Awareness of Age-related Change: Individual Differences, Intra-individual Variability, and Implications for Self-regulation and Well-being in Middle and Older Adulthood

By

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Abstract

Development at all points in life consists of a balance of gains and losses. Furthermore, developmental changes in different life domains vary substantially both between individuals and within individuals over time. The multidirectionality and multidimensionality of development has captured increasing interest in gerontological research in the past decade. The construct of awareness of age-related change (AARC) captures both positive (AARC-gains) and negative (AARC-losses) components of subjective ageing across different behavioural domains. Overall, previous research has found that adaptive outcomes are associated with higher AARC-gains, and lower AARC-losses. The aim of the current thesis is to expand on previous research by examining how AARC-gains, AARC-losses and the interplay between the two may relate to adaptive outcomes of goal adjustment and well-being in middle and older-adulthood.

The first cross-sectional study examined the role of AARC-gains, AARC-losses and their interaction in the prediction of goal adjustment strategies. Results showed that greater goal adjustment capacities were associated with higher AARC-gains, and lower AARC-losses. Furthermore, AARC-gains was shown to buffer the association between AARC-losses and goal adjustment. Additionally, relationships between AARC and processes of goal adjustment were shown to be mediated by the subjective sense of future lifetime.

The second study focused on between-person differences in AARC-gains, AARC-losses and their interaction in the prediction of both between-person differences in psychological well-being, and longitudinal change in well-being over time. Results showed that neither AARC-gains, AARC-losses, nor their interaction predicted reliable change in well-being outcomes over 12 months. However, at the between-person level, greater levels of well-being were associated with higher AARC-gains and lower AARC-losses. Additionally, the relationship between AARC-losses and well-being was buffered by AARC-gains.

The third study aimed to test the proposition that the relationship between AARC and well-being is mediated by self-regulation of goals. Longitudinal mediation results showed that the expected temporal order of associations (T1 AARC > T2 goal re-engagement > T3 well-being) was not evident. However, results indicate that AARC-gains may mediate longitudinal relationships between well-being and goal re-engagement. These findings, together with previous theoretical and empirical research suggest that further investigation using varying timescales may be needed to gain greater understanding of relationships between AARC, goal re-engagement, and well-being.

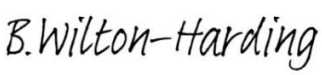
The final study moved beyond viewing AARC as a trait-level construct and investigated whether daily AARC may have implications for reactivity to daily stress. Analysis indicated that on days when AARC-gains was higher-than-usual, participants showed less affective reactivity to daily stressors (represented by lower negative affect). Furthermore, on days when AARC-losses was higher-than-usual, participants showed increased reactivity to daily stressors (represented by higher negative affect). However, interactions of daily stress with within-person AARC were not statistically reliable when controlling for between-person stress × within-person AARC, indicating that both between- and within-person variance captured by assessments of daily stress were implicated in the AARC moderation effects.

Taken together, findings from the studies in the current thesis extend knowledge regarding AARC and implications for adaptive ageing. The findings support that AARC has implications for goal adjustment and well-being and show that (1) the impact of AARC-losses on adaptive outcomes may be buffered by AARC-gains, (2) well-being, AARC, and goal adjustment may inform one another over time, and (3) daily AARC has implications for well-being and stress reactivity at the daily level. Together, these findings may inform future research directions including potential intervention programs which aim to promote positive

self-perceptions of ageing which may in turn facilitate greater adaptation in middle- and older-adulthood.

Declaration

I certify that this thesis does not incorporate, without acknowledgment any material previously submitted for a degree or diploma in any university, and that, to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due reference is made in the text.



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CHAPTER

1

INTRODUCTION

1.1 Overview

One of the most challenging questions in lifespan research is concerned with how individuals are able to preserve well-being in the context of age-related losses such as declines in physical and cognitive performance (Kessler & Staudinger, 2009). In other words, what makes people resilient in the process of ageing? Masten (2001) defined resilience as '*a class of phenomena characterised as good outcomes in spite of serious threats to adaptation or development'* (p. 227). Emotional resilience is achievable in adulthood if adequate internal and external resources are accessible to cope with increasing constraints and fewer opportunities for replenishment of resources (Kessler & Staudinger, 2009). The aim of this thesis was to gain a better understanding of individual differences and within-person processes which may enable effective management of age-related challenges, by focusing on particular psychosocial processes and resources thought to be central to resilient functioning. In particular, this thesis focused on the relevance of awareness of age-related change, self-regulation of goals, and theoretically central aspects of affective and psychological well-being to successful development in middle- and older-adulthood.

While concepts of resilience and the capacity for growth and thriving in older adulthood have a long history in gerontological research, there remains a lack of evidence surrounding the topic (Diehl & Wahl, 2010; Fry & Keyes, 2010). An important element to consider when examining resilience in later life is the multidirectionality and multidimensionality of development (P. Baltes, 1987; Infurna, 2021). A particular focus of the current thesis is the crucial role that both subjective experiences and perceptions of ageing play in developmental adaptation (Montepare, 2009). For instance, perceiving the ageing process in a more positive way has been associated with higher levels of subjective and psychological well-being (Brothers et al., 2017; Sabatini, Silarova, et al., 2020), broader social networks (Menkin et al., 2017), and better self-rated health (Beyer et al., 2015). On the

other hand, more negative perceptions of ageing have been linked to lower levels of well-being (Brothers et al., 2017; Dutt, Gabrian, & Wahl, 2018a), poorer physical and cognitive functioning (Levy, Slade, & Kasl, 2002), a higher chance of experiencing medical issues (Levy et al., 2015), and a shorter lifespan (Levy, Slade, Kunkel, & Kasl, 2002). Overall, there is increasing evidence demonstrating a crucial association between individuals' perceptions of their own ageing, and key developmental processes and adaptive outcomes in older adulthood.

Life expectancy has increased significantly in the past few decades (World Health Organization, 2021). Given that older adulthood is now a stage in life that most people will reach, the way people evaluate their ageing is increasingly important (Wurm & Westerhof, 2015). Accordingly, in the previous few decades there has been increased momentum in the field of subjective ageing, with the field advancing in important and meaningful ways (Diehl et al., 2015). Acquiring greater understanding of the relationship between evaluations of ageing and adaptive outcomes is important for not only increasing understanding of lifespan development, but also for public health practices and interventions (Wurm et al., 2017). According to Levy et al. (2020), the yearly health care cost of negative subjective ageing in the United States of America has been estimated at approximately $33.7 billion dollars.

Overall, those with more positive experiences of subjective ageing are more likely to maintain greater levels of physical, cognitive, and mental health (Westerhof et al., 2014) via multiple pathways (psychological, behavioural, and physiological; see Levy, 2009). For example, those with more positive subjective ageing show greater engagement in preventative health-related behaviours such as healthy eating (Klusmann et al., 2019), physical activity (Beyer et al., 2015; Brothers & Diehl, 2017; Wurm et al., 2010), and relatively low consumption of alcohol (Levy & Myers, 2004). Additionally, those with more positive subjective ageing often have lower overall stress levels (Levy, Hausdorff, et al.,

2000) and are therefore less likely to experience stress-related health issues (Chida & Steptoe, 2010).

Further research is needed to gain a better understanding of the processes underlying links between perceptions of one's own ageing and developmental outcomes. The current thesis adds to our understanding of subjective ageing by focusing primarily on the construct of *awareness of age-related change* (AARC). AARC is a multidimensional conceptualisation which considers both positive and negative aspects of an individual's experience of ageing across different behavioural domains. AARC is postulated as a specific formation of self-awareness which draws on subjective and objective criteria which vary in their specificity and their overall relevance to behaviour, health and well-being (Diehl & Wahl, 2010). The manuscripts in the current thesis build upon existing theoretical foundations and empirical research regarding AARC by examining previously unexplored relationships in the area of subjective ageing and developmental adaptation.

The current introductory chapter focuses on why the construct of AARC is important to consider in social gerontological research. Specifically, this chapter includes consideration of (1) the history of subjective ageing research (2) previous literature linking subjective ageing and adaptative outcomes, (3) the operationalisation and formulation of AARC, (4) previous research linking AARC and well-being, (5) self-regulation of goals as a possible mechanism linking AARC and well-being, and (6) AARC as a concept which is subject to state-like changes which may have implications for stress reactivity on a day-to-day basis. Finally, this introductory chapter provides a list of research questions focusing on AARC which are to be addressed in the following empirical chapters.

1.2 An Overview of Subjective Ageing Research

For some time, research has focused on chronological age as an important dimension along which human behaviours are delineated and examined (Kastenbaum et al., 1972;

Montepare, 2009). Differences in multiple constructs are observed in older adulthood (e.g., decreases in working memory, increases in subjective well-being, and shifts in personality traits and relationship dynamics; Allemand et al., 2008; Charles & Piazza, 2009; Fingerman & Charles, 2010; Salthouse & Babcock, 1991; Swift et al., 2014; Windsor & Anstey, 2010). However, there is substantial heterogeneity of development evident in older adulthood (Steptoe et al., 2015), and development at all points across the lifespan consists of gains and losses (P. Baltes, 1987). Overall, individuals reflect on their own development and interpret their age differently throughout their lifespan. Hence, subjective ageing has become recognised as an important construct to consider in ageing research since the 1950s, when researchers began to look beyond chronological age, by considering age and ageing as partially subjective (e.g., Erikson, 1959; Mason, 1954; Sarbin, 1954).

Subjective ageing (Kastenbaum et al., 1972) is an umbrella term which includes several constructs such as *felt age, self-perceptions of ageing, attitudes toward own ageing,* and *awareness of age-related change* which focus on experiences, ideas and beliefs that individuals may associate with increased chronological age (Diehl et al., 2014; Sabatini, 2021). How individuals understand and place meaning on their own ageing may also impact how they themselves grow older (Wurm & Westerhof, 2015). In general, subjective ageing is considered to be informed by social and cultural definitions of age, as well as physiological changes or shifts in social interactions which typically occur in older adulthood (Little, 2016; Peters, 1971). Stereotypes regarding age and ageing can impact individuals' behaviour, as well as how they experience and respond to their own ageing (Hess, 2006; Levy, 2009).

Age stereotypes involve generalised beliefs regarding older individuals (Levy, 2009), and can be positive (e.g., viewing older adults as experienced and wise) or negative (e.g., viewing older adults as less physically or cognitively capable) in nature. When evaluating older adults or ageing in general, individuals are more likely to assume that ageing consists of

aspects of loss and decline rather than aspects of gains and continued growth (Heckhausen et al., 1989). Stereotypes of ageing often reflect the expectation that older adulthood is characterised by a decline in active roles, poorer physical health, and decreases in physical and cognitive functioning (Peters, 1971). More positive perceptions of ageing and older adults do exist (e.g., gains in wisdom, generosity, experience, family orientations, freedom to pursue valued activities) but are less commonly held (Rothermund & Kornadt, 2015).

Stereotype embodiment theory applies a lifespan perspective to the development and impact of both positive and negative age stereotypes on adaptive outcomes in older adulthood (Levy, 2009). Overall, older adults are proposed to internalise societal ageing stereotypes throughout life. As these stereotypes become increasingly self-relevant with ageing, they become self-stereotypes (Kornadt et al., 2018; Wurm et al., 2017) which, in turn, impact developmental outcomes (Levy, 2009; Wurm et al., 2013). Because ageing self-stereotypes are more often negative than positive (Kotter-Grühn, 2015), they can often result in sub-optimal outcomes for older adults, particularly when they are strongly internalised (Levy, 2009).

Experimentally manipulated age-related self-stereotyping has been shown to impact aspects of performance and decision making in older adults, such that those who engaged in a positive self-stereotyping condition performed significantly better than those in the negative self-stereotyping condition on memory tasks (Levy, 1996), walking speed (Hausdorff et al., 1999), handwriting (Levy, 2000), and had increased likelihood of endorsing hypothetical life-prolonging interventions (Levy, Ashman, & Dror, 2000). Adding to this, longitudinal studies have shown that those with more positive self-perceptions of ageing lived, on average, 7.5 years longer (Levy, Slade, Kunkel, & Kasl, 2002) than those with more negative self-perceptions.

Early work on subjective ageing focused on operationalising individuals' subjective experiences of ageing. This resulted in the development of two commonly used measures of subjective ageing, *felt age* (also known as *subjective age* or *age identity*) and *attitudes toward own ageing*. Felt age consists of an overall evaluation of how old one feels. Individuals who report feeling younger than their chronological age on average show better health and well-being (Kleinspehn-Ammerlahn et al., 2008). A considerable number of studies have shown that felt age is associated with measures related to adaptive ageing such as psychological well-being, cognitive health, coping responses, sense of meaning in life, optimism, future time perspective, and walking function (Alonso Debreczeni & Bailey, 2021; Boehmer, 2007; Kleinspehn-Ammerlahn et al., 2008; Montepare, 2009; Sargent-Cox et al., 2012; Weiss & Lang, 2012; Westerhof & Barrett, 2005). The association between felt age and developmental outcomes is found among collectivist and individualist cultures (albeit stronger in the former; Alonso Debreczeni & Bailey, 2021). This psychological separation between individuals and their age group is sometimes referred to as *age-group dissociation* and is proposed to function as a self-protective factor that reduces the detrimental effects of internalised negative ageing stereotypes on self-concept (Pinquart, 2002). Overall, most middle-aged and older adults report feeling younger than their chronological age by approximately 20% (Rubin & Berntsen, 2006), and the discrepancy between individuals' chronological and subjective age increases with age (Kornadt et al., 2018).

Unlike felt age, *attitudes toward ageing* has a greater focus on individuals' evaluations of their own ageing process (Bennett & Eckman, 1973). The measurement of attitudes toward own ageing involves providing typically dichotomous (yes/no) responses to evaluative statements (Kornadt et al., 2019; Lawton, 1975) regarding individuals' own ageing experience (e.g., 'I am as happy now as I was when I was younger' or 'As you get older you are less useful'). Attitudes toward ageing are commonly informed by predominantly negative

societal beliefs and stereotypes about ageing (Hess, 2006), and have been shown to predict multiple adaptive outcomes such as longevity, decline in cognitive function, and reactivity to daily stress, with more positive attitudes toward ageing linked to more positive developmental outcomes (Levy, Slade, Kunkel, & Kasl, 2002; Neupert & Bellingtier, 2017; Robertson et al., 2016).

These early measures of subjective ageing highlight that how one experiences their own ageing has implications for developmental outcomes in middle- and older-adulthood. However, it can be argued that both felt age and attitudes toward ageing offer somewhat limited perspectives on subjective ageing. According to P. Baltes' (1987) lifespan perspective, development across the lifespan is characterised by both multidimensionality and multidirectionality. Most relevant to the current thesis is the acknowledgement that the experience of ageing is likely to vary across domains as well as in its emotional valence (i.e., positive or negative experiences of ageing; Diehl & Wahl, 2010; Rothermund & Kornadt, 2015). In older adulthood, individuals are likely to encounter various challenges and uplifts in different aspects of life (Rothermund & Kornadt, 2015). For example, an individual may notice they have lower energy levels, but may also be aware that their relationships have become more meaningful as they grow older.

While previous perspectives on subjective ageing have been informed by lifespan development theories and acknowledge that the experience of ageing can vary across domains and in terms of the positivity or negativity of these experiences, the majority of empirical research has measured subjective ageing with unidimensional tools (Diehl et al., 2014). Unidimensional scales which place an individual's experience of ageing along a positive to negative continuum may not accurately reflect the multidimensionality and multidirectionality of development. For instance, felt age is sometimes assessed across different domains (e.g., psychological, physical, and social; Kastenbaum et al., 1972;

Montepare, 2009), but statistically, these dimensions usually load onto a single factor, and are often combined to achieve a composite, unidimensional score of felt age across multiple domains (Hubley & Russell, 2009; Sabatini, 2021). Greater understanding is also needed regarding what age-related experiences are reflected by overall judgements about felt age (Diehl et al., 2014; Montepare, 2009).

Furthermore, while attitudes toward one's own ageing *can* be multidimensional and multidirectional, measurement most often categorises these attitudes as unidimensional, usually through capturing dichotomous responses to broad statements regarding ageing, placing individuals' attitudes toward their own ageing on a positive to negative continuum (Diehl et al., 2014). Additionally, ageing attitudes may not allow discrete differences in participants' evaluations and responses, or for them to report both positive and negative age-related changes in one specific domain (Hummert, 2011; Miche et al., 2015; Salthouse, 1984). For instance, an individual may perceive being treated with less respect in their workplace but may also report having greater wisdom or experience and/or finding more meaning in their work with increasing age. Overall, while these early assessments of subjective ageing have been consistently associated with important psychosocial outcomes, in recent years scholars have recognised the scope for improvements in assessment of subjective ageing that consider both the multidimensionality, and multidirectionality of the ageing experience.

1.3 Awareness of Age-related Change

Awareness of the passing of time and growing older is an important subjective experience during adulthood which plays a significant role in influencing cognition, emotion, and behaviour (Diehl & Wahl, 2010; Fry & Keyes, 2010). As mentioned, measures of *felt age* and *attitudes toward own ageing* have been commonly used in previous subjective ageing research to further understand how adults experience their own ageing. However, Diehl and

Wahl (2010) argue that merely enquiring about how old a person feels misses the opportunity to capture crucial components of the subjective experience of ageing. In addition, inquiring about which attitudes an individual may hold toward ageing, may miss the more subtle nuances of the personal experience of ageing, given that ageing is a multidimensional phenomenon (Diehl & Wahl, 2010). Furthermore, unidimensional measures of the ageing process are not overly informative when it comes to understanding why individuals may view their ageing the way they do (Montepare, 2009), or what specific changes related to ageing may be reflected in individuals' responses (Diehl et al., 2015).

An early endeavour to capture the fundamental components of multidimensionality and multidirectionality in development was made by Steverink and colleagues (2001), who explored three dimensions of subjective ageing. Two of these dimensions consisted of decline- and loss-related aspects, investigating adults' views on physical decline and social loss. The third dimension measured aspects of growth, exploring perceptions of gains and sustained development in older adulthood. Overall, adaptive outcomes were linked to higher positive, and lower negative perceptions of ageing (Steverink et al., 2001).

