. Less is known, however, about the consequences of constellations of domain-specific perceived gains and losses across the full adult lifespan. First, we explored levels of awareness of age-related gains (AARC-gains) and losses (AARC-losses) in five behavioral domains across adulthood. Second, we identified the number and types of profiles of AARC-gains and AARC-losses in young adulthood, midlife, young-old age, and old-old age. Third, we investigated whether the identified profiles differed in their associations with developmental correlates. Data came from the 2018 German Socio-Economic Panel Innovation Sample (SOEP-IS), comprising 403 young, 721 middle-aged, 260 young-old and 228 old-old individuals. We assessed AARC, physical and mental functioning, information processing speed, social relations, lifestyle, and engagement. At the sample level, AARC-losses were higher in old age, whereas AARC-gains did not differ across adulthood. Latent profile analyses revealed two distinguishable constellations of AARC-gains and AARC-losses that characterize young adulthood and old-old age, whereas four and three gains-to-losses constellations are needed to characterize midlife and young-old age, respectively. In middle, young-old, and old-old age, profiles with more AARC-losses were associated with poorer scores on all developmental correlates. Overall, study results suggest that age-related experiences are most diversified in midlife and young-old age. Asking individuals about their negative age-related experiences may help identify those individuals who are doing less well in important developmental correlates.

Public Significance Statement

Awareness of age-related losses increased throughout adulthood, whereas awareness of age-related gains stayed relatively stable. By looking at the co-occurrence of perceived age-related gains and losses throughout adulthood, we found the most diversified profiles in midlife and young-old age. In contrast, self-perceptions of aging in young adulthood and old-old age were characterized by low and high losses, respectively. Higher losses indicated poorer scores on developmental correlates in midlife and older age.

Keywords: mental and physical health, cognitive function, subjective aging, gains and losses, engagement

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The analytic code for preparing and analyzing the data reported in the current report is available online on Open Science Framework (<https://doi.org/10.17605/OSF.IO/QYW4H>; Sabatini & Rupperecht, 2023). The study was not preregistered in a public repository. The ideas and data appearing in the article have not been disseminated before (e.g., at a conference or meeting, posted on a listserv, shared on a website).

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How individuals interpret and evaluate their own aging is not only an important facet of quality of life but also represents a process that may be related to long-term developmental outcomes, such as health, cognitive functioning, and well-being. Generally, less favorable developmental outcomes are observed among those with more negative views of their own aging process (Debreczeni & Bailey, 2021; M. Diehl, Brothers, & Wahl, 2021; Westerhof et al., 2014). We argue in this article that focusing on the subjective experience of aging acknowledges three fundamental propositions. First, because development in any phase of life comes with gains and losses (Baltes et al., 2007; M. Diehl, Brothers, & Wahl, 2021; Wurm et al., 2007), awareness of aging also needs an explicit two-dimensional view in terms of perceived gains and losses. Second, we assume based on additional evidence on differential developmental resources and constraints that constellations of awareness of aging-related gains and losses differ across the adult lifespan (Baltes & Smith, 2003). Third, given the different quantitative and qualitative roles that gains/losses might play in various phases of the lifespan such as young, middle-aged, and later adulthood, both associations between aging-related gain and loss perceptions and developmental correlates might be different depending on the life stage in question.

Starting from these basic assumptions, this study focused on the construct of awareness of age-related change (AARC) as suggested by M. K. Diehl and Wahl (2010) to conduct an empirical test. AARC is defined as “a person’s state of awareness that his or her behavior, level of performance, or way of experiencing life has changed as a consequence of having grown older” (M. K. Diehl & Wahl, 2010; p. 342). The concept of AARC strives to capture the above-mentioned multidimensionality of positive (AARC-gains) and negative (AARC-losses) changes individuals may experience as they grow older (Baltes et al., 2007). AARC also considers multidimensionality within its overarching dichotomy in that it assumes that AARC-gains and AARC-losses coexist as people age and, thus, often profoundly shape developmental outcomes (Brothers & Diehl, 2017; Brothers et al., 2021; M. Diehl, Brothers, & Wahl, 2021). To assess AARC, a questionnaire exists in several versions of different length, but the most widely used is the 10-item short form (AARC-10-SF; Kaspar et al., 2019; Neri et al., 2021; Testad et al., 2022; Zhang & Wood, 2022). This short form contains five items assessing AARC-gains and five items assessing AARC-losses. Moreover, each of the gains and losses items assesses one of the five AARC behavioral domains: health and physical functioning, cognitive functioning, social-cognitive and social-emotional functioning, lifestyle and engagement, and interpersonal relations.

Levels of Perceived Gains and Losses Across Adulthood

As developmental theories postulate (e.g., Baltes et al., 2007), the experience of gains decreases with increasing old age, whereas the experience of losses increases with advancing age. Because of this, levels of AARC-gains and AARC-losses may differ across different phases of the adult lifespan. In support of this reasoning, Miche, Elsässer, et al. (2014) found, over 12 years, a steady decline in positive attitudes toward own aging among individuals aged 60 at baseline. Moreover, M. Diehl, Wettstein, et al., (2021) found that, in a sample of participants aged 40–85 at baseline, starting at about Age 65, participants showed over 21 years age-related increases in perceptions of physical and social losses, with increases getting

steeper in old age. Starting at about Age 55, participants reported increasingly fewer perceptions related to ongoing development, and this decrease was accentuated after the age of 70. These findings indicate both linear and nonlinear age trends in views of aging.

With regard to evidence on AARC, Kaspar et al. (2022) found that AARC-gains decreased and AARC-losses increased as people moved across old–old age beyond 80 years. However, in a cohort of individuals aged 40 years and older, Wettstein et al. (2022) observed a small increase in AARC-gains and stability in AARC-losses across 5 years. The observed stability in AARC-losses may be due to middle-aged and older adults having the capacity to flexibly adjust their goals (Brandtstädter & Rothermund, 2003). They may therefore be able to accept objective health-related and social losses and interpret experiences as “gains,” although these perceptions may rely on actual stability or even decrease. For example, lowering one’s aspirations for outdoor mobility may lead to interpret remaining motor functioning as a gain, although no objective increase or even some decrease happened as compared with the capacity levels of that person some time ago.

So far, only Wettstein et al. (2022) explored whether the change in levels of AARC-gains and AARC-losses differs across the five AARC behavioral domains. This study found that AARC-gains declined in all behavioral domains except for interpersonal relations, where it remained stable. Conversely, AARC-losses in the health and physical functioning, social-cognitive and social-emotional functioning, and cognitive functioning domains, on average remained stable over time, whereas AARC-losses in the interpersonal relations and lifestyle and engagement domains declined. Overall, change in levels of perceived gains and losses may vary depending on the behavioral domain in which gains and losses are experienced.

Associations Between Awareness of Age-Related Gains and Losses Across Adulthood

So far evidence on the correlation between levels of AARC-gains and AARC-losses is inconsistent. Indeed, whereas Sabatini, Siebert, et al. (2022) found a statistically nonsignificant association between AARC-gains and AARC-losses, Dunsmore and Neupert (2022) and Wilton-Harding and Windsor (2022) found a small negative association ($r = -.15$) between AARC-gains and AARC-losses, and Dutt, Wahl, and Rupperecht (2018) found a moderate positive association ($r = .32$) between AARC-gains and AARC-losses. To the best of our knowledge, only Wettstein et al. (2022) explored whether, over 5 years, change in AARC-gains was associated with change in AARC-losses. This study, in a sample of middle-aged and older adults, found only a small association between change in AARC-gains and in AARC-losses, suggesting that changes in these two dimensions were rather independent from each other. Overall, it is unclear whether changes in AARC-gains are related to AARC-losses. It may be that the size and direction of the correlation between AARC-gains and AARC-losses differ across different phases of adulthood, but this has never been examined. For example, whereas both age-related gains and losses may be common and therefore positively associated in midlife and young–old age, in old–old age losses may be more frequent than gains and hence AARC-losses may be less strongly or even negatively associated with AARC-gains. However, it may also be that in old–old age

AARC-gains become more interlinked with AARC-losses because focussing on gains might be adaptive in light of experienced losses.

Number and Types of Profiles of Awareness of Age-Related Gains and Losses Across Adulthood

Using latent profile analysis and cross-sectional data of 6,192 U.K. residents aged 50+, Sabatini, Ukoumunne, et al. (2022) identified, four classes of individuals with distinct profiles of AARC-gains and AARC-losses (i.e., many AARC-gains and few AARC-losses; moderate AARC-gains and few AARC-losses, many AARC-gains and moderate AARC-losses, and many AARC-gains and many AARC-losses). However, this study did not explore whether its findings generalize across different stages of the adult lifespan—that is, whether the constellations of AARC-gains and AARC-losses and/or the proportions of individuals experiencing these constellations remain stable across the whole lifespan (Baltes et al., 2007). Yet, experiencing levels of gains and losses may vary greatly across the adult lifespan. Indeed, whereas in young adulthood and midlife the experience of gains may outweigh losses, in young–old age and old–old age the experience of losses may outweigh the experience of gains (Baltes et al., 2007).

Young adulthood is a phase of expansion of developmental possibilities. Losses may occur in young adulthood, but they may not be directly interpreted as a consequence of one's increased age. Midlife is instead a phase where, alongside gains, losses start to become more salient, at least for some individuals. Although in young–old age losses may become increasingly frequent and notable, this is still a life phase with the potential for expansion, gain generation and consolidation, and a high diversity of age-related experiences. In contrast, old–old age can be expected to be strongly driven by loss occurrences in various domains such as health, functioning, and the social sphere, whereas the range of gain experiences should become increasingly restricted.

Moreover, constellations of AARC-gains and AARC-losses may be less diverse in specific phases of the adult lifespan. Indeed, in young adulthood, the experience of losses may be infrequent for most individuals, which may result in less diversity in constellations/subgroups of AARC-gains and AARC-losses in this life phase compared to midlife and young–old age. In old–old age instead, the majority of individuals experience some levels of losses in one or more health and life domains and may attribute them to their aging process (CALAS Team at Tel Aviv University et al., 2013; Kaspar et al., 2022). This may again result in little differentiation in constellations of AARC-gains and AARC-losses. In contrast, in midlife and young–old age, there is typically great variability in the changes that people can experience for example in their physical and cognitive health (Bertram et al., 2014; Grande et al., 2020; Klaus et al., 2017; Steiber, 2015). Hence, we expected higher subdifferentiation in terms of constellations of AARC-gains and AARC-losses both in midlife and young–old age as compared to young adulthood and old–old age.

Associations Between Profiles of Awareness of Age-Related Gains and Losses and Developmental Correlates

Although O'Brien et al. (2021) explored AARC-gains and AARC-losses in relation to cognitive interference and stress in a sample of people aged 21–78, the associations between

AARC-gains and AARC-losses and other developmental correlates have so far been explored among individuals aged 40+. Lower AARC-gains and higher AARC-losses tend to be associated with poorer self-rated health, less functional ability, more negative medical assessments, greater frailty, poorer self-reported sleep, and greater pain (Brothers et al., 2021; Sabatini, Silarova, et al., 2020; Sabatini, Turner, et al., 2023; Sabatini, Ukoumunne, et al., 2020; Sabatini, Ukoumunne, Ballard, Collins, Corbett, et al., 2021). Moreover, higher AARC-losses are associated with poorer performance on cognitive tasks assessing memory, perceptual speed, knowledge, and reasoning, although effects are either small or negligible (Sabatini, Ukoumunne, Ballard, Collins, Anstey, et al., 2021; Voelkner & Caskie, 2023).

Conversely, higher AARC-gains and lower AARC-losses are related to better mood and psychological well-being, higher life satisfaction, less stress, and better coping abilities (Dutt & Wahl, 2019; Dutt, Wahl, & Rupprecht, 2018; Neupert & Bellingtier, 2017; O'Brien & Sharifian, 2020; Sabatini et al., 2022a; Sabatini, Dritschel, et al., 2023; Sabatini, Silarova, et al., 2020; Sabatini, Ukoumunne, et al., 2020; Wilton-Harding & Windsor, 2022). Lower AARC-losses were also found to be related to greater self-efficacy and predisposition to focus on the present (Dutt & Wahl, 2019; Dutt, Wahl, & Rupprecht, 2018). Finally, higher AARC-gains and lower AARC-losses are related to greater social support (O'Brien & Sharifian, 2020), satisfaction with one's relationships (Kaspar et al., 2019), and engagement in physical exercise and enjoyable activities (Brothers & Diehl, 2017; Windsor et al., 2022).

Relations among profiles of AARC-gains and AARC-losses across the five AARC behavioral domains and developmental outcomes have been explored only among individuals aged 50+. Individuals who reported either many or moderate AARC-losses had poorer physical, mental, and cognitive functioning, irrespective of coexisting levels of AARC-gains (Sabatini, Siebert, et al., 2022). Individuals who reported many AARC-gains had better health only when they reported few concurrent AARC-losses but not when they reported many concurrent AARC-losses. This suggests that AARC-gains should be interpreted jointly with AARC-losses, despite most previous studies having solely focused on the separate associations of AARC-gains and AARC-losses with developmental outcomes. However, as Sabatini, Ukoumunne, et al. (2022) analyses were conducted in a sample of individuals aged 50+ and not stratified by age, it is unknown how associations between levels of AARC-gains and AARC-losses and developmental outcomes differ across different age groups from young adulthood to old–old age. This would be important as there is some evidence suggesting that the associations of AARC-gains and AARC-losses with developmental outcomes become stronger in older age (Brothers et al., 2017; Sabatini, Silarova, et al., 2020; Sabatini, Ukoumunne, Ballard, Collins, Anstey, et al., 2021).

The Present Study

Against this background, our study addresses three objectives. First, it explores overall levels of AARC-gains and AARC-losses and levels of AARC-gains and AARC-losses in each of the five behavioral domains across the full adult lifespan from early to very late adulthood. Although young adulthood, midlife, young–old age, and old–old age involve the experience of quite different age-related changes (Baltes et al., 2007), the AARC concept pertains, in

principle, to experiences of awareness of aging across the full adult lifespan. This follows the tenet of lifespan developmental psychology that gains and losses happen in different degrees across the entire lifespan (Baltes et al., 2007; Heckhausen et al., 1989). An important background is that available AARC-related lifespan research suggests that awareness of aging-related self-views are far from becoming overly negative as people age (Sabatini, Ukoumunne, et al., 2022). Hence, although we expect that AARC-losses increase from young adulthood to old-old age across all their five behavioral domains, the adaptational potential of older adults due to their goal flexibility (Brandtstädter & Rothermund, 2003) will help them to keep their levels of AARC-gains in at least some of the AARC behavioral domains rather stable until old-old age. For example, greater losses in the physical health domain may be compensated with more frequent perceptions of gains in the social-emotional domain.

Second, we build on the evidence in the previous research that at the sample level the constellations of AARC-gains and AARC-losses across behavioral domains differed among individuals (Sabatini, Ukoumunne, et al., 2022). Here, we want to explore whether such constellations differ and/or the same constellations are reported in different proportions by individuals in different stages of the adult lifespan. We will first document associations between overall AARC-gains and AARC-losses across different phases of adulthood. Then, we will identify number and types of profiles of AARC-gains and AARC-losses across behavioral domains in four subsamples aged 16–39 years (i.e., young adulthood), 40–65 years (i.e., midlife), 66–75 years (i.e., young-old), and 76+ (i.e., old-old age). We predict, based on developmental theories (Baltes et al., 2007; Heckhausen et al., 1989) and on empirical evidence on variability of health profiles in midlife and young-old age (Bertram et al., 2014; Grande et al., 2020; Klaus et al., 2017; Steiber, 2015), that the profiles in midlife and young-old age are more differentiated (i.e., more profiles/latent classes) than the profiles in young adulthood and old-old age.

Third, this study examines how participants' profiles of AARC-gains and AARC-losses are associated with indicators of physical and mental functioning, information processing speed, social relations, lifestyle, and engagement. Based on previous evidence (Sabatini, Ukoumunne, et al., 2022), we expect that those profiles with higher AARC-losses are associated with less favorable developmental outcomes in all stages of adult life except young adulthood. Here, AARC-losses should be so low that they may not be related to developmental outcomes. Profiles with higher AARC-gains are expected to show a positive association with developmental outcomes across all adult life stages, especially when levels of AARC-losses are low (Sabatini, Ukoumunne, et al., 2022).

Method

Sample and Procedure

Data came from the 2018 Innovation Sample of the German Socio-Economic Panel Study (SOEP-IS). SOEP is a multidisciplinary and longitudinal survey covering about 11,000 German households. SOEP-IS is a regular extension that allows researchers to address innovative research questions not covered in the core survey in a random subsample of SOEP participants (Richter & Schupp, 2015). In 2018, the AARC-10–Short Form (AARC-10-SF;

Kaspar et al., 2019) was added to the IS assessment battery. Size of the IS-2018 subsample completing the AARC questionnaire was 1,612 and the age range was from 16 to 93 years.

Measures

Awareness of Age-Related Change

We used the 10 items of the AARC-10-SF (Kaspar et al., 2019), which are reported in Supplemental Table S1. It is important to note that each item starts with the stem “With my increasing age, I realize that.” Examples of items assessing AARC-gains in the interpersonal relations and social-emotional and social-cognitive functioning domains are “I appreciate relationships and people much more” and “I have a better sense of what is important for me,” respectively. Examples of items assessing AARC-losses in the health and physical functioning and cognitive functioning domains are “I have less energy” and “my mental capacity is declining,” respectively. Each item is scored from 1 = *not at all* to 5 = *very much*. AARC-Gains and AARC-Losses subscales scores are obtained by summing items that fall into the respective scale (range: 5–25). Higher scores indicate higher AARC-gains and AARC-losses, respectively. In this sample, omega value (ω ; McNeish, 2018) was .681 with 95% bootstrap CI [.63, .74] for AARC-gains and .81 with 95% bootstrap CI [.78, .83] for AARC-losses, indicating acceptable scales reliability.¹ Importantly, a recent analysis underscored that measurement invariance of the scale can be expected from young adulthood to old-old age (Kaspar et al., 2023). Of note, the five items represent gains/losses in five behavioral domains (i.e., health and physical functioning, cognitive functioning, social-cognitive and social-emotional functioning, interpersonal relations, and lifestyle and engagement). Given this conceptual reasoning behind each item, we will also present item-wise data analyses (M. K. Diehl & Wahl, 2010; Mische, Wahl, et al., 2014) solely for exploratory and descriptive purposes.