Furthering the research of Steverink and colleagues (2001), Diehl and Wahl (2010) introduced the concept of awareness of age-related change (AARC). AARC refers to 'a person's state of awareness that his or her behaviour, level of performance, or way of experiencing life has changed as a consequence of having grown older' (p. 342). States of AARC can be triggered by internal (e.g., an individual noticing that they are becoming more forgetful), or external experiences (e.g., others treating the individual with less patience). The construct of AARC captures subjective perceptions of age-related change across the five behavioural and life domains of (1) health and physical functioning, (2) cognition, (3) interpersonal relationships, (4) socio-cognitive and socio-emotional functioning, and (5) lifestyle and engagement. Within each of these domains, there exists the potential to

experience both positive (gains) and negative (losses) age-related changes (Diehl & Wahl, 2010). The construct of AARC was informed by previous lifespan development theories which focus on age differences in the coexistence of personal gains and losses (e.g., P. Baltes, 1987; Brandtstädter & Rothermund, 2002).

Diehl and Wahl (2010) argue several reasons why the construct of AARC is of particular importance in social gerontological research. First, younger, middle-aged, and older adults have demonstrated similar beliefs and expectations to one-another regarding the occurrence of age-related gains and losses during adulthood. Specifically, developmental gains were expected (by all age groups) to be experienced across the lifespan, with losses outweighing gains in advanced older age (85 years and older; Heckhausen et al., 1989). Further to this, developmental change in late adulthood tends to be viewed as undesirable and not controllable by the individual (Heckhausen & P. Baltes, 1991). Given these findings, Diehl and Wahl (2010) argue that AARC plays an important role in personal perspectives and normative conceptions of development in adulthood.

Based on previous work focused on subjective ageing (e.g., P. Baltes, 1987; Brandtstädter & Rothermund, 2002), Diehl and Wahl (2010) placed AARC within a broader conceptual framework consisting of potential distal antecedents, proximal antecedents, constructs which may impact the processing of AARC, as well as major outcomes of AARC. Figure 1.1 illustrates this framework, identifying multiple potential antecedents and consequences. Distal antecedents include sociodemographic (e.g., chronological age, gender, education, socio-economic status), biological/health related (e.g., health history, health status), and psychological (e.g., personality traits, control beliefs, coping strategies) factors. These distal factors then inform proximal antecedents including personal goals, experience of limitations, situational appraisal, experience of age stereotyping, and current life events. AARC is informed by these proximal antecedents in the context of psychological processes

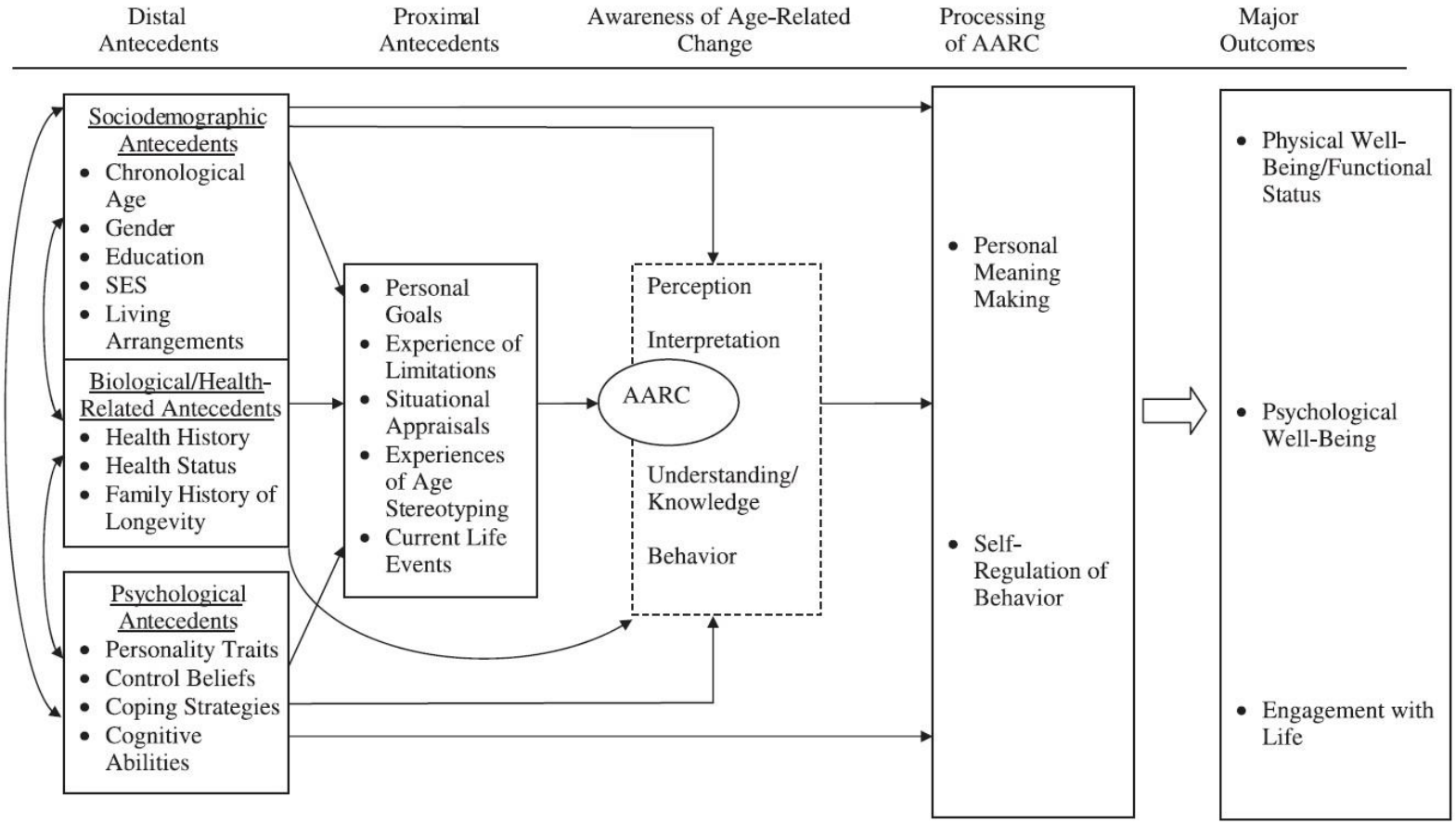

Figure 1.1. Conceptual framework for awareness of age-related change (AARC). From 'Awareness of Age-related Change: Examination of a (Mostly) Unexplored Concept' by M. Diehl & H. Wahl, 2010, *Journal of Gerontology: Social Sciences, 65B*(3), p. 346. Copyright [2021] by Oxford University Press. Reprinted with permission (see Appendix).

such as perceptions, interpretation, and behaviour. AARC itself may prompt multiple reactions which are broadly summarised as personal meaning making and self-regulation, which may result in re-evaluation of certain goals and changes to goal-directed behaviour to optimise adjustment and feelings of well-being (Diehl & Wahl, 2010).

As outlined above, traditionally, measures of subjective ageing have tended to view positive and negative evaluations of ageing as two ends of a single positive to negative continuum (Dutt, Gabrian, & Wahl, 2018a; Rothermund & Kornadt, 2015; Wurm et al., 2017). This unidimensional perspective does not allow consideration of the complexity and contextual embeddedness of individuals' views/perceptions of ageing (Rothermund & Kornadt, 2015). As mentioned, one of the features of AARC which sets this construct apart from previous subjective ageing measures, is that it captures both positive (AARC-gains) and negative (AARC-losses) perceptions of the ageing process. For example, AARC-losses may involve recognition of decline in cognitive functioning, whereas AARC-gains may involve noticing that one has greater experience and knowledge to evaluate one's life and circumstances with advancing age (Diehl & Wahl, 2010). Measurement of both positive and negative perceptions of subjective ageing allows researchers to develop a better understanding of how evaluations of one's own ageing may relate to relevant outcomes.

1.3.1 Measurement of Awareness of Age-related Change

The measurement of AARC via questionnaire has been informed via multiple approaches (Brothers, 2016). First, empirical research targeting everyday awareness of ageing recorded potential items as part of an open-ended diary study where participants reported on subjective experiences relating to AARC (Miche et al., 2014). Second, specific items from the German version which were based on conceptual reasoning were included (Wahl et al., 2013). Finally, additional items were identified through a series of focus groups in which small groups of middle-aged participants were asked to reflect upon their recent

experiences of subjective ageing (Brothers et al., 2019). This combination of approaches resulted in a pool of 189 items. In English, there are two shortened versions of the AARC measure - a 50-item version (Brothers et al., 2019) and 10-item version (AARC-10 SF; Kaspar et al., 2019) which include subsets taken from the original 189 items (Brothers, 2016). Both the 50- and 10-item scales show high reliability and validity when assessed against the original scales (Brothers, 2016; Kaspar et al., 2019). AARC in the current project was assessed using the AARC-10 SF (Kaspar et al., 2019), which assesses one gain- and one loss-related component from each behavioural domain.

1.3.2 Link Between Awareness of Age-related Change and Well-being

While AARC is a comparatively recent development in the subjective ageing literature, the construct has shown consistent associations with developmental outcomes relevant to ageing well (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018b; for a review on AARC and well-being outcomes see Sabatini, Silarova, et al., 2020). Furthermore, a cross-sectional study by Brothers and colleagues (2017) showed that AARC explained more variance in well-being-related outcomes than unidimensional subjective ageing measures. Overall, greater psychological and subjective well-being have been linked to higher AARC-gains. Additionally, greater psychological, subjective and physical well-being have been linked to lower AARC-losses (Sabatini, Silarova, et al., 2020). AARC-gains may amplify well-being in older adulthood by facilitating feelings of self-efficacy (Bandura et al., 1999), competence (Ryan & Deci, 2000), positive self-image (Levy, Slade, Kunkel, & Kasl, 2002), or an appreciation of obtained resources with increasing age (Hobfoll, 2002). Furthermore, awareness of personal strengths attributed to ageing may trigger processes of self-regulation (e.g., engaging with new goals) which may facilitate continued development in older adulthood (Diehl et al., 2015; Diehl & Wahl, 2010; Dutt, Gabrian, & Wahl, 2018b). On the other hand, AARC-losses may endanger well-being via threats to one’s self-concept or self-

representation (Diehl, 2006; Greve & Wentura, 2003; Swann Jr & Buhrmester, 2012), by bringing awareness to limited time remaining in life (Brothers et al., 2016), or by triggering increases in self-identification with negative ageing stereotypes (Levy, 2009).

Additionally, AARC may have implications for change in well-being over time. According to Diehl and Wahl (2010), perceptions of age-related change are linked to processes of personal meaning-making which become the foundation for establishing certain intentions (e.g., to improve one's health or physical fitness; Wurm et al., 2010) and motivating subsequent actions (e.g., improving one's diet or setting up regular walks with a friend). In the context of AARC, AARC-losses may inflict developmental limitations on individuals' behaviour, which may decrease the likelihood that individuals will engage in certain actions or activities which could either increase their well-being directly, or partially offset the negative impact of age-related losses. This aligns with Hobfoll's (2001) Conservation of Resources theory, which states that while experiences of loss are likely to trigger distress, they may also lead to further loss. Therefore, higher AARC-losses may not only be linked to lower well-being overall, but also steeper decline in well-being over time. On the other hand, AARC-gains may assist with determining future developmental opportunities, motivating continued pursuit of meaningful goals (Diehl et al., 2015; Dutt, Gabrian, & Wahl, 2018b). Furthermore, according to Hobfoll (2001), initial gain experiences lead to further gain. Hence, higher AARC-gains may not only be linked to higher average well-being, but also increases in well-being over time.

1.3.3 The Interplay of Awareness of Age-related Gains and Awareness of Age-related Losses and Implications for Adaptation in Older Adulthood

AARC is one of the first measures of subjective ageing which separately considers positive and negative aspects of ageing as conceptually distinct dimensions. AARC-gains and AARC-losses represent distinct components of the ageing process and have been found to

only be weakly correlated with one-another in previous research (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b; English et al., 2019; Kaspar et al., 2019). Hence, different people are likely to have differing combinations of higher and lower AARC-gains and AARC-losses. This supports that AARC is multidimensional, and that the interplay of AARC-gains and AARC-losses may be important to consider in subjective ageing research.

While higher AARC-losses has been consistently linked to lower well-being, AARC-gains may play a crucial role in this association. The acknowledgement and measurement of AARC-gains allows researchers to not only study its direct implications for well-being and adaptation but allows examination of the possibility of AARC-gains attenuating the negative association between AARC-losses and adaptive outcomes. When perceiving negative age-related change, perceptions of positive age-related change may protect individuals' self-concept by reinforcing feelings of personal competence (Ryan & Deci, 2000), self-efficacy (Bandura et al., 1999), or positive self-image (Levy, Slade, Kunkel, & Kasl, 2002). These resources may directly increase well-being (Holahan & Holahan, 1987; Pinquart & Sörensen, 2000), or they may reduce the salience of AARC-losses by encouraging the view that older adulthood can be a time for continued growth and development (Diehl & Wahl, 2010). There is some evidence for perceived resource gain buffering the effect of resource loss on depressive symptoms in adults. Specifically, a study of recent mothers found the relationship between resource loss and postpartum depressive symptoms was weaker among those who also perceived higher resource gain (Wells et al., 1999).

In the context of AARC, AARC-gains may be protective of well-being when AARC-losses lead individuals to identify with negative ageing stereotypes. As mentioned, the majority of adults report feeling younger than their chronological age (Rubin & Berntsen, 2006). Furthermore, when individuals are asked to report whether they view themselves fitting the term *older person*, they often say they do not (Weiss & Lang, 2009). When

AARC-losses may trigger identification with negative ageing stereotypes and threaten one's self-concept (Diehl et al., 2014), AARC-gains may allow individuals to re-evaluate the valence of their age-related stereotypes. Older adulthood is viewed by most age groups as a time when decline and loss are common, with gains and growth becoming increasingly rare (Heckhausen et al., 1989). The extent to which individuals believe that ageing is an inevitable/uncontrollable process of decline and loss, the less likely they are to believe that they can influence their own ageing process (Staudinger, 2015). Hence, in the presence of age-related losses, AARC-gains may allow individuals to reappraise negative notions about age and ageing and view ageing as a process consisting of positive as well as negative elements (Diehl & Wahl, 2010). In turn, AARC-gains may attenuate the association between AARC-losses and poorer developmental outcomes.

It is also possible that the interplay of AARC-gains and AARC-losses is associated with change in well-being over time. Accordingly, AARC-gains may serve as not only a trigger for continued motivation and further development into later life (Diehl et al., 2015), but may also provide emotional respite from negative subjective ageing experiences (Hobfoll, 2002). When personal losses are experienced, it is argued that individuals must invest resources in order to offset further loss (Hobfoll, 2001). In the context of AARC, perceptions of age-related losses may be associated with steeper decline in well-being over time. However, AARC-gains may attenuate the impact of AARC-losses on well-being, by facilitating pursuit of important developmental goals (Dutt, Gabrian, & Wahl, 2018b). Indirect support for a possible buffering effect of AARC-gains is evident in previous research which has shown that more negative self-perceptions of ageing predicted steeper decline in physical and psychological well-being outcomes, but that this relationship was weaker among those with higher optimism regarding their future (Wurm & Benyamini, 2014). Similarly, AARC-gains may prompt feelings of optimism in the presence of age-related losses, or prompt individuals

to perceive a degree of personal control over their ageing process (Staudinger, 2015). To summarise, the proposed relationship between AARC-losses and decline in well-being over time may be weaker among those with higher AARC-gains, due to perceptions of age-related gains providing emotional respite, promoting feelings of optimism, or enabling continued goal pursuit in the presence of AARC-losses.

While greater well-being has been consistently associated with higher AARC-gains and lower AARC-losses, the first two empirical chapters of this thesis (Chapters 2 and 3) consider the interaction of AARC-gains and AARC-losses in their prediction of adaptive outcomes. First, an examination of whether AARC-gains and AARC-losses interact in their association with goal adjustment strategies is outlined in Chapter 2. Additionally, Chapter 3 considers whether AARC-gains may be protective in the relationship between AARC-losses and between-person differences and longitudinal change in psychological well-being. Given the modifiability of development (P. Baltes, 1987), and previous research suggesting that feelings of both perceived control and optimism about one's future may mitigate the impact of negative subjective ageing on aspects of well-being (see Staudinger, 2015; Wurm & Benyamini, 2014), the awareness of positive age-related change may help to offset the negative effects of perceiving age-related losses. Furthermore, recent research suggests that AARC is amenable to change (Brothers & Diehl, 2017). Further understanding of the potential buffering effects of AARC-gains may help to inform future interventions aimed at enhancing adaptation and resilience in older adulthood, even when age-related losses may become less avoidable or particularly salient (e.g., P. Baltes & Smith, 2003; Heckhausen et al., 1989).

1.4 Potential Mechanisms Linking Awareness of Age-related Change and Well-being

There are several major lifespan models of self-regulation which refer to subjective experiences of ageing in relation to effective adaptation and subsequent well-being, yet the role and meaning of these subjective ageing experiences is not explicitly spelled out (Diehl et al., 2014). Although these theories acknowledge the subjective experience of age-related change or aspects of loss, the conditions surrounding age-related change are often discussed in a relatively general manner (Diehl et al., 2015; Diehl & Wahl, 2010). Development at all points in the life course consists of a balance of gains and losses (P. Baltes, 1987). However, gains and losses are generally not experienced equally across the lifespan. With increasing age, the balance between personal gains and losses can shift, with older adults experiencing more losses, and fewer gains relative to their younger counterparts (P. Baltes, 1987).