Developmental Correlates

Physical health and functioning were assessed with the physical health component of the 12-item Short Form Health Survey (SF-12; J. Ware et al., 1996; J. E. Ware et al., 2019), and the number of health conditions. We used a modified version of the SF-12 comprising 11 out of the 12 original items. The items represented the eight domains general health, mental health, physical functioning, social functioning, role physical, role emotional, body pain, and vitality. The eight domains formed a weighted composite score for physical health according to norms specific for the SOEP samples (Andersen, 2006) with a reliability of Mosier's $\alpha = .67$ (Mosier, 1943).² Scores could range from 0 to 100 and higher scores indicate better physical health. Number of health conditions comprised the count of cardiopathy, diabetes, cancer, asthma, sleep disorder,

¹ Note that Cronbach's α , though widely used, might be an inaccurate reliability coefficient, which most likely underestimates reliability if some rather restrictive conditions (e.g., tau-equivalence) do not hold (e.g., Cho & Kim, 2015; McNeish, 2018). Indeed, the respective α s for AARC-gains and AARC-losses were .66 and .81, respectively.

² Common reliability measures like Cronbach's α are used for sum or average scores. Mosier's α (Mosier, 1943) is a reliability measure specifically designed for weighted composite scores like the SF-12 mental and physical health score.

stroke, migraine, high blood pressure, depression, dementia, joint disorders, back pain, and other illnesses. Information processing speed was assessed with the digit symbol test (Lang et al., 2007) as an indicator of cognitive functioning. Participants had to match numbers with graphical symbols as quickly as possible. A higher number of correct responses given within 90 s indicates better perceptual information processing speed.

Social-emotional functioning was assessed using the mental health component of the SF-12 (J. Ware et al., 1996; J. E. Ware et al., 2019) and the four-item version of the Patient Health Questionnaire-4 (PHQ-4; Kroenke et al., 2009; Löwe et al., 2010). The eight domains of the SF-12 also formed a weighted composite score for mental health, again according to norms specific for the SOEP samples (Andersen, 2006). The reliability was Mosier's $\alpha = .72$ (Mosier, 1943), scores could range from 0 to 100, and higher scores indicate better mental health. The PHQ-4 assesses core symptoms of depression and anxiety over the past 2 weeks. Response options range from 1 = *not at all* to 4 = *nearly every day*. Higher total scores (range: 4–16) indicate more nonspecific mood problems. In this sample, Cronbach's α for the PHQ-4 was .78 (Cronbach, 1951).

Social relations, lifestyle, and engagement were assessed with a nine-item questionnaire capturing participation in a range of activities, including time spent with friends, physical exercise, and participation in clubs over the past 12 months (Infurna et al., 2017). Participants indicated how frequently they engaged in each activity on a scale from 1 = *never* to 4 = *at least once a week*. Higher scores (range: 9–36) indicate greater engagement. Cronbach's α in this sample was .66 (Cronbach, 1951).

Finally, sociodemographic variables comprised age, sex, education, marital status, employment status, and monthly net household income. Education was coded using the Comparative Analysis of Social Mobility in Industrial Nations indicator (Brauns et al., 2003) which comprises 10 categories (1 = *in school*; 10 = *higher tertiary education*). Marital status comprised seven categories: married/registered same-sex partnership—partner in household/registered same-sex partnership—partner not in household, separated, single, divorced, and widowed. Employment status was a nominal variable comprising nine categories (1 = *full-time employed*; 9 = *not employed*).

The PHQ-4, symbol digit test, and questionnaire capturing relations, lifestyle, and engagement were available only for a subset of study participants due to block-wise assignment of IS modules to IS subsamples.

Analyses

Descriptive statistics for all age groups were calculated. We also calculated Pearson's r correlation coefficient for the association of overall AARC-gains and overall AARC-losses in each age group. To interpret Pearson's r correlation coefficient values $\leq .09$ indicated negligible correlations, values between .10 and .29 indicated small correlations, values between .30 and .49 indicated moderate correlations, and values $\geq .50$ indicated large correlations (Cohen, 1988). To compare the size of coefficients between different age subsamples, we used the *cortesti* option in STATA, which makes it possible to compare the equality of coefficients across different samples.

To explore mean levels of gains and losses for each of the five AARC behavioral domains across the lifespan, we plotted the

average scores for AARC-gains and AARC-losses as well as the 10 items/domains as a function of mean-centered age, age², and age³. We also conducted a regression analysis with age, Age \times Age, and Age \times Age \times Age as predictors of overall AARC-gains and AARC-losses and each of the gains and losses items/domains. Age was centered before the interaction terms were computed. We explored nonlinear associations between AARC-gains and AARC-losses with age because there is evidence suggesting that age trends in views of aging concepts can be nonlinear (M. Diehl, Wettstein, et al., 2021; Pinquart & Wahl, 2021; Rupprecht & Lang, 2020).

To test whether each of the four age groups/subsamples can be further divided into classes of individuals characterized by different profiles of levels of AARC-gains and AARC-losses, we used latent profile analysis in Mplus (L. K. Muthén & Muthén, 2017) for each of the four age groups investigated separately. We fit the latent profile model based on manifest continuous variables representing responses to the 10 items of the AARC-10-SF. Doing so, we successively fitted models with two up to five latent classes for each age group. Up to date, there is no consensus about the best statistical criteria to identify the model with the optimal number of groups, instead, it is widely agreed to take into account a combination of such criteria, including model fit, accuracy of class separation (i.e., entropy), parsimony, interpretability, and theoretical relevance with respect to the research question (for an overview, see, e.g., Weller et al., 2020). Statistical indices we considered and report are widely used model fit indices (Akaike's information criterion [AIC], Bayesian information criterion [BIC]), the Lo-Mendell-Rubin likelihood ratio test [LMRT]), and the entropy statistic (Nylund et al., 2007).³ We followed the rationale to select the most parsimonious—in terms of number of latent classes—model which provides a highly accurate separation of theoretically meaningful classes. Prioritizing parsimony, we used the LMRT to compare the fit of models with different numbers of classes, with p values $\geq .05$ indicating that the more parsimonious model with one less class/profile should be chosen. Also, theoretical interpretation of the identified classes/profiles was taken into account for parsimony (i.e., when two or more classes in the identified model had very similar levels of AARC-gains and AARC-losses that were not meaningfully different at the theoretical level, the more parsimonious model was chosen). Further, we considered entropy values of .80 or above as high accuracy of class separation, required for the model selected (B. O. Muthén, 2008).

Having identified the latent class solution following to the above rationale, the percentage of the population in each group was reported, alongside the mean for each item assessing AARC-gains and AARC-losses. In latent profile analyses, each participant is assigned a probability in each of the identified classes. It is standard procedure to allocate participants to the class in which they have the highest probability of membership based on posterior probabilities. To characterize the classes, we interpreted mean scores ≤ 2 as low, > 2 and ≤ 3 as middle, and > 3 as high levels of AARC-gains or AARC-losses. We refer to these cutoffs when naming the identified latent classes.

³ We also computed the bootstrap-likelihood ratio test implemented in Mplus (BLRT, L. K. Muthén & Muthén, 2017). However, with $p < .001$ in all tests conducted, the BLRT did not provide evidence of any parsimonious latent solution, apparently showing an overrejection of the null hypothesis, "overpenalizing" model parsimony.

To test for differences in the developmental correlates of the identified classes, we conducted analyses of variance and chi-square tests in STATA (StataCorp., 2017). For analyses of variance, we used Bonferroni post hoc tests to follow-up on significant differences between individual classes. The size and significance of differences between classes were estimated by calculating eta squared (η^2) in STATA. For η^2 , effect sizes between 0.01 and 0.05 are generally interpreted as small, between 0.06 and 0.13 are interpreted as moderate, and 0.14 or above are interpreted as large (Cohen, 1988). We also report significance thresholds after having adjusted for Bonferroni's correction for multiple comparisons (Bonferroni, 1936). The analyses were conducted separately for each of the four investigated age groups.

Finally, because some of the classes identified with latent profile analyses exhibited the same combination of levels of AARC-gains and AARC-losses in different age groups, we used independent samples *t* tests to compare mean scores in developmental correlates across these age subgroups.

Results

Descriptive Statistics

The group representing young adulthood comprised 403 individuals ($M_{\text{age}} = 29.24$ years; $SD = 6.72$ years). The group representing middle-aged adults comprised 721 participants ($M_{\text{age}} = 54.02$ years; $SD = 7.17$ years). The group representing young-old age comprised 260 individuals ($M_{\text{age}} = 69.87$ years; $SD = 2.75$ years). The group representing old-old age comprised 228 individuals ($M_{\text{age}} = 80.5$ years; $SD = 3.82$ years). The age distribution within each of the four age groups is illustrated in Supplemental Figure S1. Table 1 shows the descriptive statistics for the study sample.