Individuals' efforts to find a favourable balance between gains and losses represent an important aspect of human development (Brandtstädter & Renner, 1990). The dual process model focuses on assimilative and accommodative coping as methods used by individuals to adapt to challenges and adjust their goals across the lifespan. Assimilative coping involves tenacious goal pursuit, whereby individuals persistently strive for personal goals and adjust their life circumstances to achieve these goals (e.g., via increased effort or finding alternate means; Brandtstädter & Renner, 1990). Accommodative coping, characterised by flexible goal adjustment, involves modifying one's goals to fit with current life circumstances (e.g., via re-evaluation or devaluation of unachievable goals or positive reappraisal to emergent loss; Brandtstädter & Renner, 1990).

Both assimilative and accommodative strategies play a role in well-being (Brandtstädter & Renner, 1990; Mueller & Kim, 2004). Throughout the life course, individuals often experience a gradual shift from more assimilative strategies to

accommodative strategies, due to the shifting balance of gains and losses (Brandtstädter & Renner, 1990). According to Dutt, Gabrian, and Wahl (2018b), in cases where the individual possesses high resources, assimilative strategies would typically be most beneficial for self-regulation as they allow optimal utilisation of the individual's resources needed to successfully achieve goals. The pursuit and attainment of important goals is a crucial part of successful development and is conducive to overall well-being (Heckhausen & Schulz, 1995). However, as individuals age, their circumstances often change, and resources may become more limited (Brandtstädter & Renner, 1990). In cases where the individual has lower resources, constantly striving for goals which are not achievable is likely to cause frustration and disappointment; in these cases, accommodation may represent the more appropriate strategy. Hence, both assimilative and accommodative coping play important roles in the effective self-regulation of goals (Brandtstädter, 1989).

Similar to the dual process model, the lifespan theory of primary and secondary control considers how agency and motivation may influence how older adults adapt and retain well-being in the presence of age-related losses (Heckhausen & Schulz, 1995). Primary control refers to individuals' efforts to change the external environment in attempt to fit with their desires (comparable to assimilative coping). On the other hand, secondary control refers to the targeting of internal processes in attempt to minimise perceptions of losses and retain appropriate levels of primary control by channelling efforts into more achievable pursuits (comparable to accommodative coping; Heckhausen & Schulz, 1995).

Finally, the theory of selective optimisation with compensation (SOC; P. Baltes & M. M. Baltes, 1990) also provides a theoretical framework for understanding age differences in adaptation and well-being. SOC theory proposes that there are important approaches individuals can utilise to maximise developmental gains and minimise losses when confronted with cognitive, physical, and social constraints in older adulthood. While SOC

processes operate across the lifespan, greater life experience which accompanies older adulthood may facilitate more effective selection of important domains of activity, the optimisation of skills and capabilities to achieve selected goals, and compensation for insufficient resources by using external aids, with compensation being particularly important in older adulthood (P. Baltes & M. M. Baltes, 1990).

One goal of developmental theory is to offer greater understanding of life-long development in the context of plasticity and shifts in human behaviour (M. M. Baltes & P. Baltes, 1977; Lerner & Richard, 1984). Furthermore, the aforementioned lifespan theories acknowledge that there are inter-individual differences in how people experience their own ageing (P. Baltes et al., 1998; Brandtstädter & Rothermund, 2002; Heckhausen & Schulz, 1995). However, due to a divide between theoretical frameworks of human development and measures of subjective ageing (see Diehl et al., 2014), how subjective ageing relates to developmental adaptation has been relatively overlooked in gerontological literature. How individuals construct and reconstruct their awareness and knowledge of their own ageing becomes a crucial part of their self-knowledge and self-representation (Diehl, 2006; Diehl et al., 2014) which could in turn have implications for behaviour. Hence, AARC offers a valuable perspective for understanding development in middle- and older-adulthood, including individuals' expectations of ageing, their sense of identity, as well as how they manage their goals.

1.4.1 Awareness of Age-related Change and Self-regulation of Goals

Developmental theories of self-regulation provide perspectives on how people adapt to age-related losses and preserve well-being in the face of such losses. Furthermore, subjective experiences of ageing (such as AARC) have been implicated in the processes of switching from one mode of goal regulation (e.g., assimilation or primary control) to another (e.g., accommodation or secondary control). Views on ageing play a crucial role in processes of

developmental regulation (Brandtstädter, 2006), with stereotypes of ageing informing individuals' expectations of their own development (Rothermund & Kornadt, 2015).

Recently, Dutt, Gabrian, and Wahl (2018b) explored the relationship between AARC and self-regulation of goals in the context of Brandtstädter and Renner's (1990) dual process model. Results demonstrated that AARC was predictive of developmental regulation while controlling for chronological age, demographic, and health variables. AARC-gains was positively, and AARC-losses was negatively associated with assimilation, which suggests that individuals who report perceiving higher age-related gains or lower age-related losses are more likely to engage in tenacious goal pursuit than those with lower AARC-gains or higher AARC-losses. Adding to this, AARC-gains was positively, and AARC-losses was negatively associated with accommodative strategies, suggesting that individuals who report higher age-related gains or lower age-related losses are also more likely to use flexible goal adjustment strategies than those with lower AARC-gains or higher AARC-losses.

Overall, participants who possessed what Dutt, Gabrian, and Wahl (2018b) labelled *higher resources* (i.e., higher AARC-gains and lower AARC-losses) appeared more likely to utilise both methods of goal adjustment. This balance of assimilative and accommodative coping demonstrates that in cases of higher resources, individuals may be better able to flexibly and effectively implement a wider range of regulatory strategies, depending on the challenges they face in the ageing process. Although Dutt, Gabrian, and Wahl (2018b) considered tenacious goal pursuit (assimilation) and flexible goal adjustment (accommodation) as separate outcome variables in their study, I suggest that it is the ability to flexibly implement a combination of coping strategies that best represents *flexibility* in coping. Building on this idea, a focus of the first study (Chapter 2) is whether AARC-gains and AARC-losses interact in their association with goal adjustment. Following my previous argument (Section 1.3.3), I propose that AARC-gains may be protective of the association

between AARC-losses and processes of goal adjustment by increasing feelings of competence, self-efficacy, or positive self-image which likely impact individuals' goal adjustment strategies.

In the current study, I focus on goal disengagement and goal re-engagement as important constructs to consider when evaluating AARC and implications for adaptation in older adulthood. Specifically, Wrosch, Scheier, Miller et al.'s (2003) Goal Adjustment Scale was used to measure goal disengagement (conceptually similar to accommodation), and goal re-engagement (conceptually similar to assimilation). Goal disengagement refers to the tendency to withdraw effort and commitment from unachievable goals, whereas goal re-engagement refers to the tendency to identify and pursue new or alternate goals when other goals have become blocked. Goal disengagement and goal re-engagement represent distinct dimensions which can operate in conjunction to play independent roles in adaptive self-regulation of behaviour (Wrosch, Scheier, Miller, et al., 2003; Wrosch & Scheier, 2020).

I decided to focus on goal adjustment as captured by the Goal Adjustment Scale (Wrosch, Scheier, Miller, et al., 2003) rather than in the context of the dual process model of tenacious goal pursuit and flexible goal adjustment (Brandtstädter & Renner, 1990) due to conceptual differences between the measures. While both measures focus on how people set and pursue goals, the Goal Adjustment Scale more directly taps into behavioural responses to blocked goals. For example, questionnaire items include 'it's easy for me to reduce my effort toward the goal' (disengagement) and 'I seek other meaningful goals' (re-engagement). However, the Ten-Flex scale (Brandtstädter & Renner, 1990) includes of a broader range of responses which can reflect additional appraisals such as high personal expectations of development (e.g., 'the harder a goal is to achieve, the more appeal it has to me'; assimilation) or aspects of positive reappraisal (e.g., 'when everything goes wrong, I can usually find a positive side'; accommodation). Furthermore, studies have been critical of the

psychometric properties of the Ten-Flex scales, with limited support of the proposed two-factor solution, associations with chronological age, construct validity, or content support (when using expert raters; Henselmans et al., 2011; Mueller & Kim, 2004). Hence, it was decided that the Goal Adjustment Scale would be most suited to the specific research questions of the current project which focuses on the extent to which AARC-gains and AARC-losses are associated with goal-related *behaviour*, and how goal-related behaviour might link to aspects of well-being.

1.4.2 Goal Flexibility

In addition to examining both goal disengagement and goal re-engagement as independent facets of self-regulation, in the current thesis, I also consider whether the two strategies as regulatory processes operate in conjunction to facilitate optimal adaptation. This approach is comparable with contemporary perspectives on coping which acknowledge coping flexibility as a dynamic process involving effective adaptation in coping responses in reaction to situational demands and available resources (Cheng et al., 2014; Kato, 2012). Early research defined coping flexibility in terms of an individual possessing a broad repertoire of coping strategies which foster psychological adjustment (Pearlin & Schooler, 1978). Coping flexibility is a dynamic process involving the exchange between the individual and their environment and refers to an individual's ability to flexibly and effectively adapt their coping behaviour given the current situation (Cheng et al., 2014; Kato, 2012). Overall, flexibility in coping provides a basis for adaptability and therefore equips individuals with the necessary responses to effectively deal with an ever-changing environment and inevitable stressful situations (Cheng et al., 2014).

Self-regulation of goals has been widely adopted as a way to operationalise effective adaptation in the study of coping flexibility (Cheng et al., 2014). Within perspectives on developmental self-regulation, flexibility is reflected in the way that individuals modify their

goals to adjust to specific challenges or losses (Brandtstädter & Renner, 1990; Cheng et al., 2014). In Chapter 2, *goal flexibility* is considered as the endorsement of both goal disengagement and goal re-engagement strategies (see Section 2.3.2 for further information regarding operationalisation and calculation). The main focuses for Chapter 2 were to examine how perceptions of both one's own ageing (AARC) and aspects of motivation relate to processes of goal adjustment (and flexibility) in older adulthood.

1.4.3 Awareness of Age-related Change and Motivation

While AARC may directly inform processes of goal adjustment as previously outlined, Chapter 2 also explores future time perspective as a possible mediator of these associations. Perceptions of time remaining in life often shift as people age (Carstensen et al., 1999). Future time perspective, or the subjective sense of time remaining until death, gradually becomes more salient with increasing age. As goal-directed behaviour intrinsically relies on perceived time remaining (e.g., setting distant future goals is impractical when perceived time remaining is very limited), individuals' perception of time is inherently tied to their pursuit and selection of goals. This ties in with socioemotional selectivity theory, which is concerned with how time horizons become shortened with increasing age, and how changing perceptions of time remaining influence motivation (Carstensen et al., 1999).

According to Carstensen (2006), as people grow older, and increasingly view time remaining as limited, they begin to invest more time and resources towards important relationships and goals which promote positive emotions, and place less importance on goals which expand their horizons and future opportunities (such as experiencing novelty or gaining/expanding knowledge). Overall, future time perspective may mediate relationships between AARC and self-regulation. Specifically, as people become increasingly aware of age-related changes, they may also experience a shift in perspectives of finitude, which in turn, may impact how they approach and evaluate goals.

Previous work has found that experiences which may prompt individuals to view older adulthood as a time for growth and opportunity (i.e., AARC-gains) are associated with more expansive perceptions of future time (greater future time perspective; Brothers et al., 2016). On the other hand, experiences which may lead individuals to identify with negative age-related stereotypes (i.e., AARC-losses) are associated with more limited perceptions of remaining lifetime (more restricted future time perspective; Brothers et al., 2016). In Chapter 2, I extend this research to examine whether future time perspective mediates the relationship between AARC and self-regulation of goals. If an individual perceives themselves as experiencing high developmental losses or low gains, this may lead to a more restricted future time perspective, which may lead to changes in self-regulation (i.e., higher likelihood of disengaging from unattainable goals, and lower likelihood of pursuing new, achievable goals).

1.5 Awareness of Age-related Change, Self-regulation of Goals, and Well-being

Motivational theories suggest that goals play a crucial role in successful development and the facilitation of well-being (Carver & Scheier, 1998; Wrosch & Scheier, 2020). As goals are often tied to valued aspects of a person's life, the pursuit and attainment of personal goals provide individuals with a sense of purpose (Wrosch & Scheier, 2020). In the instance of unattainable goals and associated failure in reaching certain important personal goals, individuals' subjective well-being may be threatened, which may result in increased levels of depressive symptoms or reduced feelings of purpose (Carver & Scheier, 1998). Given that resources for goal pursuit are finite (Schulz & Heckhausen, 1996), when individuals retain focus on unattainable goals (e.g., by continued pursuit or rumination), they will likely have fewer resources to pursue alternate and potentially obtainable goals (Wrosch, Scheier, Miller, et al., 2003). Hence, these individuals may not have the opportunity to gain the positive psychological benefits of pursuing and obtaining personal goals (such as feelings of mastery

and purpose; Wrosch et al., 2013) which may, in turn, compensate for the potentially negative consequences of the original goal failure (Carver & Scheier, 1998; Wrosch & Scheier, 2020). Hence, both goal disengagement and goal re-engagement play their respective roles for well-being in older adulthood.

Relationships between AARC, self-regulation of goals and well-being have received some attention in the previous literature. Dutt, Gabrian, and Wahl (2018a) found that accommodative coping moderated the relationship between AARC-gains and change in depressive symptoms over a 2.5-year period. Overall, those with lower AARC-gains showed steeper declines in well-being over time than those with higher AARC-gains. However, this relationship was weaker among those with higher levels of accommodative coping. Overall, when individuals perceive themselves as having relatively few gains associated with ageing, they may perceive a discrepancy between their current situation and their desired state. However, as tendencies of accommodative coping are aimed to reduce discrepancies between current and desired states (Brandtstädter & Rothermund, 2002), those with higher levels of accommodative coping were better able to preserve well-being when this discrepancy arose (Dutt, Gabrian, & Wahl, 2018a).

While self-regulation of goals may play a moderating role between AARC and aspects of well-being, Chapter 4 of the current thesis focuses on the theoretically proposed mediating role of self-regulation of goals in this association. Specifically, this Chapter tests Diehl and Wahl's (2010) proposition that self-regulation of goals plays an intervening role between AARC and well-being (See Figure 1.1). According to Diehl and Wahl (2010), as AARC is often assessed against individuals' previous performance or the performance of others, AARC may trigger reactions surrounding personal meaning making and self-regulation. Hence, perceptions of changes attributed to ageing may lead to a readjustment of personal goals in order to stabilise one's sense of self (Greve & Wentura, 2003), and optimise

adaptation and overall well-being. Given theoretical propositions of the processing of AARC (Diehl & Wahl, 2010), and previous research linking AARC and goal regulation (Dutt, Gabrian, & Wahl, 2018b), as well as goal regulation and well-being outcomes (Barlow et al., 2020; Wrosch et al., 2011), Chapter 4 assesses longitudinal relationships to gain further understanding regarding the temporal order of associations between the three constructs.

While disengagement from unattainable goals may be adaptive at times (such that energy is no longer directed toward unattainable goals), it may also reflect maladaptive behaviours such as premature goal disengagement or low motivation (Wortman & Brehm, 1975). On the other hand, goal re-engagement may more consistently reflect positive developmental outcomes, as identification and pursuit of new, attainable goals provides opportunities for continued growth and development (Brandtstädter & Rothermund, 2002).

Furthermore, the strategies of goal disengagement and goal reengagement are said to differ in the strength of their relationships with different dimensions of well-being (See Barlow et al., 2020). In general, goal disengagement tendencies are more strongly associated with a reduction of negative indicators of well-being (i.e., lower psychological distress and depressive symptoms; Dunne et al., 2011; Wrosch et al., 2007). On the other hand, goal re-engagement capacities tend to relate more strongly to increases in positive indicators of well-being (higher positive affect or purpose in life; Wrosch et al., 2007, 2013). One of the major well-being outcomes considered within the current thesis is psychological well-being, as the focus on realisation of individual potential and functioning (e.g., Deci & Ryan, 2008) aligns with the focus of the current thesis surrounding aspects of self-knowledge (AARC), goal adjustment, and motivation in older adulthood. Overall, goal re-engagement may more consistently reflect adaptation in older adulthood and has been found to be more strongly associated with positive dimensions of well-being (such as psychological well-being) than goal disengagement (Barlow et al., 2020). Hence, I focus specifically on goal *re-engagement*

as a potential mediator of the longitudinal relationship between AARC and psychological well-being in Chapter 4.

1.6 Well-being Outcomes used in the Present Research

According to Rowe and Kahn (1997) successful ageing involves living into advanced older adulthood (85+ years) while having low disease or disease-related disability, and retaining relatively high levels of cognitive functioning, physical ability, engagement with life and adaptiveness to a changing environment. Diehl and Wahl (2010) suggest that future research should investigate when AARC may result in adaptive behavioural responses which may foster resilience in later life, and when AARC might generate maladaptive or negative outcomes. Furthermore, Diehl and Wahl (2010) propose that specific outcomes of AARC which should be assessed include different dimensions of psychological well-being (along with assessments of physical well-being and functional status, and other indicators of adaptive functioning and quality of life). In the current thesis I focus on psychological well-being as broadly reflecting attributes consistent with full human functioning and realisation of potential (e.g., Deci & Ryan, 2008). Brothers and colleagues (2016) previously examined associations between AARC and psychological well-being using a composite measure based on Ryff's Scales of Psychological Well-being (1989). In Chapters 3 and 4 I focus on a composite well-being measure comprised of four aspects of psychological well-being with particular relevance to ageing well, including the satisfaction and frustration of basic psychological needs, vitality, and engagement with life.

The choice of outcome measures representing psychological well-being to comprise the composite measure were initially guided by self-determination theory (Ryan & Deci, 2000), which considers both satisfaction and frustration of basic psychological needs for autonomy (perceiving control over one's life and outcomes), competence (feelings of mastery and efficacy in one's life and environment), and relatedness (feelings of belonging and

connection to others) as crucial for realisation of full potential, functioning and subsequent psychological well-being. Empirical support for the centrality of basic psychological needs in supporting well-being is evident in numerous studies (e.g., Church et al., 2013; Martela & Ryan, 2016; Patrick et al., 2007). Additionally, the importance of basic psychological needs is proposed to remain constant over the lifespan (Ryan & Deci, 2000), yet satisfaction of these needs is proposed to become more challenging in older adulthood resulting from declines in energy or resources (such as social status or physical health; Coleman, 2000). The challenges for need satisfaction that can arise in later life, and the relatively few studies in the area points to the value of taking a perspective grounded in self-determination theory as a means of better understanding lifespan implications of AARC for psychological well-being.

Subjective vitality was also considered as an additional marker of psychological well-being in older adulthood. Vitality is closely aligned with subjective energy and is said to be impacted by both somatic and psychological factors (Ryan & Frederick, 1997). Specifically, individuals notice ongoing changes in the energy that they perceive themselves as possessing, as a function of physical (e.g., illness) and psychological (e.g., autonomy) factors (Ryan & Frederick, 1997). Previous research has found that higher vitality correlates with various aspects of positive functioning including better subjective physical health, life satisfaction, and psychological well-being, and fewer symptoms of anxiety and depression, with these associations remaining relatively consistent across the lifespan (Kasser & Ryan, 1999; Ryan & Frederick, 1997). Subjective energy often declines in later life, yet some older adults report little or no decline even into advanced older adulthood (over 85 years; Avlund, 2010). Having energy available to the self for continued development when losses are experienced has been identified as an important resource for adaptation, yet vitality is a relatively understudied component of healthy ageing (American Psychological Association, 1996; Cardini & Freund, 2020; Erikson et al., 1986).

Finally, engagement with life is considered as an indicator of psychological well-being, which focuses on the extent to which an individual perceives purpose in their life. Purpose refers to a strong sense of what one hopes to achieve in life, and the setting of important goals (Windsor et al., 2015). In the context of age-related changes and the re-prioritisation of goals in older adulthood, a sense of purpose may be a particularly protective and meaningful facet of psychological well-being (Brandtstädter & Renner, 1990; Windsor et al., 2015). In addition, Diehl and Wahl (2010) explicitly identify engagement with life as a major outcome of AARC (alongside physical well-being/functional status and psychological well-being more generally, see Figure 1.1).

1.7 Awareness of Age-related Change as a State-like Construct

In addition to examining individual differences in subjective perceptions of ageing and implications for overall psychological well-being, the final empirical chapter of the current thesis (Chapter 5) focuses on day-to-day fluctuations in AARC and implications for daily stress reactivity. While AARC has traditionally been viewed as an individual difference trait, recent research has found that both AARC-gains and AARC-losses show substantial variability at the within-person level. Specifically, Neupert and Bellingtier (2017) found that the variability of AARC-gains and AARC-losses was 8%, and 9% within-person, respectively. This finding demonstrates that perceptions of age-related changes do not necessarily need to be extreme or infrequent in order to be noticed (e.g., sudden decline in physical functioning), but can be relatively minor, common experiences (e.g., noticing that it takes more time to complete certain tasks than previously).

1.7.1 Daily Awareness of Age-related Change and Implications for Reactivity to Daily Stressors

Adding to recent research regarding day-to-day fluctuations in subjective ageing, Chapter 5 considers the role AARC may play in modifying individuals' reactions to daily

stressors. Daily stressors refer to relatively minor hassles which may occur from day-to-day which can accumulate over time and have significant implications for well-being (Almeida, 2005; Lazarus, 1999). When individuals experience a stressor, they often show a corresponding increase in psychological distress (e.g., decreased positive affect and/or increased negative affect; Almeida, 2005; Almeida & Kessler, 1998). However, there are factors which can buffer or exacerbate this relationship. For example, those with higher trait levels of neuroticism have shown stronger within-person associations between daily stressors and negative affect than those low on the trait (i.e., those higher in neuroticism demonstrated higher stress reactivity; Mroczek & Almeida, 2004). In addition to between-person differences, day-to-day fluctuations in certain constructs have also been implicated in the stressor-affect relationship. For example, reactivity to stressors has been found to be lower on days when perceived control was higher-than-usual (Diehl & Hay, 2010; Ong et al., 2005).

The relationship between chronological age and reactivity to daily stressors is somewhat unclear from previous research. Overall, older adults report experiencing fewer stressors, and perceiving these stressors as less severe than their younger counterparts (Almeida & Horn, 2004; Birditt et al., 2005). Some research suggests that older adults demonstrate less emotional reactivity to stress than their younger counterparts (Hay & Diehl, 2010). This finding reflects what researchers have termed the *dampening* effect, where older adults gain experience with emotion regulation over their lifespan, lessening emotional reactivity to stress later in life (Diener et al., 1991; Mroczek & Almeida, 2004). On the other hand, additional research regarding age and stress reactivity found that older adults showed higher reactivity to daily stress than younger and middle-aged adults in terms of both affective (Mroczek & Almeida, 2004), and physical (Uchino et al., 2005) reactivity. This finding may be reflective of the *kindling* effect, a process whereby repeated exposure to certain stimulus (e.g., stressors) causes heightened sensitivity to the stimulus and a more

automatic response (e.g., reduced affective well-being; Gilbert, 1994; Kendler et al., 2001; Mroczek & Almeida, 2004). Overall, age differences in stress reactivity are somewhat unclear. However, as mentioned throughout the current chapter, the metric of chronological age may not the most accurate measure of the experience of human ageing (Staudinger, 2015). The final empirical chapter of this thesis focuses on daily subjective perceptions of age-related change as a possible moderator of the stress-affect relationship.

As mentioned, AARC has only recently begun to be considered as a construct which can fluctuate at the daily level. In terms of implications for well-being, daily AARC-losses has been found to co-vary with daily negative affect (AARC-gains was not examined in this context; Neupert & Bellingtier, 2017). In another recent study by Bellingtier and Neupert (2018), it was found that those with more negative attitudes toward ageing at baseline overall showed greater reactivity to daily stress. To my knowledge, associations between day-to-day fluctuations in AARC and the stress-affect relationship have not yet been examined.

AARC may have implications for stress reactivity for multiple reasons. Diehl and Wahl (2010) proposed that as a particular form of self-knowledge, AARC is likely linked to other self-related constructs which may be implicated in the process of stress reactivity, such as perceptions of control, self-efficacy, self-concept clarity, and self-representation. Furthermore, societal stereotypes of age and ageing are often internalised by individuals (Hess, 2006), which can lead to negative self-stereotyping (Rothermund & Kornadt, 2015), which may prompt individuals to feel less equipped to handle stressful situations (Diehl & Wahl, 2010).

According to Diehl and Wahl (2010), when perceptions of age-related change are negative, they may impose developmental limitations, which may exacerbate the impact of daily stressors. Higher-than-usual AARC-losses may prompt increased identification with internalised negative ageing stereotypes (Levy, 2009), which has previously been linked to

increased reactivity to stress (Levy, Hausdorff, et al., 2000). Furthermore, individuals exposed to negative ageing stereotypes showed greater physical response to stress in comparison to those exposed to positive stereotypes (Levy, 2000). Conversely, when perceptions of age-related change are positive, they may enhance well-being by allowing appreciation of life experiences and accumulated resources (Hobfoll, 2002), and motivating adaptive processes of self-regulation (Diehl & Wahl, 2010; Wrosch, Scheier, Carver, & Schulz., 2003) possibly lessening the impact of daily stressors on well-being. Furthermore, having a higher-than-usual positive evaluation of own's own ageing could provide respite from negative experiences (e.g., daily stressors; Hobfoll, 2002).

Further support for the role of AARC in the stress-reactivity process is found within research on day-to-day fluctuations in perceived control and stress reactivity. Overall, reactivity to stressors was found to be lower on days when individuals perceived higher-than-usual personal control (Diehl & Hay, 2010; Ong et al., 2005). Daily positive perceptions of ageing (AARC-gains) may elicit greater perceptions of personal control by triggering feelings of competence (Ryan & Deci, 2000), self-efficacy (Bandura et al., 1999), or positive self-image (Levy, Slade, Kunkel, & Kasl, 2002). Furthermore, perceiving higher-than-usual age-related gains may encourage individuals to view their ageing experience in a more positive manner - as an opportunity for growth and continued development (Diehl & Wahl, 2010), possibly attenuating the effect of daily stressors. Additionally, higher-than-usual AARC-losses may make individuals aware of possible future limitations due to ageing, which may threaten perceptions of personal control over their life and outcomes (Brothers et al., 2016; Heckhausen & P. Baltes, 1991). In turn, lower perceptions of personal control may limit individuals' feelings of competence to effectively deal with stressors (Ong et al., 2005). Previous research has found that AARC and perceived control covary at the daily level, with

higher personal control reported on days when AARC-gains was higher-than-usual, and on days when AARC-losses was lower-than-usual (Zhang & Neupert, 2021).

Previous research has found that daily AARC-losses covary with daily well-being (Neupert & Bellingtier, 2017), and reactivity to daily stressors is higher among those with more negative perceptions of ageing at baseline (Bellingtier & Neupert, 2018). However, the relationship between AARC and reactivity to stress has not been examined at the daily level. In Chapter 5, I examine relationships between AARC, daily stressors, and affective well-being, to examine whether the extent to which individuals perceive age-related change from day-to-day (AARC-gains and AARC-losses) may play a role in how they respond to stressors. Specifically, Chapter 5 seeks to address whether reactivity to daily stress may be (a) buffered by higher-than-usual AARC-gains, and (b) exacerbated by higher-than-usual AARC-losses.

1.8 Remaining Research Questions to be Addressed in Thesis Manuscripts

This thesis consists of the current general introduction and literature review followed by five chapters. Chapters 2-5 are in the format of journal articles which have been published or are soon to be submitted for publication. A summary of the content of each empirical chapter (and the research questions they aim to address) and the general discussion chapter follows below:

Chapter 2: Awareness of age-related change, future time perspective, and implications for goal adjustment in older adulthood. Using cross-sectional data, Chapter 2 examines whether AARC has implications for flexibility in goal adjustment, taking into consideration the potential interplay of AARC-gains and AARC-losses, and whether future time perspective mediates the relationship between AARC and goal adjustment strategies.

Specific questions addressed in this chapter include:

1) Does AARC have implications for flexibility in goal adjustment strategy use?

2) Do AARC-gains and AARC-losses interact in their associations with goal adjustment?

3) Are relationships between AARC and goal adjustment mediated by future time perspective?

Chapter 3: Awareness of age-related gains and losses and their associations with psychological well-being: A longitudinal examination. While AARC has been relatively consistently linked to well-being (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a; Sabatini, Silarova, et al., 2020), how AARC-gains, AARC-losses and their interaction may inform change in psychological well-being outcomes over time has not (to my knowledge) been examined in previous literature. Multi-level modelling of longitudinal data based on three time-points was used to assess whether AARC relates to changes in psychological well-being, and whether negative associations between AARC-losses and well-being were weaker among those with higher AARC-gains.

Specific questions addressed in this chapter include:

1) Does AARC have implications for longitudinal change in psychological well-being?

2) Do AARC-gains and AARC-losses interact in their associations with between-person differences in psychological well-being and change in well-being over time?

Chapter 4: Goal re-engagement as a mediator of longitudinal associations between awareness of age-related change and psychological well-being: An initial examination. While theorised in the literature, self-regulatory processes have not been previously examined as mediators of relationships between AARC and well-being. Complete longitudinal mediation tests were conducted in Mplus to examine how AARC (gains and losses), goal re-engagement and well-being relate to one another over time.

Specific questions addressed in this chapter include:

1) Is the longitudinal relationship between AARC and psychological well-being mediated by goal re-engagement?

Chapter 5: Implications of awareness of age-related change for stress reactivity: A daily diary study. AARC has recently been shown to vary significantly from day-to-day. Furthermore, more negative perceptions of ageing at baseline have been associated with increased reactivity to stress. This chapter focuses on daily diary data to examine relationships between daily AARC, stressor exposure, and affective well-being to determine whether AARC may play a role in the stress-affect association at the daily level.

Specific questions to be addressed in this chapter include:

1) How does AARC relate to reactivity to daily stress?
    a) Does AARC-gains buffer the relationship between daily stressors and affective well-being?
    b) Does AARC-losses exacerbate the relationship between daily stressors and affective well-being?

Chapter 6: General discussion. The final chapter synthesises the findings from the four papers presented in this thesis. Results are discussed in the context of the main research questions. Contributions of the current thesis to the broader literature, and implications of research findings are considered. Finally, Chapter 6 considers methodological issues related to the research findings and provides suggestions for future research.

1.9 Conclusion and Data Collection Information

The overarching purpose of the proposed research is to further existing knowledge regarding AARC, self-regulation and their relevance for resilience and adaptive ageing in middle- and older-adulthood. More specifically, this project aims to (1) examine AARC-gains, AARC-losses, and their interaction as predictors of flexible coping in older adulthood, (2) assess AARC-gains, AARC-losses and their interaction as predictors of between-person

differences and longitudinal change in well-being outcomes, (3) test theoretical assumptions regarding goal re-engagement as a mediator of longitudinal associations between AARC and psychological well-being, and (4) examine AARC at the daily level as a potential moderator of reactivity to daily stress.

These aims were investigated via two main studies. Data from an initial cross-sectional online survey were used to investigate how AARC-gains and AARC-losses may interact in their associations with goal adjustment strategies and considered future time perspective as a possible mediator of the relationship between AARC and goal adjustment (Chapter 2). Two follow-up assessments from the initial cross-sectional survey formed the basis of the Chapters 3 and 4. Chapter 3 examined AARC's implications for longitudinal change in well-being outcomes, as well as the interaction of AARC-gains and AARC-losses in the cross-sectional and longitudinal prediction of change in well-being. In Chapter 4, the theoretical proposition that the association between AARC and well-being is mediated by goal re-engagement was tested. The final study consisted of a daily diary design, which forms the basis for Chapter 5. Here, the focus is on within-person differences in AARC-gains and AARC-losses as potential moderators of the relationship between daily stressors and affective well-being.

CHAPTER 2

AWARENESS OF AGE-RELATED CHANGE, FUTURE TIME PERSPECTIVE, AND IMPLICATIONS FOR GOAL ADJUSTMENT IN OLDER ADULTHOOD

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BWH contributed 75% and TDW contributed 25% to the research design, data collection and analysis, and writing and editing of the manuscript, respectively.

2.1 Abstract

Objectives: How people adjust their goals is central to adaptation across the lifespan. However, little is known about individual difference characteristics that predict how and why people use different self-regulatory strategies. The present study investigated associations of perceived age-related gains and losses, and their interaction, as predictors of goal adjustment in older adulthood. Furthermore, we examined whether future time perspective (FTP) mediated relationships between awareness of age-related change (AARC) and goal adjustment.

Method: A community-based sample of 408 adults (aged 60-88 years) was recruited via an internet-based research platform. Participants completed questionnaire measures of AARC, FTP, goal disengagement, and goal re-engagement. A flexibility index reflecting tendencies toward use of both goal disengagement and re-engagement strategies was also analysed.

Results: Although AARC-losses was associated with lower goal re-engagement and goal flexibility, this association was weaker among those with higher AARC-gains, indicating AARC-gains may be protective in the relationship between AARC-losses and goal adjustment. The association between AARC and goal adjustment was also shown to be mediated by FTP. Higher AARC-gains was associated with more expansive FTP, which was associated with lower goal disengagement and higher goal re-engagement. On the other hand, higher AARC-losses was associated with more restricted FTP, which was associated with higher goal disengagement and lower goal re-engagement.

Discussion: Results have implications for how we conceptualise the combined effects of age-related gains and losses on developmental outcomes relevant to adaptive ageing. Furthermore, perceptions of future time with advancing age may be implicated in processes linking AARC with goal adjustment.

Key Words: Subjective ageing – Self-regulation – Goal Flexibility

2.2 Introduction

Lifespan perspectives on self-regulation, (see P. Baltes, 1987; Brandtstädter & Renner, 1990; Heckhausen & Schulz, 1995) focus on how people adjust their goals to promote opportunities for developmental gains and minimise losses. Common to these perspectives (for a review see Boerner & Jopp, 2007) is the notion that effective self-regulation involves processes of goal disengagement and goal re-engagement. Goal disengagement refers to relinquishment of unachievable goals, whereas goal re-engagement refers to identifying and pursuing alternative goals (Wrosch & Scheier, 2003).

Throughout the life course, individuals typically experience a gradual shift in the relative emphasis placed on goal disengagement strategies. A reduction of resources can occur with ageing (such as declines in health), and people often re-evaluate and re-prioritise their goals accordingly (Brandtstädter & Renner, 1990). Therefore, goal disengagement, coupled with well-judged efforts toward re-engaging with alternative, achievable goals, typically assumes increasing importance later in life (Bailly et al., 2012; Dutt, Gabrian, & Wahl, 2018b; Wettstein et al., 2019).

This study moves a step beyond previous research (e.g., Brandtstädter & Renner, 1990; Dutt, Gabrian, & Wahl, 2018b; Heckhausen et al., 2010; Heyl et al., 2007; Wrosch & Miller, 2009) by considering goal disengagement and goal re-engagement not only as independent components of self-regulation, but as regulatory processes operating in conjunction to facilitate optimal adaptation. This approach is analogous with contemporary perspectives on coping, which recognise coping flexibility as a dynamic process involving effectively adapting coping behaviour in response to contextual demands and available resources (Cheng et al., 2014; Kato, 2012). In the present study, we operationalise *goal flexibility* as endorsement of both goal disengagement and goal re-engagement strategies. Our substantive aims are concerned with how key aspects of both subjective ageing and motivation are

associated with processes of goal adjustment in older adulthood. First, we examined how both positive and negative perceptions of ageing may interact to predict aspects of goal adjustment. Second, we examined future time perspective as a possible mediator of relationships between awareness of age-related change and goal adjustment.

2.2.1 Awareness of Age-related Change

Awareness of age-related change (AARC) refers to a recognition of behaviour, performance level, or experience of life changing as a result of growing older (Diehl & Wahl, 2010). AARC differs from previous subjective ageing measures by capturing both positive (AARC-gains) and negative (AARC-losses) aspects of individuals' experience of their own ageing (for a review, see Sabatini, Silarova, et al., 2020). For example, AARC-losses could include the recognition that one may feel more dependent on help from others, whereas AARC-gains might involve having a better sense of what is important in life as a result of growing older. According to Diehl and Wahl (2010), AARC may prompt a variety of reactions regarding personal meaning-making and self-regulation, prompting individuals to re-evaluate their goals.