The correlation between levels of AARC-gains and AARC-losses in young adulthood was .38 ($p < .001$); whereas it was lower in middle-aged adults ($r = .23$; $p < .001$), young-old age ($r = .18$; $p = .004$), and old-old age ($r = .20$; $p = .003$). Test of equality of correlations coefficients suggested correlations coefficients were significantly different across age groups, with those in young adulthood differing significantly from the remaining age groups.

Levels of Gains and Losses Across the Adult Lifespan

For overall AARC-losses, we found a pattern of small cross-sectional increase with chronological age in young adulthood, stability across age cohorts in midlife, and accelerated cross-sectional increase across age cohorts in old age (see Figure 1). In an exploratory approach using the behavioral domains represented by single items, the overall pattern was replicated in the single domains (Table 2). This was indicated by positive, cubic age trends in all domains, as well as positive linear and quadratic age trends in four out of five domains, respectively. Losses in the physical health, interpersonal relations, and lifestyle domains nonlinearly increased across the adult lifespan. Losses in cognitive functioning instead increased in young adulthood, remained stable in young-old age, and increased again in old-old adulthood. Social-cognitive and social-emotional losses increased in young-old and old-old adults and were stable in the younger age groups.

For overall AARC-gains, we found a slight cross-sectional increase in the second half of life, indicated by a positive linear and positive quadratic age trend (Table 2). Age trajectories indicated

specific developmental patterns for each behavioral domain. Gains in the physical domain increased linearly throughout adulthood. Gains in the cognitive and interpersonal domains had a more pronounced increase in old age with either a high (cognitive domain) or a low (interpersonal domain) in midlife. Lifestyle gains showed a succinct nonlinear pattern with highs in young adulthood and young-old age, a clear low in midlife, and a slight decrease in old-old age. Gains in the social-cognitive and social-emotional domains stayed stable throughout the adult lifespan.

Identifying AARC Profiles Within Each Age Subgroup

Supplemental Table S2 reports model selection statistics for two-, three-, four-, and five-class models for each age subsample.

In the subsample of young adults, a two-class solution was chosen. Even though AIC and BIC indices suggest that a three-class (as well as four- and five-class) model better fit the data compared to a two-class model, the LMRT indicates that the increase in model fit gained by adding another latent class to the two-class model was not statistically significant. In the two-class model, the entropy statistic was .86; hence, the two classes were well-defined. Thus, following the model selection rationale as explained in the Methods section, the two-class solution should be retained as a more parsimonious model that nonetheless provides an accurate separation of latent profiles. Young adults in Class 1 reported low-to-moderate AARC-gains and low AARC-losses ($n = 96$; 23.8%), whereas young adults in Class 2 reported high AARC-gains and low AARC-losses ($n = 307$; 76.2%). Figure 2 and Supplemental Table S3 present the mean scores for each of the 10 AARC items separately for each class for young adults.

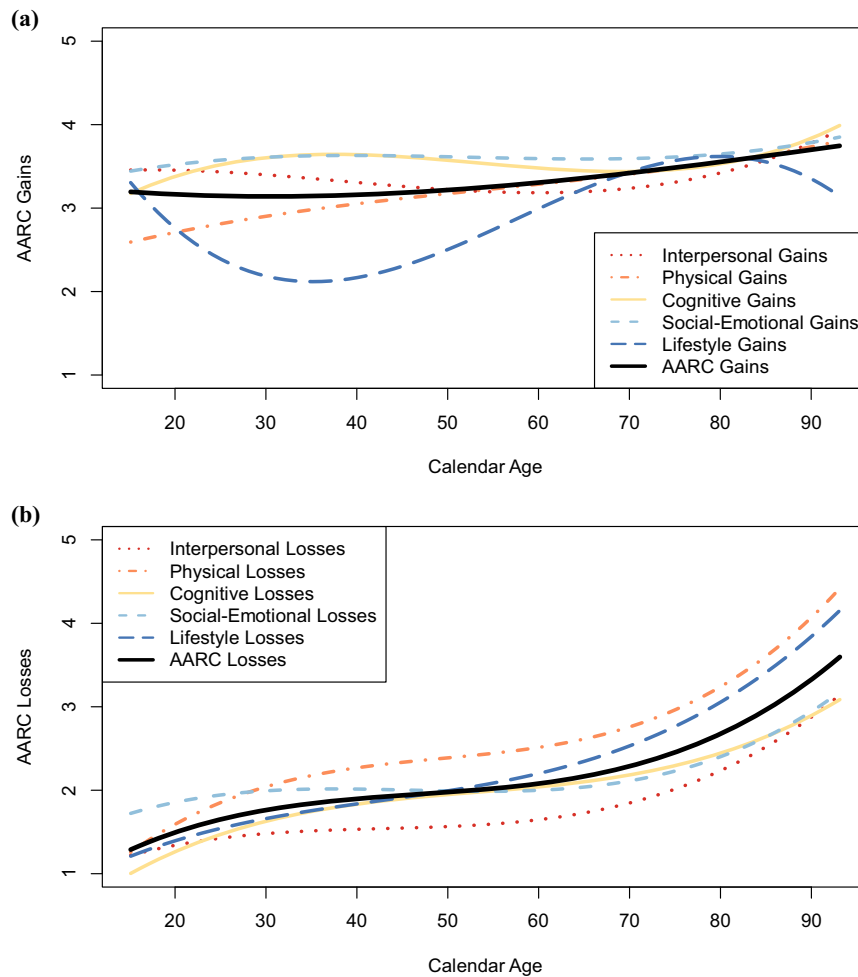
In individuals in midlife, a four-class solution was chosen. Even though AIC, BIC, and LMRT suggest that a five-class solution better fits the data than a four-class solution, in the five-class solution, two classes reported very similar levels of gains and losses across the 10 AARC items and hence at the theoretical level, we did not deem appropriate further differentiation of participants into five groups (see Supplemental Tables S4 and S5). For the four-class solution, the entropy statistic was .82, hence the four classes were well-defined. Middle-aged individuals in Class 1 reported moderate AARC-gains and low AARC-losses ($n = 109$; 15.1%), individuals in Class 2 reported high AARC-gains and low AARC-losses ($n = 267$; 37.0%), individuals in Class 3 reported high AARC-gains and moderate AARC-losses ($n = 208$; 28.8%), and individuals in Class 4 reported high AARC-gains and moderate-to-high AARC-losses ($n = 137$; 19.0%). Figure 3 and Supplemental Table S4 present the mean scores for each of the 10 AARC items separately for each class for middle-aged individuals.

In the subsample of young-old individuals, a three-class solution was chosen. Even though AIC and BIC indices suggest that a four-class model better fit the data compared to three-class model, the nonsignificant *p* value on the LMRT suggested that the three-class solution could be retained as a more parsimonious model. In the selected three-class model, the entropy statistic was .77, slightly below the optimal cutoff of .80; hence, the three classes were relatively well-defined. Young-old individuals in Class 1 reported moderate AARC-gains and low AARC-losses ($n = 63$; 24.2%), individuals in Class 2 reported high AARC-gains and low AARC-losses ($n = 65$; 25.0%), and individuals in Class 3 reported high AARC-gains and moderate AARC-losses ($n = 132$; 50.8%). Figure 4