Previous work by Dutt, Gabrian, and Wahl (2018b) found that AARC-gains was associated with higher use of both assimilative (analogous to goal re-engagement) and accommodative (analogous to goal disengagement) strategies, suggesting that more positive perceptions of ageing may encourage flexible goal adjustment. The relationship between AARC-losses and goal adjustment is less clear. Some studies have found putatively negative experiences (such as perceiving age-related losses) may be beneficial in encouraging disengagement from unattainable goals (see Wrosch & Scheier, 2020). However, Dutt, Gabrian, and Wahl (2018b) found AARC-losses was negatively associated with use of both assimilative and accommodative strategies. This may be due to negative attitudes toward ageing impacting perceptions of meaning around disengagement from goals, and possibly

reducing the perceived efficacy/benefit of re-engaging in new goals. We propose perceptions of negative age-related change may have less impact on goal adjustment, when accompanied by awareness of positive age-related changes.

2.2.2 Awareness of Age-related Gains as a Potential Moderator of Associations Between Awareness of Age-related Losses and Adjustment of Goals

Of primary interest in this study is whether AARC-gains is protective in the relationship between AARC-losses and adaptive self-regulation as reflected in goal adjustment strategies. AARC-losses has been associated with higher depressive symptomology (Dutt, Gabrian, & Wahl, 2018a; Kaspar et al., 2019) and negative affect (Neupert & Bellingtier, 2017), as well as poorer psychological well-being (Brothers et al., 2016), and self-rated health (Kaspar et al., 2019). However, in some circumstances, AARC-losses may serve as a trigger for adaptation, as a precursor to disengagement from barren goals (e.g., 'loss-based selection', see P. Baltes & M. M. Baltes, 1990).

Due to AARC-gains and AARC-losses representing conceptually distinct dimensions and being only weakly correlated in previous studies (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b; Kaspar et al., 2019), individuals are likely to have varying combinations of high and low AARC-gains and AARC-losses. Someone perceiving high age-related losses, and low gains, may be quicker to disengage from goals and less likely to re-engage with alternative goals. However, someone perceiving high age-related losses, but simultaneously perceiving high age-related gains, may be relatively better placed to adapt to ageing-related challenges. This is based on assumptions that AARC-gains may prompt recognition of one's performance capacity and facilitate feelings of competence (Ryan & Deci, 2000) and self-efficacy (Bandura et al., 1999), which may encourage individuals to engage in new goals (Brandtstädter & Rothermund, 2002). With previous research linking AARC-losses with poorer goal adjustment (Dutt, Gabrian, & Wahl, 2018b), we expect AARC-losses will be

related to lower levels of goal re-engagement and goal flexibility. However, we expect this association will be weaker for those with higher AARC-gains.

2.2.3 Future Time Perspective as a Potential Mediator of Associations Between Awareness of Age-related Change and Processes of Self-regulation

Shifting perceptions of future time may also contribute to changes in goal adjustment tendencies in older adulthood. According to socioemotional selectivity theory (e.g., Carstensen et al., 2003), as people grow older, and increasingly view time remaining as finite, they attach more importance to goals related to facilitating emotional meaning in the present, and less importance to goals concerned with future opportunities (e.g., knowledge acquisition; Carstensen, 2006). In older adulthood, AARC may have implications for perceptions of time remaining in life. AARC is assessed in direct reference to one's increasing age, and research has shown associations of AARC-losses with more limited future time perspective (FTP), and AARC-gains with more expansive FTP (Brothers et al., 2016).

FTP may also be implicated in processes linking AARC with adjustment of goals. Previous research has shown that FTP mediates relationships between (1) AARC-losses and psychological well-being (Brothers et al., 2016), and (2) AARC-losses and increased depressive symptoms (Dutt & Wahl, 2019). We propose both AARC and FTP may also have implications for goal adjustment. For example, someone with higher AARC-losses may view their remaining lifetime as more limited, and more readily disengage from goals (not seeing future benefit in persistence), and/or be less likely to re-engage with new goals. On the other hand, someone with higher AARC-gains may be more cognisant of future opportunities, and less focused on limits to time remaining, and more likely to re-engage with new goals following goal disengagement.

2.2.4 Research Aims and Hypotheses

We initially examined whether AARC-gains plays a protective role in the relationship between AARC-losses and goal adjustment. Specifically, we expected those with higher AARC-losses would score lower on goal re-engagement and our index of goal flexibility. However, we expected these negative associations to be weaker among those who also reported higher levels of AARC-gains.

We also examined FTP as a mediator of relationships between AARC and goal adjustment. As people become increasingly aware of age-related changes, they may experience a shift in perspectives of finitude, which may impact how they evaluate goals. We predicted that AARC-gains would be associated with more expansive FTP, and in turn higher goal re-engagement and goal flexibility. We also expected AARC-losses would be associated with more limited FTP, and in turn lower goal re-engagement and goal flexibility. We do not view goal disengagement to be inherently adaptive or maladaptive unless considered alongside subsequent goal re-engagement (hence our focus on the goal flexibility index, where relatively higher levels of both re-engagement and disengagement would be regarded as indicative of higher potential for flexible adaptation). Consequently, we included goal disengagement as an additional dependent variable in exploratory analyses for comparative purposes.

2.3 Method

2.3.1 Participants and Study Design

Following approval by the Institutional Research Ethics Committee, an advertisement was placed on TurkPrime, an online crowdsourcing platform (Litman et al., 2017). American TurkPrime workers aged over 60, who had completed at least 100 previous studies, with a job approval rating greater than 95%, were invited to participate in a 15-minute online study investigating coping and well-being across the lifespan. Participants were paid approximately

$1.50USD. The sample consisted of 408 adults aged 60-88 years (*M* = 67.07, *SD* = 4.57). Two thirds were women (65.9%). Participants identified predominantly as North American (67.6%), with others reporting more than one ethnicity (e.g., North American and Asian). Half of participants were partnered (50.5%). Education level was high, with 58.3% of respondents having completed tertiary education. Over half of participants (53.2%) were retired. Surveys were administered using Qualtrics software, with data comprising the baseline assessment as part of an ongoing longitudinal study.

2.3.2 Measures

Awareness of age-related change. AARC was measured using the AARC-10 SF (Kaspar et al., 2019), consisting of two five-item subscales measuring AARC-gains and AARC-losses across five domains (health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive and social-emotional functioning, lifestyle and engagement; Diehl & Wahl, 2010). Participants responded to items regarding how their life may have changed as a result of growing older (e.g., '…I appreciate relationships and people much more') on a five-point scale (1 = *not at all*, 5 = *very much*). Scores for each subscale were summed, with higher scores reflecting greater AARC-gains (α = .74) and AARC-losses (α = .83), respectively.

Goal adjustment. The Goal Adjustment Scale (Wrosch, Scheier, Miller, et al., 2003) contains two subscales capturing goal disengagement (four items) and goal re-engagement (six items). Participants respond to the stem "If I have to stop pursuing an important goal in my life…" by rating their level of agreement with a series of accompanying statements on a scale from 1 *(strongly disagree)* to 5 *(strongly agree)*. Example items from the goal re-engagement subscale include "I start working on new goals" and "I seek other meaningful goals". Examples from the goal disengagement scale include "It's easy for me to reduce my effort towards the goal" and "I find it difficult to stop trying to achieve the goal (reversed)".

Scores for each subscale were summed, with higher scores reflecting higher tendencies toward disengagement (α = .81) and re-engagement (α = .90).

To obtain a measure of flexibility in goal adjustment, we followed Kaplan's (1972) metric, combining sum and discrepancy scores from two separate scales to create a single variable that captures co-occurrence of experiences/behaviours. This formula provides a score which is equivalent to the lower score of the two scales multiplied by 2 and has been used for operationalising flexibility in goal adjustment (Mahlo & Windsor, 2020) and coping strategy use (Bonanno et al., 2011). Following Bonanno et al. (2011), the goal adjustment subscales were transformed into Z-scores, then the lower of the two scores was doubled to capture people's tendencies to make use of both goal disengagement and goal re-engagement strategies. For our purposes, using this formula is preferable to other methods of combining scores (e.g., summing, averaging, or calculating discrepancies), as highest scores are achieved when goal disengagement and goal re-engagement scores are both relatively high (see Ersner-Hershfield et al., 2008). For example, an individual with moderate/high scores on *both* goal adjustment strategies (e.g., disengagement z-score = 3, re-engagement z-score = 2) would achieve a relatively high score on the flexibility index (2 × lowest score = 4). However, if one goal adjustment strategy is rarely used (e.g., disengagement z-score = 3, re-engagement z-score = -1), an individual would achieve a low flexibility score (2 × lowest score = -2), even when the score on the other dimension is high (e.g., disengagement z-score = 4, re-engagement z-score = -1). Kaplan's formula captures whether both goal adjustment strategies are being used or if one strategy may be relied upon disproportionately.

Future Time Perspective. FTP was assessed using Carstensen and Lang's (1996) scale. Each item describes expectations of opportunities and limitations in reference to the future (e.g., 'there is plenty of time left in my life to make new plans'). Participants indicated their agreement to each statement on a scale from 1 *(very untrue)* to 7 *(very true).* Scores

were summed, with higher scores representing more open-ended FTP (α = .93).

Covariates. Consistent with previous studies examining associations of AARC with well-being and self-regulation (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b), all analyses controlled for chronological age, gender (coded as men = 0, women = 1), education (0 = did not complete tertiary education, 1 = completed tertiary education), and physical functioning, as previous research found associations between these variables and our constructs of interest (Boerner, 2004; Brandtstädter & Renner, 1990). Physical functioning was measured using the 10-item physical functioning subscale from the RAND Health Survey (Ware & Sherbourne, 1992). Participants reported generally high levels of physical functioning (*M* = 71.03, *SD* = 26.50; scores range from 0 to 100, with higher scores reflecting better physical functioning).

2.3.3 Statistical Analysis

First, to address our research question concerning whether AARC-gains may be protective in relationships between AARC-losses and goal adjustment strategies, we conducted a series of separate moderated hierarchical regression analyses. The baseline models included AARC-gains and AARC-losses, and covariates entered as predictors. Interaction terms for Age × AARC-gains, Age × AARC-losses, and AARC-gains × AARC-losses were added in Model 2. Of key interest was the interaction of AARC-gains with AARC-losses.

Next, to examine our research question concerning the possible role of FTP in mediating associations between AARC and goal adjustment we used Hayes PROCESS tool (v3.3; Hayes, 2017). Separate simple regression analyses (PROCESS Model 4) were conducted, and bootstrapped confidence intervals (based on 10,000 samples) were estimated to determine whether indirect effects were significant.

All scale-level predictors were mean-centred before analysis. When analysing effects of AARC-gains or AARC-losses, the alternate AARC scale was included as a covariate to isolate unique effects of each dimension. No data were missing for the variables included in this study.

2.4 Results

Descriptive statistics and bivariate correlations among study variables are reported in Table 2.1.

2.4.1 Awareness of Age-related Change, Future Time Perspective, and Goal Flexibility

Our initial focus was whether AARC-gains moderated associations between AARC-losses and goal adjustment. The results of the regression analysis investigating the relationship between AARC and goal flexibility are shown in Table 2.2. Only AARC-gains emerged as a significant predictor in Model 1, indicating that those with higher AARC-gains scored higher on goal flexibility. AARC-losses was associated with lower goal flexibility, although this association fell just short of significance (p = .051).

Model 2 revealed a statistically reliable interaction of AARC-gains × AARC-losses in the prediction of goal flexibility. Consistent with our predictions, higher AARC-losses was associated with less flexible strategy use (operationalised as the combination of goal disengagement and goal re-engagement), but this relationship was weaker among those reporting higher AARC-gains. To display the nature of this interaction we plotted predicted values for goal flexibility for hypothetical individuals with different combinations of low (- 1 SD) and high (+ 1 SD) AARC-gains and AARC-losses (Figure 2.1, panel a). The interaction term for Age × AARC-gains was also significant, indicating that older age was associated with higher goal flexibility among those with higher AARC-gains, whereas older age was associated with lower goal flexibility among those with lower AARC-gains (see Figure 2.2,

Table 2.1

Descriptive Statistics and Bivariate Correlations Among the Study Variables

Variable	*M* (*SD*) or %	1	2	3	4	5	6	7	8	9
1. Age	67.07 (4.57)	-								
2. Gender (Female)[a]	65.9%	-.003	-							
3. Education (University)[b]	58.3%	.08	-.14**	-						
4. Physical functioning[c]	71.03 (26.50)	-.09	-.10	.15**	-					
5. AARC-gains	21.44 (2.89)	-.01	.17**	-.06	.11*	-				
6. AARC-losses	13.65 (4.68)	.08	.03	-.13**	-.58**	-.15**	-			
7. Future time perspective	40.57 (13.15)	-.12*	.04	-.004	.33**	.33**	-.53**	-		
8. Goal flexibility[d]	-0.99 (1.89)	-.02	.08	.03	.10	.23**	-.16**	.19**	-	
9. Goal re-engagement	22.37 (4.50)	-.02	.09	.10*	.15**	.36**	-.28**	.41**	.75**	-
10. Goal disengagement	11.46 (3.39)	.03	.06	-.02	-.01	-.03	.05	-.13**	.64**	.17**

Note. N = 408. M = Mean, SD = standard deviation, AARC = awareness of age-related change, [a]0 = male, 1 = female, [b]0 = did not complete tertiary education, 1 = completed tertiary education. [c]Higher values = higher physical functioning. [d]Goal flexibility scores derived from the standardised (*Z*-scores) goal disengagement and re-engagement subscales (see Section 2.3.2).

*p < .05, **p < .01

Table 2.2

Regression Models with Goal Re-engagement, Goal Disengagement, and Goal Flexibility, Respectively as the Criterion: Separate Models to Test for Moderation

	Goal Flexibility				Goal Re-engagement				Goal Disengagement			
	b	SE	β	95% CIs	b	SE	β	95% CIs	b	SE	β	95% CIs
Model 1												
AARC												
- AARC-gains	.14**	.03	.21	.07, .20	.52***	.07	.33	.37, .66	-.04	.06	-.03	-.16, .08
- AARC-losses	-.05	.02	-.12	-.09, .00	-.23***	.06	-.10	-.33, -.12	.05	.05	.07	-.04, .14
Covariates												
- Age	-.003	.02	-.01	-.04, .04	-.01	-.05	-.01	-.09, .08	.02	.04	.03	-.05, .10
- Gender	.20	.20	.05	-.18, .59	.47	.44	.05	-.39, 1.33	.46	.37	.06	-.26, 1.17
- Education	.13	.19	.03	-.24, .50	.91*	.42	.10	.08, 1.74	-.08	.35	-.01	-.77, .61
- Physical Functioning	.00	.004	.004	-.01, .01	-.01	.01	-.04	-.03, .01	.01	.01	.04	-.01, .02
R^2	.07***				.19***				.01			
Model 2												
AARC												
- AARC-gains	.13**	.03	-	.06, .19	.49***	.07	-	.35, .63	-.05	.06	-	-.17, .07
- AARC-losses	-.06*	.02	-	-.11, -.01	-.26***	.05	-	-.36, -.15	.05	.07	-	-.04, .14
Covariates												
- Age	-.01	.02	-	-.05, .03	-.02	.04	-	-.10, .07	.02	.04	-	-.05, .10
- Gender	.22	.19	-	-.16, .60	.49	.43	-	-.35, 1.34	.43	.37	-	-.29, 1.16
- Education	.10	.19	-	-.27,.46	.82*	.41	-	.01, 1.64	-.10	.35	-	-.79, .59
- Physical Functioning	-.002	.004	-	-.01, .01	-.01	.01	-	-.03, .01	.01	.01	-	-.10, .02
Interaction terms												
- Age × AARC-gains	.02**	.01	-	.01, .03	.05**	.01	-	.02, .07	-.01	.01	-	-.02, .03
- Age × AARC-losses	-.002	.004	-	-.01, .01	-.001	.01	-	-.02, .02	.004	.01	-	-.02, .03
- AARC-gains × AARC-losses	.02**	.01	-	.01, .03	.05*	.01	-	.02, .07	-.004	.01	-	-.03, .02
R^2	.11**				.23***				.01			

Note. N = 408. AARC = awareness of age-related change. *p < .05, **p < .01, ***p < .001

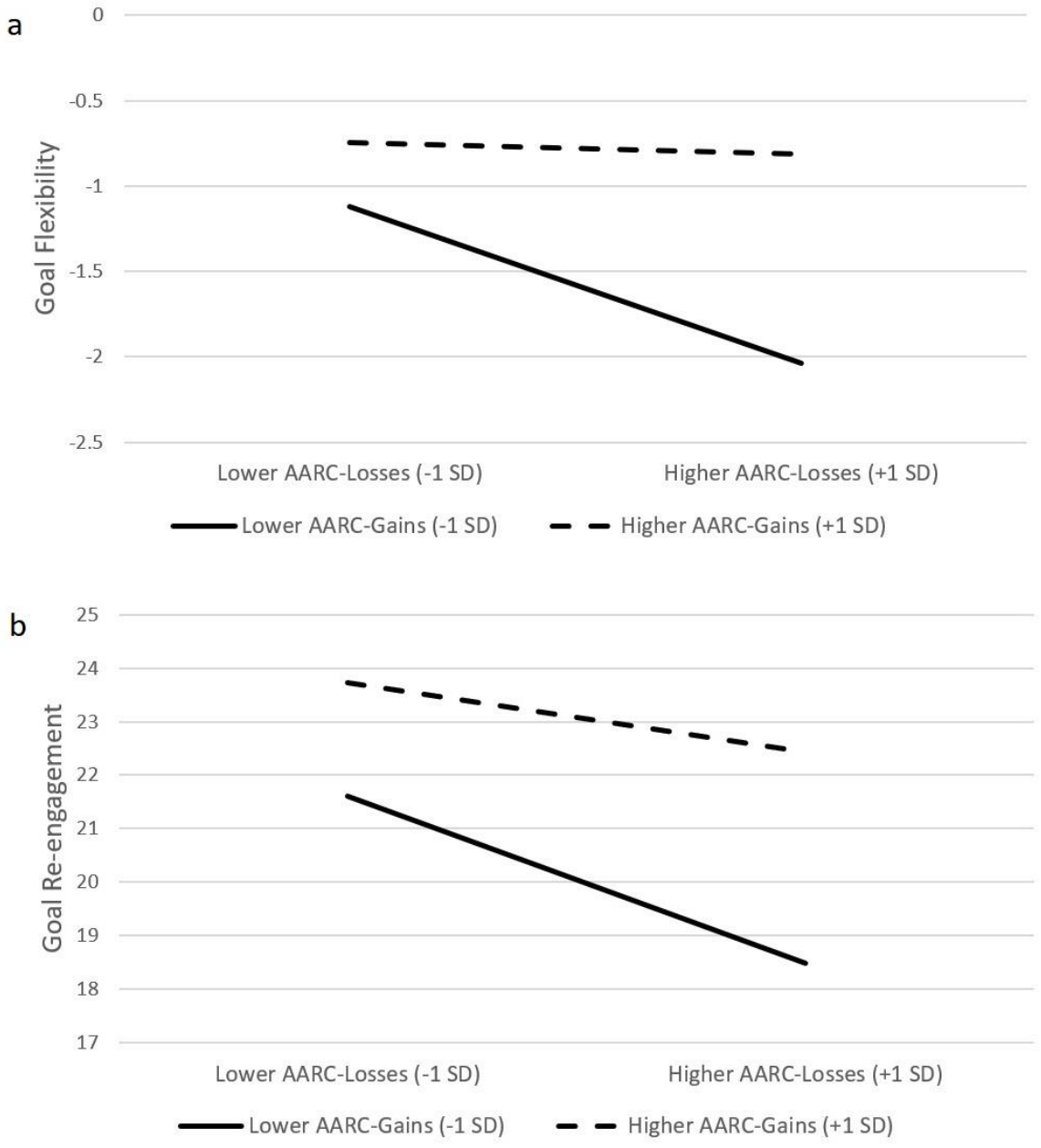

Figure 2.1. Interaction of AARC-gains and AARC-losses in the prediction of (a) goal flexibility and (b) goal re-engagement. Higher AARC-losses was associated with lower goal flexibility and goal re-engagement. However, this association was less evident among those reporting higher AARC-gains.