Table 1
Descriptive Statistics of Study Variables

Variable	Overall sample (<i>n</i> = 1,612)	Young adulthood (40-3; 25%)	Midlife (72-1; 44.7%)	Young-old age (260; 16.1%)	Old-old age (228; 14.1%)	<i>p</i> values	η^2
Age, <i>M</i> (<i>SD</i> , range)	54.13 (18.18)	29.24 (6.72; 16-39)	54.02 (7.17; 40-65)	69.87 (2.75; 66-75)	80.5 (3.82; 76-93)	<.001	.88
Sex (female), <i>n</i> (%)	849 (52.7)	212 (52.6)	384 (53.3)	138 (53.1)	115 (50.4)	<.001	
Education, <i>n</i> (%)							
In school	15 (0.9)	15 (3.8)	0 (0)	0	0		
Not having completed school	36 (2.3)	9 (2.3)	21 (2.9)	3 (1.2)	3 (1.3)		
Completed general elementary school	92 (5.8)	22 (5.6)	29 (4.0)	14 (5.4)	27 (11.9)		
Completed intermediate school	377 (23.6)	39 (10.0)	149 (20.8)	90 (34.8)	99 (43.6)		
General maturity certificate	65 (4.1)	21 (5.4)	22 (3.1)	11 (4.3)	11 (4.9)		
Vocational maturity certificate	479 (30.0)	104 (26.5)	265 (36.9)	74 (28.6)	36 (15.9)		
Basic vocational qualification	65 (4.1)	43 (11.0)	15 (2.1)	3 (1.2)	4 (1.8)		
Intermediate vocational qualification	158 (9.9)	61 (15.6)	78 (10.9)	7 (2.7)	12 (5.3)		
Lower tertiary education	83 (5.2)	18 (4.6)	42 (5.9)	11 (4.3)	12 (5.3)		
Higher tertiary education	226 (14.2)	60 (15.3)	97 (13.5)	46 (17.8)	23 (10.1)		
Missing		9	3				
Marital status, <i>n</i> (%)							
Married/registered same-sex partnership, partner in household/registered same-sex partnership, but partner not in household	856 (53.2)	116 (28.8)	436 (60.5)	178 (68.5)	126 (55.3)	<.001	
Married, but separated	28 (1.7)	3 (0.7)	17 (2.4)	2 (0.8)	6 (2.6)		
Single (never been married)	388 (14.1)	266 (66.0)	98 (13.6)	12 (4.6)	12 (5.3)		
Divorced	201 (12.5)	18 (4.5)	138 (19.1)	31 (11.9)	14 (6.1)		
Widowed	139 (8.6)	0 (0)	32 (4.4)	37 (14.2)	70 (30.7)		
Employment status, <i>n</i> (%)							
Full-time employed	578 (35.9)	158 (39.2)	378 (52.4)	39 (15.0)	3 (1.3)		
Regular part-time employment	196 (12.2)	33 (8.2)	147 (20.4)	14 (5.4)	2 (0.9)		
Vocational training	42 (2.6)	40 (9.9)	2 (0.3)	0 (0)	0 (0)		
Marginally employed	91 (5.6)	33 (8.2)	35 (4.9)	18 (6.9)	5 (2.2)		
Near retirement, zero work	10 (0.6)	0 (0)	4 (0.6)	5 (1.9)	1 (0.4)		
Military service	3 (0.2)	3 (0.7)	0 (0)	0 (0)	0 (0)		
Community service	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)		
Sheltered workshop	2 (0.1)	1 (0.3)	1 (0.1)	0 (0)	0 (0)		
Not employed	690 (42.8)	135 (33.5)	154 (21.4)	184 (70.8)	217 (95.2)		
Monthly net household income (€), <i>M</i> (<i>SD</i>)	3,043.24 (1,718.03)	3,243.02 (1,585.64)	3,329.66 (1,947.41)	2,596.50 (1,483.76)	2,283.52 (895.72)	<.001	.05
Number of health conditions, <i>M</i> (<i>SD</i>)	2.25 (1.97)	1.0 (1.25)	2.25 (1.93)	2.87 (1.90)	3.76 (1.86)	<.001	.20
Short form survey—physical health, <i>M</i> (<i>SD</i>)	48.5 (10.25)	54.36 (7.71)	48.41 (10.0)	45.43 (9.73)	41.76 (9.88)	<.001	.16
Symbol digit test, <i>M</i> (<i>SD</i>)	31.11 (10.05)	39.37 (8.36)	30.59 (8.15)	24.16 (7.82)	21.70 (7.22)	<.001	.36
Patient Health Questionnaire-4, <i>M</i> (<i>SD</i>)	5.93 (2.06)	6.05 (1.99)	6.08 (2.19)	5.45 (1.74)	5.77 (2.01)	.010	.01
Short form survey—mental health, <i>M</i> (<i>SD</i>)	52.61 (9.63)	50.40 (8.96)	52.10 (9.61)	56.59 (9.08)	53.57 (10.03)	<.001	.04
Relations, lifestyle, and engagement, <i>M</i> (<i>SD</i>)	18.06 (4.30)	18.74 (3.93)	18.01 (4.42)	18.72 (4.17)	16.31 (4.26)	<.001	.04

Figure 1
Awareness of Age-Related Gains and Losses Across the Adult Lifespan



Note. (a) after age-related gains and (b) after losses. Average age trends are depicted for AARC-gains and AARC-losses. As can be observed, the lifespan trajectories of AARC-gains are domain-specific. AARC-losses follow a trend of marginal increase in young adulthood, relative stability in middle age, and increases in older ages. AARC = awareness of age-related change. See the online article for the color version of this figure.

and [Supplemental Table S6](#) present the mean scores for each of the 10 AARC items separately for each class for young–old individuals.

In the subsample of individuals in old–old age, a two-class solution was chosen. Even though AIC and BIC indices suggest that a three-class (and four-class) model better fit the data compared to a two-class model, the nonstatistically significant p value on the LMRT suggests to retain the two-class solution as a more parsimonious model that nonetheless does not fit worse than the three- or four-class models. In the selected two-class model, the entropy statistic was .83; hence, the two classes were well-defined. Old–old individuals in Class 1 reported high AARC-gains and low-to-moderate AARC-losses ($n = 116$; 50.9%), whereas individuals in Class 2 reported high AARC-gains and high AARC-losses ($n = 112$; 49.1%). [Figure 5](#) and [Supplemental Table S7](#) present the mean scores for each of the 10 AARC items separately for each class for those in old–old age.

Testing for Differences in Developmental Correlates

Young Adulthood

[Supplemental Table S8](#) reports distributions of scores on sociodemographic variables, and on variables assessing health, social relations, lifestyle, and engagement for the two latent classes in young adulthood. Both before and after applying for Bonferroni's correction for multiple comparisons, in young adulthood, the two identified classes did not significantly differ in sociodemographic and developmental variables.

Middle-Aged Adults

[Supplemental Table S9](#) reports distributions of scores on sociodemographic variables, and on variables assessing health, social relations, lifestyle, and engagement for the four latent

Table 2
General and Domain-Specific Adult Lifespan Trends in AARC

Variable	Intercept Estimate (SE)	Age <i>b</i> (SE)	Age ² <i>b</i> (SE)	Age ³ <i>b</i> (SE)
AARC-gains	3.25 (0.02)	0.008 (0.002)	0.00014 (0.00005)	-0.000001 (0.000003)
Physical	3.22 (0.04)	0.011 (0.003)	-0.00001 (0.00008)	0.000003 (0.000004)
Cognitive	3.53 (0.03)	-0.010 (0.003)	0.00003 (0.00008)	0.000013 (0.000004)
Interpersonal	3.20 (0.03)	-0.004 (0.003)	0.00033 (0.00008)	0.000007 (0.000004)
Social-cognitive socioemotional	3.61 (0.03)	-0.002 (0.003)	0.00003 (0.00007)	0.000005 (0.000004)
Lifestyle gains	2.70 (0.04)	0.049 (0.004)	0.00035 (0.00009)	-0.000034 (0.000004)
AARC-losses	2.01 (0.02)	0.009 (0.002)	0.00028 (0.00005)	0.000013 (0.000003)
Physical	2.43 (0.04)	0.012 (0.003)	0.00027 (0.00008)	0.000019 (0.000004)
Cognitive	1.98 (0.03)	0.009 (0.003)	0.00004 (0.00007)	0.000012 (0.000004)
Interpersonal	1.59 (0.03)	0.007 (0.003)	0.00039 (0.00007)	0.000011 (0.000004)
Social-cognitive socioemotional	1.99 (0.04)	-0.000 (0.003)	0.00030 (0.00008)	0.000012 (0.000004)
Lifestyle	2.07 (0.04)	0.020 (0.003)	0.00040 (0.00008)	0.000012 (0.000004)

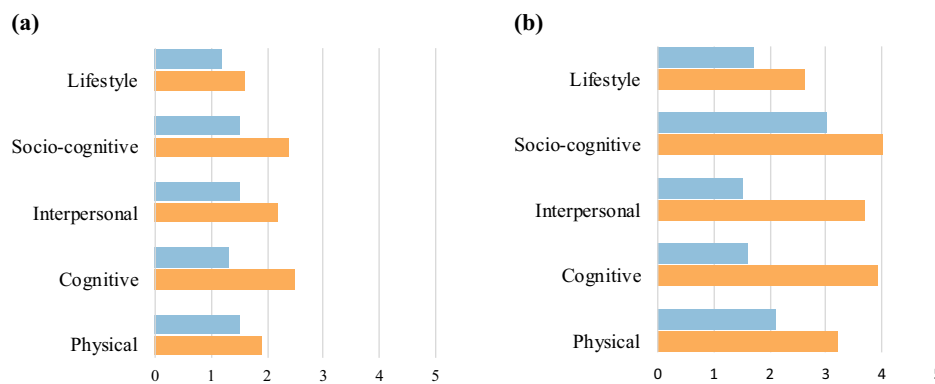
Note. Estimates that are significant ($p < .05$) are printed in bold. AARC = awareness of age-related change; SE = standard error.

classes in middle age. On average, the four identified classes differed in their age, educational achievement, employment status, and household net income. The classes with low AARC-losses (moderate AARC-gains and low AARC-losses; high AARC-gains and low AARC-losses) included individuals who scored more favorable on these indicators and who were younger than those in the remaining classes having high AARC-gains and moderate AARC-losses; high AARC-gains and moderate-to-high AARC-losses, respectively.