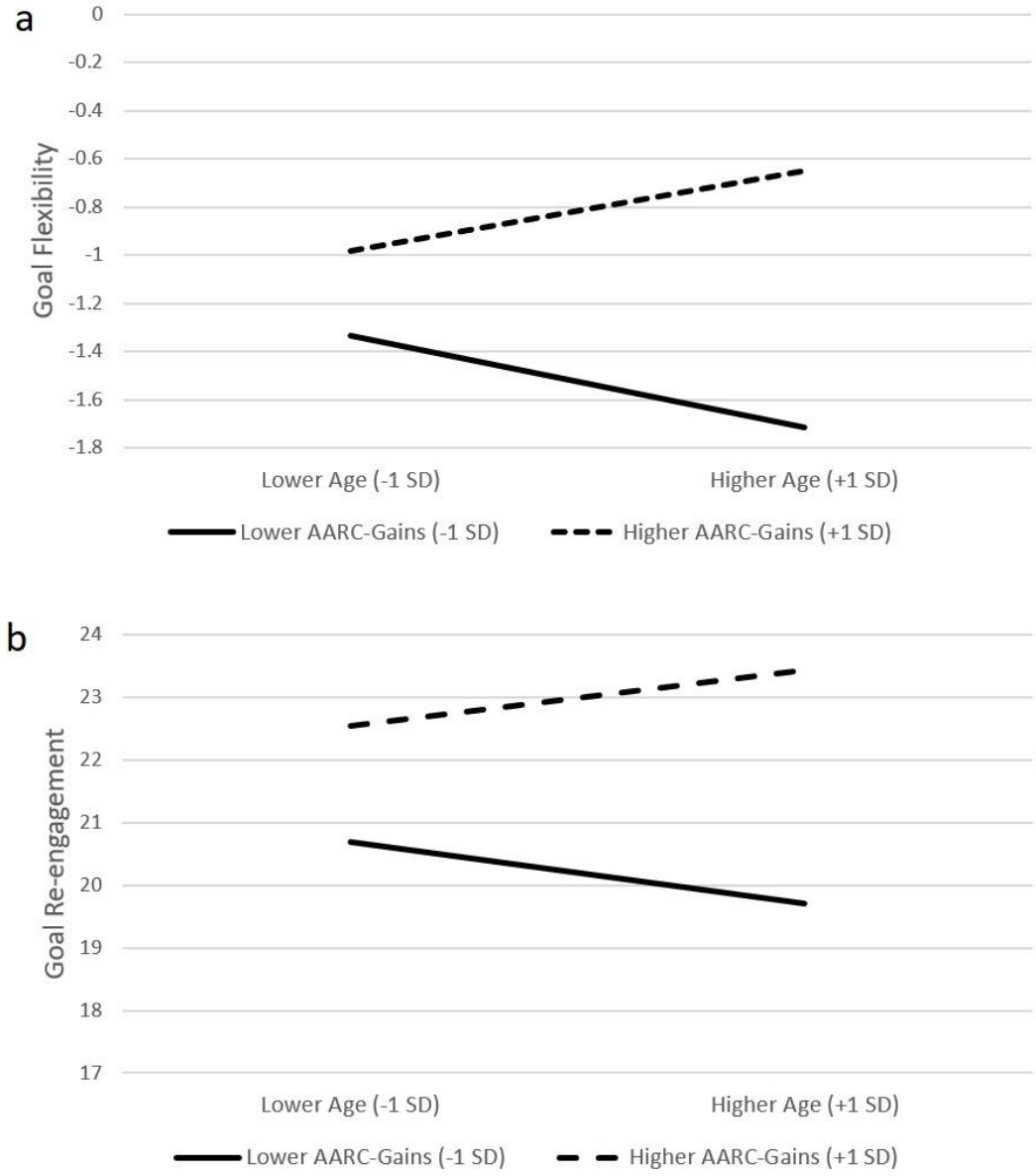

Figure 2.2. Interaction of AARC-gains and age in the prediction of (a) goal flexibility and (b) goal re-engagement. For those with higher AARC-gains, higher age was associated with higher goal flexibility and goal re-engagement. However, for those with lower AARC-gains, higher age was associated with lower goal flexibility and goal re-engagement.

panel a). We next re-specified the regression model as a mediation analysis (see *Statistical Analyses*), to test the hypothesis that FTP mediates the relationship between AARC and goal flexibility. FTP did not mediate relationships between AARC and goal flexibility. Those with higher AARC-gains had more open-ended FTP (*B* = 1.15), and those with higher AARC-losses had shorter FTP (*B* = 1.36). However, FTP was not associated with goal flexibility (*B* = 0.01, 95% CI for indirect effect = -.01, 04).

2.4.2 Awareness of Age-related Change, Future Time Perspective, and Goal Re-engagement

Results of the regression analysis investigating the relationship between AARC and goal re-engagement are also shown in Table 2.2. Model 1 indicated that AARC-gains was positively associated with goal re-engagement, whereas AARC-losses was negatively associated with goal re-engagement. Education was the only significant covariate, with those more educated reporting higher use of goal re-engagement strategies.

In Model 2, both the AARC-gains × AARC-losses, and Age × AARC-gains interactions significantly predicted goal re-engagement. Showing a similar pattern of findings to goal flexibility, those with higher AARC-losses reported less use of goal re-engagement strategies (see Figure 2.1, panel b). Consistent with our predictions, this relationship was weaker for those with higher AARC-gains. The interaction of Age × AARC-gains showed a similar pattern to the one described above for goal flexibility (see Figure 2.2, panel b).

Re-specifying the model as a mediation analysis, AARC-gains indirectly predicted goal re-engagement through its association with FTP. As seen in Figure 2.3, people with higher AARC-gains perceived more time remaining in life. In turn, those who perceived more time remaining were more likely to re-engage in goals (95% CI for indirect effect = .06, .18). AARC-gains remained a significant predictor of goal re-engagement independent of its association with FTP.

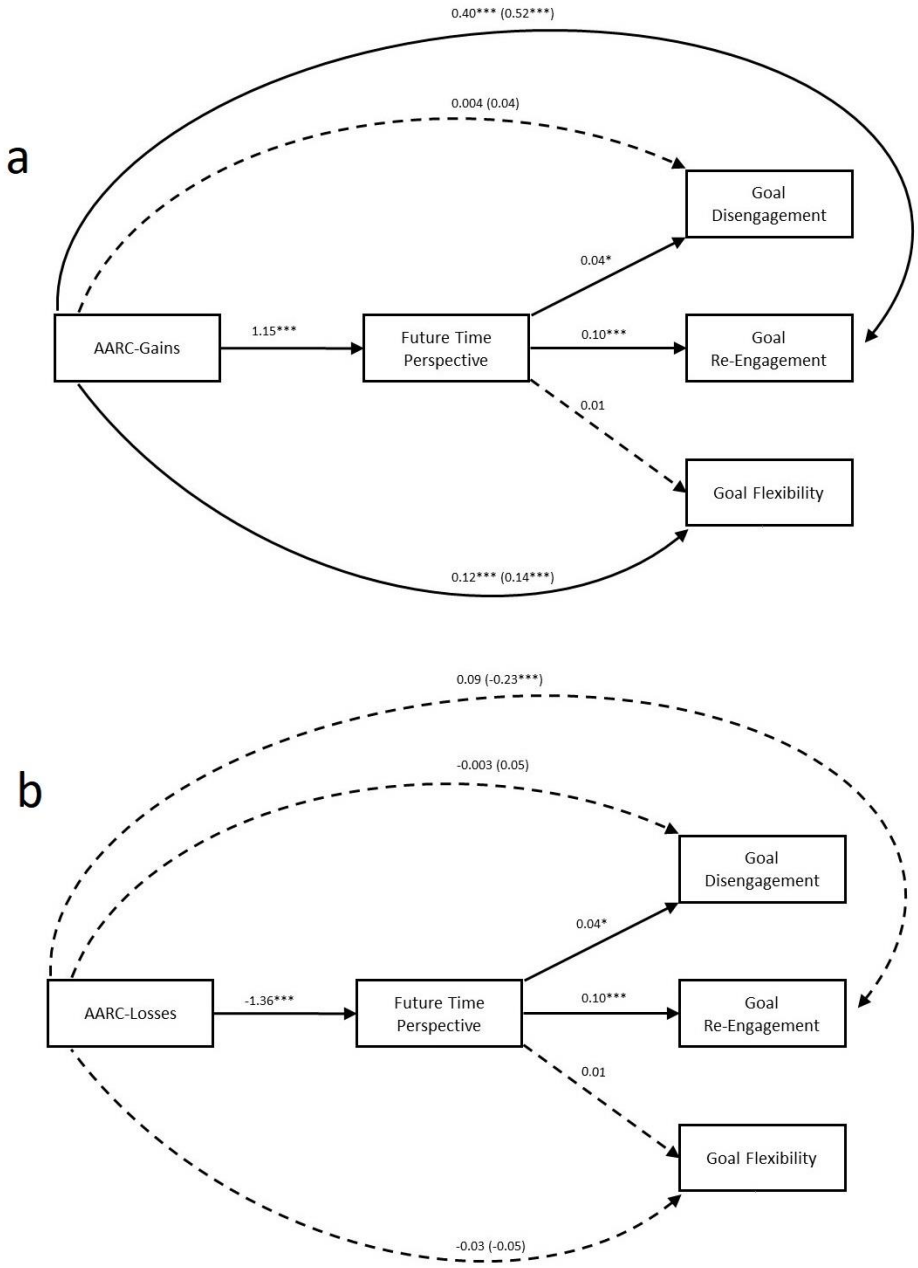

Figure 2.3. Unstandardised path coefficients for mediation models with (a) AARC-gains and (b) AARC-losses as the predictor. Numbers in parentheses are regression coefficients for the total effects of the predictor on goal adjustment outcomes unadjusted for mediation. Covariates include the alternate AARC subscale, calendar age, gender, education, and physical functioning. Significant pathways are indicated by a solid line. *p < .05, ***p < .001.

FTP also mediated the association of AARC-losses with goal re-engagement. As shown in Figure 2.3, those with higher AARC-losses had shorter FTP. Those with shorter FTP were less likely to re-engage in goals (95% CI for indirect effect = -.20, -.07). AARC-losses did not have a significant effect on goal re-engagement independent of its association with FTP.

2.4.3 Awareness of Age-related Change, Future Time Perspective, and Goal Disengagement

Results of the regression analysis investigating the relationship between AARC and goal disengagement are shown in Table 2.2. None of the main effects (Model 1) or interactions (Model 2) emerged as statistically reliable predictors.

Although we did not make specific predictions in relation to a potential mediating role of FTP in the association of AARC with goal disengagement, we conducted additional exploratory mediation analyses for comparative purposes and to further contextualise the findings. As seen in Figure 2.3, FTP mediated the relationship between AARC-gains and goal disengagement. As mentioned, people with higher AARC-gains had more expansive FTP. Additionally, individuals with more expansive FTP were less likely to disengage from goals (95% CI for indirect effect = -.09, -.01). AARC-gains was not related to goal disengagement independent of its association with FTP.

FTP also mediated the relationship between AARC-losses and goal disengagement (see Figure 2.3). As mentioned, people with higher AARC-losses were more likely to have shorter FTP. Those with shorter FTP were more likely to disengage from goals (95% CI for indirect effect = .01, .10). AARC-losses was not associated with goal disengagement independent of its association with FTP.

2.4.4 Follow-up Analyses

Although we approached our analysis of moderation and mediation separately in the results reported above, we also conducted a follow-up analysis of moderated mediation to

assess whether AARC-gains moderated the pathway between AARC-losses and FTP. Results are reported in Table 2.3; overall, the relationship between AARC-losses and FTP did not vary as a function of AARC-gains. Second, consistent with previous research (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b) we controlled for physical health to examine psychological perspectives of age-related losses and gains independent of functional restrictions. Because health relates to one of the specific domains of AARC (health and physical functioning), and we did not control for covariates representing the other domains (see Section 2.3.2), the above models we re-analysed without including physical functioning as a covariate. This did not change the pattern of results reported above; nor did testing interaction terms individually to allow for possible multi-collinearity.

2.5 Discussion

2.5.1 Awareness of Age-related Gains as a Protective Factor in Associations Between Awareness of Age-related Losses and Goal Adjustment Strategy Use

Our initial aim was to examine whether perceptions of age-related gains might protect against threats to agentic goal-directed behaviour associated with greater AARC-losses. Although more acute perceptions of age-related losses were associated with lower goal re-engagement and goal flexibility, these associations only emerged in the context of lower AARC-gains. These findings align with theories surrounding the protective role of gains in the presence of losses. Hobfoll's (2002) Conservation of Resources theory argues that gains (e.g., having more appreciation for the value of social relationships in later life) may not have a strong impact on emotional and functional outcomes in and of themselves. However, when losses are experienced (e.g., a decline in energy or cognitive resources), gains become more salient as they provide emotional respite from loss-based experiences and encourage goal re-engagement (Hobfoll, 2002; Wells et al., 1999). Our findings are among the first to directly support Diehl and Wahl's (2010) proposition that AARC-gains may serve as a motivational

Table 2.3.

Regression Model with Future Time Perspective as the Criterion. Separate Models to Test for Moderation

Future Time Perspective	b	SE	β	95% CIs
Model 1				
AARC				
AARC-gains	1.15***	.19	.25	.78, 1.52
AARC-losses	-1.36***	.14	-.48	-1.63, -1.08
Covariates				
Age	-.22	.12	-.08	-.44, .01
Gender	.25	1.14	.01	-1.99, 2.50
Education	-.1.27	1.10	-.05	-3.43, .89
Physical Functioning	.01	.03	.02	-.04, .06
R^2	.36***			
Model 2				
AARC				
AARC-gains	1.16***	.19	-	.78, 1.53
AARC-losses	-1.38***	.14	-	-1.66, -1.10
Covariates				
Age	-.23*	.116	-	-.46, -.003
Gender	.37*	1.14	-	-1.88, 2.61
Education	-1.29	1.10	-	-3.44, .874
Physical Functioning	.003	.03	-	-.05, .05
Interaction terms				
Age × AARC-gains	.03	.04	-	-.05, .10
Age × AARC-losses	-.02	.03	-	-.07, .03
AARC-gains × AARC-losses	.06	.04	-	-.10, .13
R^2	.36***			

Note. N = 408. AARC = awareness of age-related change.

*p < .05, **p <.01, ***p <.001

driver in older adulthood, as well as offering counterbalancing effects when it comes to experiencing negative age-related changes.

Although not a focus of our analysis, it was noteworthy that AARC-losses was not associated with goal disengagement. This contrasted with Dutt, Gabrian, and Wahl (2018b) who reported negative associations of AARC-losses with accommodative coping. One possible reason for the divergent findings could be differences in measures used in each respective study. While items from the Goal Adjustment Scale (Wrosch, Scheier, Miller, et al., 2003) used in the present study directly assess goal-related behavioural processes (e.g., 'it's easy for me to reduce my effort toward the goal'), several items from Brandtstädter and Renner's (1990) Ten-Flex scale used by Dutt, Gabrian, and Wahl (2018b) to assess accommodation are conceptually related to elements of active coping when faced with blocked goals such as positive re-appraisal and optimism (e.g., 'I find that even life's troubles have a bright side'). Thus, the Dutt, Gabrian, and Wahl (2018b) findings may reflect the extent to which negative views of ageing correspond with more negative assessments of life more generally.

Furthermore, associations of AARC and goal disengagement were relatively weak in comparison to associations of AARC with goal re-engagement. While both regulatory strategies have complimentary roles in effective regulation (Wrosch & Scheier, 2020), goal disengagement may less consistently reflect effective adaptation, depending on the context.