Compared to the remaining groups (having moderate AARC-gains and low AARC-losses and high AARC-gains and low AARC-losses, respectively), participants reporting high AARC-gains and moderate AARC-losses and those reporting high AARC-gains and moderate-to-high AARC-losses scored more poorly on the SF-12—physical

health component ($p < .001$) and had a higher number of health conditions ($p < .001$). They also scored more poorly on the SF-12 mental health component ($p < .001$) and on the PHQ-4 ($p < .001$). Participants reporting moderate-to-high AARC-gains and moderate AARC-losses scored most poorly on the symbol digit test ($p < .001$) compared to the remaining three classes. Participants reporting high AARC-gains and moderate AARC-losses and those reporting high AARC-gains and moderate-to-high AARC-losses also scored more poorly on the questionnaire capturing relations, lifestyle, and engagement ($p = .001$) compared to those reporting moderate AARC-gains and low AARC-losses and high AARC-gains and low AARC-losses, respectively. Statistical difference between classes held after applying Bonferroni’s correction for multiple comparisons for all variables except for age.

Figure 2
Mean Scores for Each of the 10 AARC Items Separately for Each Class for Young Adulthood

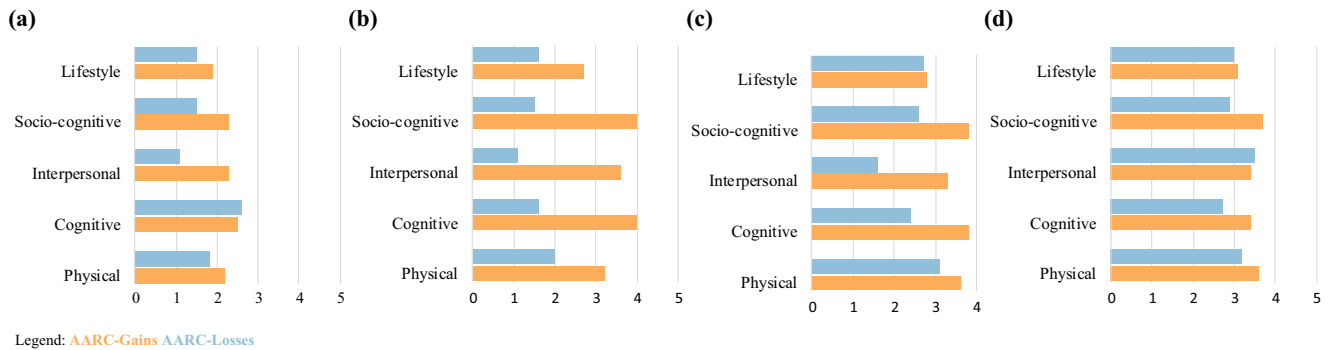


Legend: AARC-Gains AARC-Losses

Note. (a) Group with low-to-moderate gains and low losses. (b) Group with high gains and low losses. The x-axis represents the possible score on each AARC item, ranging from 1 to 5. The y-axis comprises the five AARC items assessing gains and the five AARC items assessing losses across AARC behavioral domains. As can be observed, in young adulthood participants can be differentiated in only two classes reporting either low or low-to-moderate losses. AARC = awareness of age-related change. See the online article for the color version of this figure.

Figure 3

Mean Scores for Each of the 10 AARC Items Separately for Each Class for Middle-Aged Individuals



Note. (a) Group with moderate gains and low losses. (b) Group with high gains and low losses. (c) Group with high gains and moderate losses. (d) Group with high gains and moderate-to-high losses. The x-axis represents the possible score on each AARC item, ranging from 1 to 5. The y-axis comprises the five AARC items assessing gains and the five AARC items assessing losses across AARC behavioral domains. As can be observed, in middle-age participants can be differentiated in four classes reporting varying degrees of gains and losses. AARC = awareness of age-related change. See the online article for the color version of this figure.

Young–Old Adults

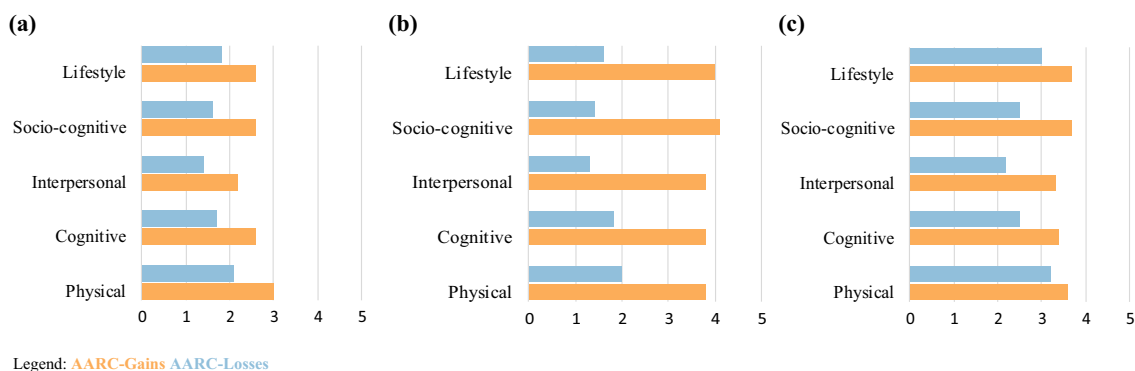
Supplemental Table S10 reports distributions of scores on sociodemographic variables, and on variables assessing health, social relations, lifestyle, and engagement for the three latent classes in young–old age. The only sociodemographic characteristic in which the three identified classes differed was sex, with those reporting high AARC-gains and moderate AARC-losses including the highest proportion of women compared to those reporting moderate AARC-gains and low AARC-losses and those reporting high AARC-gains and low AARC-losses. This difference was statistically significant even after having applied Bonferroni's correction.

Because few participants in our study sample were in young–old age, statistical significance in the following analyses needs to be interpreted with caution. Participants reporting high AARC-gains

and moderate AARC-losses scored most poorly on the SF-12 physical health component ($p < .001$) and had the highest number of health conditions ($p < .001$) compared to those reporting moderate AARC-gains and low AARC-losses and those reporting high AARC-gains and low AARC-losses. Participants reporting high AARC-gains and moderate AARC-losses also scored most poorly on the SF-12 mental health component ($p = .002$) compared to those reporting moderate AARC-gains and low AARC-losses and those reporting high AARC-gains and low AARC-losses. These differences were statistically significant even after having applied Bonferroni's correction. Those reporting moderate AARC-gains and low AARC-losses and those reporting high AARC-gains and low AARC-losses did not differ significantly in their scores on the PHQ-4, symbol digit test, and on the questionnaire assessing relations, lifestyle, and engagement.

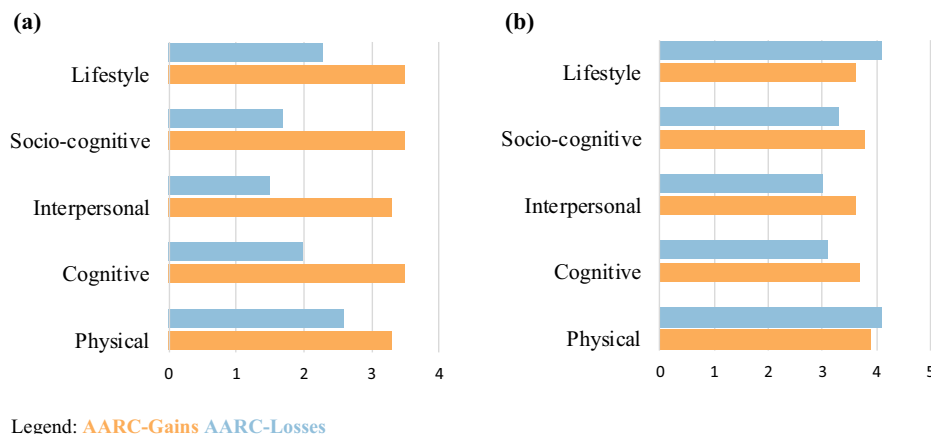
Figure 4

Mean Scores for Each of the 10 AARC Items Separately for Each Class for Young-Old Individuals



Note. (a) Group with moderate gains and low losses. (b) Group with high gains. (c) Group with high gains and moderate losses. The x-axis represents the possible score on each AARC item, ranging from 1 to 5. The y-axis comprises the five AARC items assessing gains and the five AARC items assessing losses across AARC behavioral domains. As can be observed, in early old age participants can be differentiated in three classes reporting varying degrees of gains and losses. AARC = awareness of age-related change. See the online article for the color version of this figure.

Figure 5
Mean Scores for Each of the 10 AARC Items Separately for Each Class for Old–Old Individuals



Note. (a) Group with high gains and low-to-moderate losses. (b) Group with high gains and high losses. The x-axis represents the possible score on each AARC item, ranging from 1 to 5. The y-axis comprises the five AARC items assessing gains and the five AARC items assessing losses across AARC behavioral domains. As can be observed, in advanced old age participants can be differentiated in only two classes reporting lower or higher levels of losses. AARC = awareness of age-related change. See the online article for the color version of this figure.

Old–Old Adults

Supplemental Table S11 reports distributions of scores on sociodemographic variables, and on variables assessing health, social relations, lifestyle, and engagement for the two latent classes in old–old age. Participants in the class reporting high AARC-gains and high AARC-losses were significantly older and had a higher average monthly net household income than participants reporting high AARC-gains and low-to-moderate AARC-losses. After having applied Bonferroni's correction, however, the two groups were no longer statistically different in their average monthly net household income.

Those reporting high AARC-gains and high AARC-losses scored most poorly on the SF-12 physical health component ($p < .001$) and had a higher number of health conditions ($p < .001$) than those reporting high AARC-gains and low-to-moderate AARC-losses. Those in moderate-to-high AARC-gains and high AARC-losses also had poorest mental health, as indicated by their scores on the SF-12 and on the PHQ-4 (both $p < .001$), compared to those reporting high AARC-gains and low-to-moderate AARC-losses. Those reporting moderate-to-high AARC-gains and high AARC-losses also scored most poorly on the symbol digit test compared to those reporting moderate-to-high AARC-gains and low-to-moderate AARC-losses ($p < .001$). Participants reporting high AARC-gains and high AARC-losses scored most poorly on the questionnaire assessing their relations, lifestyle, and engagement ($p = .005$) compared to those reporting moderate-to-high AARC-gains and high AARC-losses, but this difference was no longer statistically significant after having applied Bonferroni's correction.

Similar patterns/constellations of AARC-gains and AARC-losses were found in different age groups. First, about three-quarters of those in young adulthood, a little more than one third of those in midlife, and about one quarter of those in young–old age reported high AARC-gains and low AARC-losses. Among participants reporting high AARC-gains and low AARC-losses, levels of gains

and losses in each of the 10 AARC items were comparable across age groups except for those in young–old age reporting higher gains in the lifestyle domain compared to those in young adulthood and midlife. Among participants reporting high AARC-gains and low AARC-losses those in young adulthood scored higher on the physical health component of the SF-12, had fewer health conditions, scored lower on the mental health component of the SF-12, and scored higher on the PHQ-4 and the symbol digit test than those in midlife and in young–old age (Table 3). Moreover, those in midlife had a lower number of health conditions and scored higher on the mental health component of the SF-12 and on the symbol digit test than those in young–old age.

Second, a small subgroup of middle-aged and young–old participants reported moderate AARC-gains and low AARC-losses. Among participants reporting moderate AARC-gains and low AARC-losses, levels of gains and losses in each of the 10 AARC items were comparable across middle-aged and young–old participants but those in young old age reported higher gains in the physical and lifestyle domain. However, among participants reporting moderate AARC-gains and low AARC-losses those in midlife scored higher on the physical health component of the SF-12, had a lower number of health conditions, scored lower on the mental health component of the SF-12, and scored higher on the symbol digit test.

About one fifth of participants in midlife and half of those in young–old age reported high AARC-gains and moderate AARC-losses, respectively. Among participants reporting high AARC-gains and moderate AARC-losses those in young–old age reported higher gains in the lifestyle domain and higher interpersonal losses than those in midlife. Those in midlife scored lower on the physical health component of the SF-12, had fewer health conditions, scored lower on the mental health component of the SF-12, scored higher on the PHQ-4, and scored higher on the symbol digit test. Hence, they had poorer self-rated physical and mental health but objectively

Table 3*Developmental Correlates Across Subsamples Reporting the Same Configurations of AARC-Gains and AARC-Losses*

Developmental correlates across those subsamples in young adulthood, midlife, and young-old age that reported high AARC-gains and low AARC-losses

Variable	Young adulthood class ($n = 307$; 76.2% of the subsample of young adults)	Midlife ($n = 267$; 37.0% of the subsample in midlife)	Young-old age ($n = 65$; 25% of the subsample in young-old age)	Young adulthood versus midlife p values	Young adulthood versus young-old age p values	Midlife versus young-old age p values
Short form survey—physical health score, M (SD)	54.07 (7.69)	51.55 (8.26)	50.27 (8.05)	.0002	.0004	.261
Number of health conditions, M (SD)	1.08 (1.31)	1.79 (1.58)	2.44 (1.69)	<.001	<.001	.0036
Short form survey—mental health score, M (SD)	50.32 (9.04)	54.54 (8.14)	58.55 (6.64)	<.001	<.001	.0003
Patient Health Questionnaire-4, M (SD)	6.16 (2.08)	5.4 (1.6)	5.11 (1.66)	<.001	.002	.1942
Symbol digit test, M (SD)	39.64 (8.39)	32.3 (7.6)	24.64 (6.52)	<.001	<.001	<.001
Relations, lifestyle, and engagement, M (SD)	18.88 (3.88)	18.88 (4.23)	19.78 (3.94)	1.00	.091	.120

Developmental correlates across those subsamples in midlife and young-old age that reported moderate AARC-gains and low AARC-losses

Variable	Midlife ($n = 109$; 15.1% of the subsample in midlife)	Young-old age ($n = 63$; 24.2% of the subsample in young-old age)	Midlife versus young-old age p values
Short form survey—physical health score, M (SD)	51.4 (8.63)	46.81 (9.19)	.0013
Number of health conditions, M (SD)	1.71 (1.64)	2.44 (1.68)	.0059
Short form survey—mental health score, M (SD)	54.11 (8.27)	58.75 (7.66)	.0004
Patient Health Questionnaire-4, M (SD)	5.3 (1.4)	5.06 (1.71)	.3200
Symbol digit test, M (SD)	29.9 (8.6)	25.25 (8.45)	.0007
Relations, lifestyle, and engagement, M (SD)	18.67 (4.92)	18.90 (4.76)	.7654

Developmental correlates across those subsamples in midlife and young-old age that reported high AARC-gains and moderate AARC-losses

Variable	Midlife ($n = 137$; 19.0% of the subsample in midlife)	Young-old age ($n = 132$; 50.8% of the subsample in young-old age)	Midlife versus young-old age p values
Short form survey—physical health score, M (SD)	45.95 (10.22)	42.16 (9.63)	.002
Number of health conditions, M (SD)	2.56 (2.00)	3.31 (2.01)	.002
Short form survey—mental health score, M (SD)	49.98 (10.06)	54.48 (10.34)	.0044
Patient Health Questionnaire-4, M (SD)	6.8 (2.5)	5.86 (1.73)	.0004
Symbol digit test, M (SD)	31.1 (8.1)	23.20 (8.17)	<.001
Relations, lifestyle, and engagement, M (SD)	17.66 (4.28)	17.95 (3.82)	.559

Note. AARC = awareness of age-related change.

fewer health conditions. The two classes identified in older age instead did not overlap with any of the other classes across the remaining age groups.

Discussion

This study explored levels of domain-specific and overall AARC-gains and AARC-losses across the adult lifespan (16–93 years). It also reported correlations between AARC-gains and AARC-losses across the adult lifespan. Moreover, it identified the number and types of latent profiles of AARC-gains and AARC-losses across behavioral domains within the four age subgroups of young adulthood, midlife, young-old age, and old-old age. Finally, this study tested for each age subsample, whether the identified profiles differed in their associations with developmental correlates, and to what degree similar profiles of AARC-gains and AARC-losses

across the adult lifespan relate differently to developmental outcomes.

In line with established lifespan developmental psychology reasoning, postulating that as people grow older the ratio between gains and losses becomes more unfavorable over time, and especially in old-old age (Baltes et al., 2007; Baltes & Smith, 2003), results suggest that, on average, overall levels of AARC-losses increased across the adult lifespan, whereas overall levels of AARC-gains remained fairly stable throughout adulthood. Across behavioral domains, AARC-losses presented a distinct pattern of accelerated increase across adulthood. In contrast, AARC-gains exhibited more complex and domain-specific developmental patterns. The constant increase observed for overall AARC-losses and each AARC-losses behavioral domain may be due to losses being both more objectively common and subjectively expected with increasing age. Moreover, compared to the younger age groups, participants in old-old age were less educated, had lower

income, and were more likely to be widowed. All these demographic characteristics are generally associated with older age and higher AARC-losses (English et al., 2019; Rupprecht et al., 2022; Sabatini, Ukoumunne, et al., 2020).

Our finding that overall AARC-gains consistently showed positive and small correlations with overall AARC-losses across all age groups may have several interpretations. First, it may be that certain individuals have higher levels of reflexivity and awareness of change, irrespective of the valence of the change. Second, it may be that individuals are able to experience some gains even when facing negative changes. For example, the caregiving literature documents coexistent positive and negative experiences of caregiving in older age (Gonçalves-Pereira et al., 2021), indicating that individuals may perceive and appraise even very challenging situations as having a positive meaning. Third, increasing focus on gains may represent a mostly unconscious coping strategy that individuals put in place as a consequence of increased perceived losses. Indeed, literature on the age-positivity bias suggests that, when facing negative information (i.e., awareness of losses), older individuals tend to concomitantly increase their focus on positive information (i.e., awareness of gains; Carstensen, 2006; Kisley et al., 2007).