Goal re-engagement typically involves identification and pursuit of new goals, providing opportunities for growth (Wrosch, Scheier, Miller, et al., 2003). On the other hand, processes of goal disengagement could involve either well-judged relinquishment of unattainable goals *or* potentially premature disengagement and/or a lack of motivation. Thus, disengagement may show relatively weaker associations with AARC, which captures beliefs about present competencies (Diehl & Wahl, 2010). This is consistent with previous work

showing that goal re-engagement is a stronger predictor of well-being outcomes than goal disengagement (Barlow et al., 2020; e.g., Wrosch, Scheier, Miller, et al., 2003).

2.5.2 Future Time Perspective as a Mediator of the Relationship Between Awareness of Age-related Change and Goal Adjustment Strategy Use

As predicted, higher AARC-gains was associated with more expansive FTP, which was associated with lower goal disengagement, and higher goal re-engagement. Overall, those with higher AARC-gains may be more aware of future opportunities due to recognition of their resources (Hobfoll, 2002) and performance capacity (Ryan & Deci, 2000), therefore remaining committed to goals for longer, and more readily engaging with new goals. Additionally, AARC-losses was associated with more restricted FTP, which was associated with higher goal disengagement, and lower goal re-engagement. Those with higher AARC-losses may have more willingness to disengage when goals are thwarted, but also less likely to identify and pursue new goals.

While FTP showed unique associations with both goal disengagement and goal re-engagement, no significant findings were evident for associations with *flexibility* in goal adjustment. Taken together, the findings suggest that FTP is more relevant to each of the separate dimensions of goal disengagement/re-engagement than the flexible use of both strategies in combination. For example, those with more expansive FTP may actively seek new goals but perceive little need for goal disengagement.

Overall, the mediation findings broadly align with principles outlined in lifespan developmental perspectives on self-regulation and motivation. Older adults may retain psychological well-being despite being aware of age-related losses by downgrading the importance of unachievable goals, and disengaging (Brandtstädter & Renner, 1990). Further, awareness of losses may increase the salience of limited time remaining, creating a shift away

from more expansive goals, with emotionally meaningful goals assuming priority, consistent with socio-emotional selectivity (Carstensen et al., 1999).

2.5.3 Limitations and Outlook

It is important to consider our findings in the context of several limitations. First, as is common in studies using convenience samples (Nielsen et al., 2017), participants reported high levels of education and physical functioning, both of which are related to adaptive outcomes in later life (Boerner, 2004; Brandtstädter & Renner, 1990). People with access to resources may attend more to personal goals and have a greater insight into their own use of goal disengagement and re-engagement strategies. Ogletree and Katz (2020) recently found that older online participants had higher scores of verbal fluency and depression, as well as self-rated health and memory compared to a national probability sample. Due to the select nature of our sample, caution is advised when generalising these results to the general population. Furthermore, multiple individual difference characteristics could influence how sensitive people are to AARC. We controlled for multiple demographic and health variables, but other possible confounding variables exist (e.g., personality traits, age-related stereotypes, chronic illnesses, depressive symptoms, loneliness), and controlling for these various factors was beyond the scope of the present study.

Another limitation to the current research is that our approach to the assessment of goal flexibility has not been widely used in the study of goal adjustment. According to Cheng et al. (2014), there is currently no general consensus on the optimal approach to assessing flexibility in coping and self-regulation. Therefore, further research is needed to establish valid and reliable methods of assessing trait-like differences in the extent to which people exercise adaptive and flexible goal management strategies across different life contexts. Furthermore, due to data being cross-sectional, causal interpretation is not possible. AARC may impact FTP and goal adjustment, but these variables may also influence individuals'

AARC, and goal adjustment strategies may influence FTP. Longitudinal research is needed for more conclusive evidence (Shrout, 2011) - particularly regarding the mechanisms we have proposed surrounding FTP as a mediator of relationships between AARC and goal adjustment.

2.5.4 Conclusions

This research highlights the importance of perceptions of both one's own ageing and remaining lifetime in the context of developmental regulation in older adulthood. Specifically, awareness of losses may not inherently undermine self-regulatory behaviour if this awareness is accompanied by an appreciation of gains. Furthermore, the relationship between AARC and goal adjustment may be partially explained by shifts in FTP. Future research should address longitudinal associations between the key constructs. Further integration of research on subjective ageing, motivation, and goal-directed behaviour is a promising future direction when focusing on optimising developmental potential in older adulthood.

CHAPTER 3

AWARENESS OF AGE-RELATED GAINS AND LOSSES AND THEIR ASSOCIATIONS WITH PSYCHOLOGICAL WELL-BEING: A LONGITUDINAL EXAMINATION

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Author Contributions

BWH contributed 75% and TDW contributed 25% to the research design, data collection and analysis, and writing and editing of the manuscript, respectively.

3.1 Abstract

Objectives: How people experience their own ageing is more strongly linked to well-being than chronological age. This study examined associations of awareness of age-related change (AARC) with between-person differences and longitudinal changes in psychological well-being (PWB). We expected that higher AARC-gains would be associated with higher PWB and increases in PWB over time. Conversely, we expected higher AARC-losses would be associated with lower PWB, and steeper decline in PWB over time. Furthermore, we tested the interaction of AARC-gains and AARC-losses to examine whether negative associations between AARC-losses and PWB would be weaker among those reporting higher AARC-gains.

Method: Data were collected in three waves from a 12-month longitudinal study of 408 community-dwelling older adults (aged 60+). Multilevel growth models were used to analyse associations between AARC and a composite measure of PWB which included key components of PWB identified in self-determination theory (satisfaction and frustration of basic psychological needs), as well as vitality, and life engagement.

Results: At the between-person level, higher AARC-gains and lower AARC-losses were consistently associated with higher PWB. Furthermore, associations between AARC-losses and lower PWB were weaker among those with higher AARC-gains. There was no evidence to suggest the interplay of AARC-gains and AARC-losses had implications for change in PWB over time.

Discussion: Appreciation of age-related gains may buffer the impact of AARC-losses on PWB. However, longitudinal studies conducted over varying macro- and micro-time scales are needed to better understand the developmental significance of AARC for later life.

Keywords Subjective ageing, awareness of ageing, self-determination

3.2 Introduction

Later in life, experiencing negative age-related change becomes a reality for many (P. Baltes & Smith, 2003). Subjective perceptions of age-related change have been of interest in recent research, and have been linked to depressive symptoms (Dutt, Gabrian, & Wahl, 2018a), and psychological (Brothers et al., 2016) and physical well-being (Dutt & Wahl, 2019). Using longitudinal data from a community-based sample of 408 older adults (aged 60+), we extend recent work in the field of awareness of ageing and implications for well-being in two ways. First, we examined longitudinal associations between awareness of age-related change (AARC) and psychological well-being (PWB). Here we conceptualised PWB as broadly reflecting attributes consistent with full human functioning and realisation of potential (e.g., Ryan & Deci, 2000). PWB was operationalised in the current study using measures of basic psychological need satisfaction and frustration, vitality, and life engagement. Second, we extend conceptual advances related to AARC outlined in an earlier cross-sectional examination (Wilton-Harding & Windsor, 2021a) by examining whether perceptions of positive and negative aspects of ageing interact in their associations with PWB.

3.2.1 Awareness of Age-related Change and Well-being

Subjective ageing has been of interest to gerontological researchers for some time (e.g., Bennett & Eckman, 1973; Levy, Slade, Kunkel, & Kasl, 2002). Comparatively recently, Diehl and Wahl (2010) refined previous conceptualisations of subjective ageing by developing the concept of AARC, which refers to ‘a person’s state of awareness that his or her behaviour, level of performance, or way of experiencing life has changed as a consequence of having grown older’ (Diehl & Wahl, 2010, p. 342). AARC differs from previous unidimensional subjective ageing constructs by capturing both positive (AARC-gains) and negative (AARC-losses) evaluations of individuals’ own ageing. For example,

AARC-losses may involve recognition of having to limit activities, whereas AARC-gains may involve having greater appreciation for the value of close personal relationships with advancing age (Diehl & Wahl, 2010).

A recent systematic review and meta-analysis (Sabatini, Silarova, et al., 2020) found that AARC consistently predicts subjective, psychological, and physical well-being outcomes. Overall, higher AARC-gains and lower AARC-losses are associated with greater well-being. AARC-gains may enhance well-being by facilitating appreciation of valued life experiences and accumulated resources (Hobfoll, 2001), and encouraging effective processes of self-regulation (Diehl & Wahl, 2010; Wrosch, Scheier, Miller, et al., 2003). Additionally, AARC-losses may threaten well-being by undermining self-representation (Diehl, 2006), or highlighting limits to remaining lifetime (Brothers et al., 2016). Another possible mechanism linking AARC-losses to poorer outcomes may be increased identification with generally negative stereotypes regarding ageing and older adults in general (Levy, 2009).

AARC may also have implications for change in well-being over time. The Conservation of Resources Theory states that while resource loss can trigger distress, it may also lead to further loss (Hobfoll, 2001). Therefore, those with higher AARC-losses may not only show lower levels of well-being overall, but also show steeper decline in well-being over time compared to those with lower AARC-losses. Hobfoll (2001) further argues that gain also begets gain. Hence, those with higher AARC-gains may be more likely to increase in PWB over time compared to those with lower AARC-gains.

Brothers et al. (2016) found that higher AARC-gains and lower AARC-losses were associated with greater PWB assessed using a composite measure based on Ryff's (1989) PWB scales. However, to our knowledge AARC has not previously been examined as a predictor of change in PWB over time. Our aims for the current study are to add to understanding of links between AARC and change in PWB and to examine the interaction of

AARC-gains and AARC-losses and possible implications for between- and within-person differences in PWB.

3.2.2 Awareness of Age-related Gains as a Potential Moderator of Associations Between Awareness of Age-related Losses and Psychological Well-being

Previous research has shown that the separate dimensions of AARC-gains and AARC-losses are not strongly correlated (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b; Kaspar et al., 2019). This supports the view that AARC is multidimensional and suggests that for any given individual, AARC-gains and AARC-losses may combine to affect well-being in different ways. For example, an individual perceiving age-related loss in one domain (e.g., health and physical functioning), may be simultaneously perceiving gain in another (e.g., interpersonal relations). While AARC-losses is linked to lower well-being overall, such associations may be weaker among those with higher AARC-gains. In the presence of age-related losses, AARC-gains may support beliefs about personal competence (Ryan and Deci, 2000) or self-efficacy (Bandura et al., 1999; Diehl & Wahl, 2010), which are linked to higher well-being (Holahan & Holahan, 1987). Being aware of one's own age-related strengths or resources might also facilitate self-regulatory processes (e.g., compensatory strategies in response to loss) that facilitate ongoing adaptation and development into later life (Diehl & Wahl, 2010).

Furthermore, AARC-gains may have implications for how adults evaluate their own ageing experience. As mentioned, AARC-losses may lead to identification with negative age stereotypes that become increasingly self-relevant with age (Levy, 2009). However, recognition of gains that accompany ageing may encourage individuals to view ageing more favourably, and as an ongoing context for continued growth and development (Diehl et al., 2014). According to Hobfoll (2001), gains may be particularly important in instances of loss, as appreciation of gains can provide emotional respite from loss-related experiences. Our

research group has begun to examine interactions of AARC-gains with AARC-losses in the prediction of adaptive ageing outcomes. Our work has found that AARC-gains may play a protective role in relationships between AARC-losses and components of goal adjustment (Wilton-Harding & Windsor, 2021a), self-reported physical functioning, life engagement, and subjective well-being (Windsor et al., 2021).

In the current study, we also anticipate that the between-person interplay of AARC-gains and AARC-losses may have implications for change in PWB over time. As mentioned, we expected those with higher AARC-losses would show steeper decline in PWB over time. However, as AARC-gains may buffer the impact of AARC-losses on PWB, this decline may be weaker among those with higher AARC-gains.

3.2.3 The Present Study

In the current study, we considered individual components of PWB which may be of particular relevance in older adulthood, in addition to overall PWB as reflected in a composite measure. In choosing outcome measures representing PWB (a major outcome of AARC; Diehl & Wahl, 2010), we were guided by self-determination theory (Ryan & Deci, 2000), which focuses on both satisfaction and frustration of basic psychological needs for autonomy (feeling in control of one's life and outcomes), competence (perceived mastery and being effective in one's life and environment), and relatedness (a sense of belonging and connection with others) as crucial for personal growth and well-being. Empirical support for the centrality of basic psychological needs in supporting well-being is evident in numerous studies (e.g., Church et al., 2013; Martela & Ryan, 2016). The importance of basic psychological needs is proposed to remain constant over the lifespan (Ryan & Deci, 2000), yet satisfaction of these needs may become more challenging in older adulthood resulting from declines in energy or resources (e.g., social status or physical health; Coleman, 2000). Moreover, studies have only recently begun to examine the relative importance of satisfaction

and frustration of different needs for late-life subjective well-being (Neubauer et al., 2017). The challenges for need satisfaction that arise in later life, and the relative paucity of studies in the area points to the value of taking a perspective grounded in self-determination theory as a means of better understanding lifespan implications for PWB.

We also considered vitality as an additional marker of PWB. Vitality is closely aligned with subjective energy (Ryan & Frederick, 1997), which has been identified as an important, yet understudied component of healthy ageing and a resource for adaptation (e.g., Cardini & Freund, 2020). Finally, we considered engagement with life in terms of the extent to which individuals perceive purpose through engaging in activities which are subjectively valued and meaningful (Scheier et al., 2006). Engagement with life is recognised as a key component of ageing well (Rowe & Kahn, 1997) and is specified as a major developmental outcome of AARC in Diehl & Wahl's (2010) conceptual model. A degree of conceptual overlap between domains of PWB is widely recognised (e.g., Ryff & Singer, 2008) and our data showed substantial intercorrelations among the PWB indicators (*r*s at baseline ranged from 0.58 to 0.89). Hence, consistent with Brothers et al. (2016) we base our main analysis on a composite measure of PWB, however we also report results for individual indicators in follow-up analyses.

3.2.4 Aims and Hypotheses

Our aims for the current research were to (1) examine relationships between AARC and both between-person differences and longitudinal changes in PWB, and (2) examine whether the interaction of AARC-gains and AARC-losses accounts for between- and within-person differences in PWB over and above their main effects. Consistent with previous research and theory, we expected AARC-gains would be linked to higher levels of PWB and increases in PWB over time. Conversely, we expected AARC-losses would be linked with lower levels of PWB and decreases in PWB over time. Finally, we expected that poorer outcomes for those

with higher AARC-losses would be less evident among those with relatively higher AARC-gains.

Although our main analysis focused on a composite measure of PWB as the dependent variable, we also conducted follow-up analyses to provide initial information on whether AARC-gains and AARC-losses were relatively stronger, or weaker predictors of individual components of PWB. In the absence of previous empirical research, we regarded these analyses as exploratory.

3.3 Method

3.3.1 Study Design and Participants

Following approval from the Institutional Research Ethics Committee, an advertisement was placed on CloudResearch, an online crowdsourcing platform (Litman et al., 2017). American CloudResearch workers aged over 60, who had completed >100 previous studies, with job approval ratings >95% were invited to participate in a 15-minute online study examining coping and well-being across the lifespan (data from this baseline assessment were used for our earlier cross-sectional study; Wilton-Harding & Windsor, 2021a). Participants (N = 408) were invited to complete follow-up assessments after approximately six (N = 361) and 12 (N = 311) months. Participants who responded to all three assessments (N = 298) were on average 0.33 years older than those who completed fewer than three assessments (N = 110). However, the selectivity effect amounted to less than 0.08 *SD* units for all study variables, suggesting negligible bias resulting from attrition (Lindenberger et al., 2002).

At T1, participants were aged between 60 and 88 years (M = 67.07, SD = 4.57). Almost two-thirds of participants were female (65.9% female; 34.1% male; 0% non-binary), and over half were retired (53.5%). 58.3% of participants reported completion of tertiary education. Participants were approximately 90% Caucasian, 5% African American, 2% Asian American

and 3% other (e.g., Multiracial, Native American, or undisclosed). Approximately half of respondents were partnered (49.6%). In the absence of widely established and accessible methods for power calculations in the multilevel modelling context, our sample size considerations were based on similar studies that have reported reliable associations of AARC indices with well-being (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b).

3.3.2 Measures

Awareness of age-related change. AARC was assessed with the AARC-10 SF (Kaspar et al., 2019). This measure consists of two five-item subscales measuring AARC-gains and AARC-losses across the five domains of health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive and social-emotional functioning, and lifestyle and engagement (Diehl & Wahl, 2010). Participants responded to items regarding how their life may have changed as a result of growing older (e.g., '…I have a better sense of what is important to me' or '… I have less energy') on a five-point scale (1 = *not at all,* 5 = *very much*). Scores for each subscale were summed, with higher scores reflecting greater AARC-gains (baseline $\alpha = .74$) and AARC-losses (baseline $\alpha = .83$), respectively.

Need satisfaction and need frustration. Need satisfaction and need frustration were assessed with the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015). This measure consists of two 12-item subscales measuring both satisfaction (e.g., 'I feel confident that I can do things well') and frustration (e.g., 'I feel insecure about my abilities') of basic psychological needs for autonomy, competence, and relatedness on a five-point scale (1 = *not at all true,* 5 = *completely true*). Scores from each subscale were summed, with higher scores reflecting higher need satisfaction and frustration, respectively (α ranged from .91 to .92 for need satisfaction, and from .89 to .90 for need frustration across the three time points).

Vitality. Vitality was measured using the Subjective Vitality Scale (Bostic et al., 2000; Ryan & Frederick, 1997). Participants indicated their agreement to six statements regarding their energy (e.g., 'I nearly always feel alert and awake') on a scale from 1 (*not at all true*) to 5 (*very true*). Scores were summed, with higher scores representing higher subjective vitality (α ranged between .92 and .93). This measure of vitality has previously shown utility in older samples (e.g., Solberg et al., 2013) including those with chronic illnesses (e.g., Yu et al., 2015).