However, the association between overall AARC-gains and overall AARC-losses was stronger in size in young adulthood compared to midlife, young-old, and old-old age. This may be due to younger individuals experiencing fewer losses and having less awareness of change in general. It may be that whereas in older age levels AARC-gains and AARC-losses can be influenced by the objective changes individuals experience (Sabatini, Siebert, et al., 2022), in young adulthood levels of AARC-gains and AARC-losses are less related to objective changes and more related to personality traits capturing reflexivity and self-consciousness. The small size of the associations found between AARC-gains and AARC-losses suggests that perceived gains are rather independent from perceived losses. This may be due to levels of AARC-gains and AARC-losses being influenced by different predictors (Sabatini et al., 2022b; Sabatini, Siebert, et al., 2022). For example, whereas higher AARC-losses are associated with poorer physical well-being, lower AARC-gains are not consistently associated with poorer psychological well-being (Sabatini, Silarova, et al., 2020).

Based on different combinations of levels of AARC-gains and AARC-losses across behavioral domains, individuals in young adulthood and old-old age revealed limited diversity that could most parsimoniously be captured by two distinct profiles. In contrast, among individuals in midlife four profile groups and among individuals in young-old age three profile groups were needed to most parsimoniously cover within-group variability in AARC-gains/losses. Hence, our prediction of more diversified profiles of AARC-gains/losses in those in midlife and young-old age was supported. The different number of classes identified across age subsamples suggests that perceptions of age-related changes in gains and losses start with low diversity in young adulthood represented by only two groups and then diversify in midlife and young-old age, followed again by reduced within age group diversity in old-old age. The different number of classes we found in midlife and young-old age also indicates that, although average levels of AARC-losses are higher in these age groups, there is variability in the levels of AARC-losses that individuals experience, with some groups continuing to report low-to-moderate AARC-losses. Moreover, we found that individuals in old-old age reported high AARC-gains, suggesting that

flexible goal adjustment in later life (Brandtstädter & Rothermund, 2003) may help to secure gain experiences even in case of significant objective losses. The coexistent levels of AARC-gains and AARC-losses observed in old-old age are also consistent with literature on the paradox of well-being in older age (Kunzmann et al., 2000).

Linking classes identified in each age group with developmental correlates, in the subsamples of those in midlife, young-old age, and old-old age, the groups with higher levels of AARC-losses consistently revealed poorer mental and physical health, information processing speed, social relations, lifestyle, and engagement. In contrast, in young adulthood, higher levels of AARC-losses were not significantly related to developmental correlates; further suggesting that perceived gains and losses in young adulthood may not be related to objective changes. Hence, the magnitude and heterogeneity that we found in perceived combinations of levels of age-related gains and losses in those in the second half of life are not yet happening in young adulthood as predicted by lifespan developmental theorizing and conceptual reasoning on the life phase of midlife compared to previous and later life stages (Baltes et al., 2007; Lachman et al., 2015). Importantly, results suggest the same constellation of levels of AARC-gains and AARC-losses may be related to different levels of mental and physical health outcomes, according to participants' age. Reports of moderate/high AARC-gains and low AARC-losses may be more related to greater objective physical health in young adulthood and midlife, whereas they may be more related to greater mood and mental health in young-old age. Moreover, reports of moderate AARC-losses may be more related to poorer self-rated physical and mental health in midlife but with more health conditions in young-old age.

We found more homogeneous perceptions of aging in young adulthood and old-old age. Whereas in young adulthood individuals from different classes consistently reported low losses, in old-old age individuals from different classes consistently reported at least moderate losses. It may be that even when young adults are in bad health, even if they experience different gains and losses, they may not attribute them to their aging and thus not report high levels of AARC-losses (Prohaska et al., 1987). Indeed, health indicators were not related to AARC classes in young adulthood. Instead, in old-old age, it may be that the majority of individuals experience some losses in one or more health domains and may attribute them with high probability to their aging process (CALAS Team at Tel Aviv University et al., 2013; Kaspar et al., 2022). Indeed, those in old-old age reported, on average, about four health conditions. Moreover, sociodemographic characteristics that characterize young adulthood (e.g., getting married) and old-old age (e.g., loss of a spouse) have previously been related to levels of AARC-gains and AARC-losses and may have influenced the classes of AARC-gains and AARC-losses found in different age groups (Rupprecht et al., 2022).

Whereas those groups with higher levels of AARC-losses (with the exception of those in young adulthood) consistently scored more poorly on developmental correlates, higher levels of AARC-gains were consistently across age groups not related to developmental correlates. By taking into consideration concurrent levels of AARC-gains and AARC-losses our latent profile approach enabled us to notice that higher levels of AARC-gains were consistently reported by those groups reporting higher levels of AARC-losses. Hence, those people who experience and pay more attention to losses also pay more attention to gains. The same pattern of results was found in Sabatini, Ukoumunne, et al.'s (2022) study. A possible explanation

for this finding is that people who notice more age-related losses are more motivated to pay attention to and report age-related gains as a sort of emotional coping strategy that may help them to maintain a certain degree of emotional well-being in the face of losses (Loidl & Leipold, 2019).

Still, different levels of AARC-losses may be more discriminative of developmental correlates than different levels of AARC-gains. This also fits with previous findings related to the AARC construct that consistently found stronger associations between AARC-losses experiences and developmental outcomes as compared to the associations with AARC-gains (Brothers & Diehl, 2017; Brothers et al., 2021; Dutt, Gabrian, & Wahl, 2018). Explanations may lie in previously identified evidence that negative self-stereotyping has much stronger effects on outcomes, such as cognitive performance, than positive self-stereotyping (Meisner, 2012). Consequently, individuals reporting high levels of losses, irrespective of their levels of gains, should be the prioritized target of interventions aimed to decreasing negative perceptions of aging and promoting physical exercise, engagement in enjoyable activities, and coping with age-related challenges (M. Diehl et al., 2020; Knight et al., 2022).

Strengths and Limitations

This study has several limitations. First, older people in this cross-sectional sample are part of a longitudinal cohort that may have had different educational, cultural, and political experiences during their life compared to the general population. Hence, the present study sample may have different views on what aging means. For example, they may report more gains and fewer losses related to their physical health. Second, in SOEP, a modified version of the SF-12 was used, which does not include one-item assessing functional difficulties with moderately intense activities. Hence, this limits comparison of our results with those generated from other studies using the original version of the SF-12. Nonetheless, there are no immediate reasons to be concerned about the validity of this scale because all theoretically distinguished subconcepts and scales are fully represented by the SOEP measurement approach.

Third, in SOEP-IS, the PHQ-4, the symbol digit test, and the questionnaire assessing relations, lifestyle, and engagement were administered to a subsample of participants only; therefore, analyses of variance and chi-square tests examining whether identified classes differed in these indicators were based on a reduced sample. Fourth, as analyses were based on cross-sectional data, it was only possible to examine how AARC profiles related to concurrent health, relations, lifestyle, and engagement, but not to longitudinal outcomes. Fifth, in this sample, the measure assessing relations, lifestyle, and engagement obtained a Cronbach's α value below the optimal cutoff of .70. Nonetheless, we retained this measure in the study analyses because there is evidence suggesting that Cronbach's α s $\geq .65$ can be used (Taber, 2018).

Sixth, due to low numbers and to the fact that until the age of 40 individuals may be unlikely to experience significant age-related losses, we grouped individuals aged 16–39 together. Still, we acknowledge that this is a limitation of our study as the life experiences of individuals in their 20s may be different from those of individuals in their 30s. We also acknowledge that our approach of exploring number and types of constellations of AARC-gains and AARC-losses throughout the adult lifespan comes with the categorization of age, which may reduce information compared

to using age as a continuous variable. Seventh, for descriptive and exploratory purposes, we conducted some analyses on one-item questions capturing gain and loss experiences across the five AARC behavioral domains. This is a limitation as in the development of the AARC questionnaire items were selected from each behavioral domain based on their ability to assess perceived gains or losses, not necessarily based on their ability to best represent domain-specific age awareness (Brothers et al., 2019; Kaspar et al., 2019).

Nonetheless, this study has several strengths. First, it related AARC-gains and AARC-losses to numerous developmental correlates showing that levels of AARC-gains and AARC-losses are consistently related to several aspects of individuals' lives. Second, study analyses were based on one of the most comprehensive panel studies on the adult German population, providing a more representative picture of the role of age awareness at the population level and beyond convenience samples. Third, this is one of the few studies extending the empirical inquiry of the concept of AARC to young adults and linking profiles of AARC-gains and AARC-losses to developmental correlates in four subsamples representing young adults, middle-aged adults, young-old adults, and old-old adults. Fourth, most previous studies simply looked at linear associations of AARC-gains and AARC-losses with developmental correlates (Laidlaw et al., 2018; Sarkisian et al., 2005; Steverink et al., 2001), or at the interaction between levels of AARC-gains and AARC-losses as predictor of developmental correlates. Our group-oriented approach enabled us to identify, in each age group, how many individuals reported different constellations of AARC-gains and AARC-losses, in addition to showing that when high AARC-gains co-occur with high AARC-losses individuals score more poorly on a wide range of health correlates.

Conclusion

In this national sample, average levels of AARC-losses increased from young adulthood to old-old age, whereas levels of AARC-gains increased in midlife but not in older age. However, aging experiences were more heterogeneous in midlife and young-old age compared to young adulthood and old-old age. The levels of AARC-losses reported by middle-aged, young-old, and old-old individuals appear to be informative of their physical and mental health, cognitive functioning, and engagement in social activities.

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