Engagement with life. Life engagement was measured using the Life Engagement Test (Scheier et al., 2006). Participants indicated their agreement with six statements regarding how much purpose they perceived in their life (e.g., 'to me, the things I do are all worthwhile') on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The appropriate items were reverse coded, and all items were summed, with higher scores indicating higher life engagement (α ranged between .88 and .90).

Covariates. Consistent with previous studies examining associations of subjective ageing with well-being (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b), all analyses controlled for T1 chronological age, gender (coded as male = 0, female = 1), education (0 = did not complete tertiary education, 1 = did complete tertiary education), and time-varying employment status (0 = in the labour force, 1 = not in the labour force) and mean-centred physical functioning, as previous research has found associations between these variables and the constructs of interest (Brandtstädter & Renner, 1990; Henning et al., 2019; Steptoe et al., 2015). Using the 10-item physical functioning subscale from the RAND health survey (Ware Jr & Sherbourne, 1992), participants were asked to rate the extent to which their health limits them from participating in certain activities (e.g., walking several blocks, carrying groceries) on a 3-point scale with answers ranging from 'no, not limited at

all', to 'yes, limited a lot' (recoded scores range 0-100, with higher scores reflecting better physical functioning, $\alpha = .93$).

As our study intersected coronavirus 2019 (COVID-19) being declared a global pandemic by the World Health Organisation (baseline, July 2020; Wave 2, January 2019; final wave, July 2020), we included a measure assessing increased stress/worry due to COVID-19 in the final assessment (July 2020). Participants indicated which of the listed experiences applied to them (e.g., 'reduction of face-to-face contact with friends and family' or 'increased worry regarding my health'; range 0-7, $M = 3.16$, $SD = 1.66$). See Table 3.1 for the full measure.

3.3.3 Statistical Analysis

To examine associations of AARC with levels (intercepts) and rates of change (slopes) in PWB, a series of multilevel models were fitted. Multilevel models allow examination of longitudinal data comprised of measurement points (Level 1) nested within individuals (Level 2). Average rates of change in PWB outcomes were investigated by fitting unconditional linear growth models which included PWB outcomes as dependent variables and Time modelled at Level 1 as the sample average of Time (in months) elapsed since baseline (measurement 1 = 0, measurement 2 = 6, measurement 3 = 12). Random effects for the intercept were included in each model, and for time (if significantly contributing to model fit), to account for differences in level and slope for PWB outcomes. All available data contributed to growth model estimation via maximum likelihood estimation under the usual data missing-at-random-assumptions.

To generate a composite measure of PWB, the need frustration scale was first reversed, then each outcome variable (need satisfaction, need frustration, vitality, and life engagement) was standardised at each assessment using baseline values for the *M* and *SD*. The standardised scores were then converted to a T-metric ($M = 50$, $SD = 10$), and we took the

Table 3.1.

COVID-19-related Stressors Measure

Please indicate if the following experiences have applied to you since the **COVID-19 virus** was declared a global pandemic on the 11th of March by the World Health Organization. Please select any/all that apply to you
Reduction of face-to-face contact with friends and family
Increased feelings of loneliness
Increased worry regarding work (such as losing my job)
Increased worry regarding income/finances
Increased worry about my housing
Increased worry about my health (including health care costs, accessing healthcare and/or becoming sick)
Increased worry about losing someone I care about
Increased worry about: Other (please specify)
None of the above

mean of the T-scores across all four PWB components at each assessment (range 17.01-64.39; see Linley et al., 2009; Mackinnon & Sherry, 2012).

3.4 Results

3.4.1 Associations of Awareness of Age-related Change with Psychological Well-being - Main Effects

Descriptive statistics and bivariate correlations among key study variables at T1 are provided in Table 3.2. Results of multilevel models testing associations of individual differences in AARC with levels and rates of change in PWB are shown in Table 3.3. Both AARC-gains and AARC-losses were reliably associated with the intercept for overall PWB (Model 1), with individuals with higher AARC-gains and lower AARC-losses reporting greater PWB. compared to those with lower AARC-gains and higher AARC-losses respectively.

In terms of predicting change in PWB over time (associations with the slope), AARC-gains showed associations with overall PWB. Those with higher AARC-gains- although showing substantially higher PWB at the between-person level- also showed marginally steeper rates of decline over the study period. AARC-losses was unrelated to rates of change in the composite PWB measure.

3.4.2 Awareness of Age-related Gains as a Moderator of Associations Between Awareness of Age-related Losses and Psychological Well-being

The interaction term for AARC-gains and AARC-losses showed associations with the intercept for overall PWB. As predicted, while those with higher AARC-losses showed lower levels of PWB, this relationship was weaker among those with higher AARC-gains. To display the nature of this interaction, we plotted predicted values for PWB for hypothetical individuals with different combinations of low (-1 *SD*) and high (+1 *SD*) AARC-gains and

Table 3.2

Descriptive Statistics and Bivariate Correlations Among the Study Variables at Time 1

Variable	*M* (*SD*) or %	1	2	3	4	5	6	7	8	9	10	11
1. Age	67.07 (4.57)	-										
2. Gender (Female)[a]	66.0%	-.003	-									
3. Education (University)[b]	58.4%	.08	-.13**	-								
4. Employment (in the labour force)[c]	42.7%	.24**	.01	-.03	-							
5. Physical functioning[d]	70.96 (26.55)	-.09**	-.10	.15**	-.15**	-						
6. AARC-gains	21.42 (2.89)	-.01	.17**	-.06	-.01	.11*	-					
7. AARC-losses	13.66 (4.67)	.08	.03	-.13**	.14**	-.58**	-.15**	-				
8. Psychological well-being[e]	50.00 (8.77)	.04	.07	-.01	-.10*	.33**	.55**	-.56**	-			
9. Need satisfaction	48.41 (7.80)	.02	.08	-.04	-.13**	.27**	.59**	-.43**	.92**	-		
10. Need frustration	23.98 (8.75)	-.05	-.08	.03	.05	-.27**	-.41**	.47**	-.76**	-.86**	-	
11. Vitality[f]	20.58 (5.65)	.03	.01	.02	0.12*	.41**	.45**	-.62**	.70**	-.85**	-.58**	-
12. Life engagement	24.45 (4.53)	.05	.07	.01	-.05	.22**	.48**	-.46**	.75**	.89**	-.66**	.70**

Note. N = 408 at baseline. AARC = awareness of age-related change, M = mean, SD = standard deviation. [a]0 = male, 1 = female, [b]0 = did not complete tertiary education, 1 = completed tertiary education, [c]0 = in the labour force, 1 = not in the labour force [d]higher values = higher physical functioning, [e]composite measure, [f]vitality was measured on a 5-point scale in the current study: Therefore, the mean for vitality is not comparable to studies where vitality was measured using the standard 7-point scale.

**$p < .01$, *$p < .05$

Table 3.3

Awareness of Age-related Change (Gains and Losses) as Predictors of Psychological Well-being (Composite Measure)

	Psychological Well-being (Composite Measure)							
	Model 1				Model 2			
	Intercept		Slope		Intercept		Slope	
Parameter	Est.	*SE*	Est.	*SE*	Est.	*SE*	Est.	*SE*
Fixed Effects								
Mean intercept/slope	51.90*	0.71	-0.21*	0.06	51.98*	.70	-0.22*	0.06
Control Variables								
Age at T1	0.19*	0.07	0.001	0.01	0.18*	0.06	0.003	0.01
Gender	0.04	0.63	0.04	0.05	0.12	0.62	0.03	0.05
Education	-1.10	0.61	0.03	0.05	-1.10	0.60	0.03	0.05
Employment	-1.01*	0.46	0.01	0.05	-0.99*	0.45	-0.001	0.05
Physical Functioning	0.01	0.01	0.003*	0.001	0.01	0.01	0.003*	0.001
Main Predictors								
AARC-gains	1.02*	0.08	-0.02*	0.01	0.97*	0.08	-0.02*	0.01
AARC-losses	-0.75*	0.06	-0.01	0.01	-0.77*	0.06	-0.01	0.01
AARC-gains × AARC-losses	-	-	-	-	0.05*	0.01	-0.003	0.002
Random Effects								
Variance	25.46*	2.68	0.01	0.09	24.50*	2.63	0.01	0.02
Intercept-slope covariance	0.25	0.16	-	-	0.32	0.15	-	-
Residual	10.80*	0.88	-	-	10.85*	0.89	-	-
Pseudo R^2 Level 1	0.19	-	-	-	0.20	-	-	-
Pseudo R^2 Level 2	0.59	-	-	-	0.60	-	-	-

Note. N = 408 at baseline. AARC = awareness of age-related change, Est. = estimate, SE = standard error. Pseudo R^2 was calculated based on the proportional change in covariance parameters at Levels 1 and 2 (Singer & Willett, 2003).

*p <.05

AARC-losses (see Figure 3.1). No evidence was found suggesting AARC-gains buffered the relationship between AARC-losses and *change* in PWB over time.

3.4.3 Follow-up Analyses

Follow-up analyses showed that the patterns described above for overall PWB were relatively consistent across individual PWB components (see Table 3.4). For main effects, higher PWB was linked to higher AARC-gains and lower AARC-losses consistently across all outcome variables. When predicting change in PWB over time, AARC-gains was associated with need satisfaction and life engagement (but not need frustration or vitality), with those with higher AARC-gains showing overall higher PWB on these indices, but marginally steeper rates of decline (see Figure 3.2). Those with higher AARC-losses showed relative stability in need frustration compared to those with lower AARC-losses, who showed slight decline in need frustration over time (indicating relative increase in PWB; see Figure 3.3). The interaction term for AARC-gains and AARC-losses showed associations with the intercept for need satisfaction, need frustration, and life engagement (but not vitality). Consistent with the PWB composite, higher AARC-losses was associated with lower PWB, but this relationship was weaker among those with higher AARC-gains (See Figure 3.4).

To control for the possible impact COVID-19 may have had for our pattern of findings, we re-ran all aforementioned models with our COVID-19-specific stressor variable (see Section 3.3.2) included as a covariate. Overall, the pattern of results remained consistent.

3.5 Discussion

This research aimed to provide a better understanding of how subjective perceptions of both gains and losses attributed to ageing are associated with PWB in older adulthood. Findings suggest AARC-gains, AARC-losses, and their interaction reliably accounted for between- person differences using a composite measure of PWB. Furthermore, those with

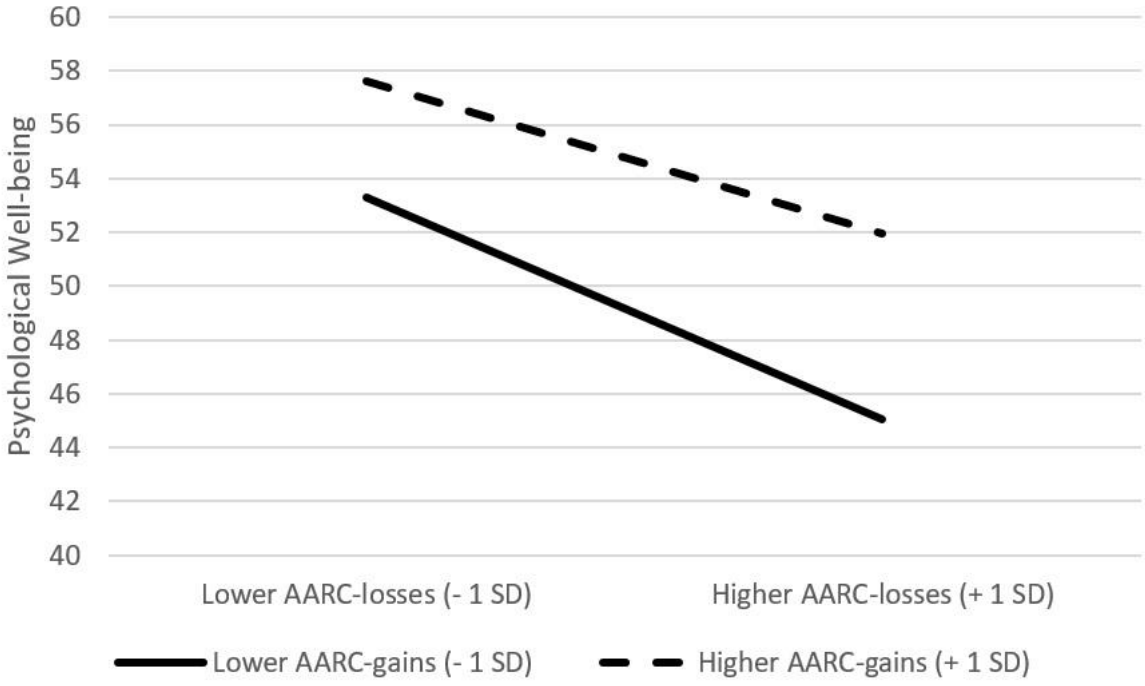

Figure 3.1. Interaction of AARC-gains and AARC-losses in the prediction of psychological well-being. Higher AARC-losses was associated with lower levels of psychological well-being. However, this association was weaker among those with higher AARC-gains.

Table 3.4

Awareness of Age-related Change (Gains and Losses) as Predictors of Psychological Well-being Components

	Need Satisfaction								Need Frustration							
	Model 1				Model 2				Model 1				Model 2			
	Intercept		Slope		Intercept		Slope		Intercept		Slope		Intercept		Slope	
Parameter	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	*SE*	Est.	*SE*	Est.	*SE*	Est.	*SE*
Fixed Effects																
Mean intercept/slope	50.07*	0.68	-0.11	0.06	50.13*	0.67	-0.12	0.06	23.14*	0.84	0.06	0.07	23.05*	0.82	0.06	0.07
Control Variables																
Age at T1	0.12	0.06	-0.001	0.01	0.11	0.06	<0.001	0.01	-0.18*	0.08	-0.001	0.006	-0.17*	0.08	-0.002	0.01
Gender	0.95	0.60	0.01	0.05	0.17	0.59	0.01	0.05	-0.69	0.74	0.02	0.06	-0.79	0.73	0.02	0.06
Education	-1.06	0.58	0.002	0.05	-1.06	0.57	-0.001	0.05	1.21	0.71	0.04	0.06	1.22	0.70	-0.04	0.06
Employment	-1.12*	0.46	-0.004	0.05	-1.10*	0.46	-0.01	0.05	0.13	0.55	<0.001	0.05	0.10	0.54	0.01	0.05
Physical Functioning	0.01	0.01	0.002	0.001	0.01	0.01	0.002*	0.001	-0.02	0.01	-0.001	0.001	-0.01	0.01	-0.002	0.001
Main Predictors																
AARC-gains	1.04*	0.08	-0.02*	0.01	1.00*	0.78	-0.02	0.01	-0.72*	0.09	0.01	0.01	-0.66*	0.09	0.01	0.01
AARC-losses	-0.49*	0.06	-0.01	0.01	-.51*	0.06	0.01	0.01	0.62*	0.07	0.02*	0.01	0.65*	0.07	0.02*	0.01
AARC-gains × AARC-losses	-	-	-	-	0.05*	0.01	-0.003	0.002	-	-	-	-	-0.06*	0.02	0.003	0.002
Random Effects																
Variance	21.41*	2.44	0.02	0.02	20.63*	2.39*	0.01	0.02	35.99*	3.61	0.03	0.03	34.57*	3.53	0.03	0.03-
Intercept-slope covariance	0.30	0.16	-	-	0.36*	0.16	-	-	-0.05	0.22	-	-	0.03	0.21	-	-
Residual	11.75*	0.93	-	-	11.75*	0.93	-	-	14.09*	1.14	-	-	14.12*	1.15	-	-
Pseudo R^2 Level 1	0.15	-	-	-	0.16	-	-	-	0.07	-	-	-	0.08	-	-	-
Pseudo R^2 Level 2	0.55	-	-	-	0.55	-	-	-	0.43	-	-	-	0.44	-	-	-

Table 3.4
Continued

	Vitality								Life Engagement							
	Model 1				Model 2				Model 1				Model 2			
	Intercept		Slope		Intercept		Slope		Intercept		Slope		Intercept		Slope	
Parameter	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Fixed Effects																
Mean intercept/slope	22.50*	0.46	-0.17*	0.04	22.52*	0.46	0.10*	0.04	25.28*	0.42	-0.16*	0.04	25.31*	0.42	-0.16*	0.04
Control Variables																
Age at T1	0.10*	0.04	-0.001	0.003	0.10*	0.04	<0.001	0.003	0.09*	0.04	0.003	0.003	0.09*	0.04	0.003	0.003
Gender	-0.56	0.40	0.003	0.03	-0.54	0.40	-0.001	0.03	0.03	0.37	0.05	0.03	0.06	0.36	0.05	0.03
Education	0.52	0.39	0.02	0.03	-0.52	0.39	0.02	0.03	-0.30	0.35	0.02	0.03	-0.30	0.35	0.02	0.03
Employment	-0.63*	0.32	-0.02	0.03	0.63*	0.32	-0.02	0.03	-0.53	0.29	0.03	0.03	-0.52	0.29	0.02	0.03
Physical Functioning	0.02*	0.01	0.002*	0.001	0.02*	0.01	-.002*	0.001	-0.01	0.01	0.002*	0.001	-0.01	0.01	0.002*	0.001
Main Predictors																
AARC-gains	0.56*	0.05	-0.004	0.01	0.55*	0.05	-0.004	0.01	0.50*	0.05	-0.01*	0.01	0.48*	0.05	-0.01	0.01
AARC-losses	-0.49*	0.04	-0.01	0.01	-0.49*	0.04	0.01	0.01	-0.38*	0.04	0.001	0.004	-0.39*	0.04	0.002	0.004
AARC-gains × AARC-losses	-	-	-	-	0.01	0.01	-0.002	0.001	-	-	-	-	0.02*	0.01	-0.001	0.001
Random Effects																
Variance	9.37*	0.87	-	-	9.39*	0.87	-	-	7.76*	0.91	0.01	0.01	7.54*	0.90	0.01	0.01
Intercept-slope covariance	-	-	-	-	-	-	-	-	0.03	0.07	-	-	0.04	0.06	-	-
Residual	5.62*	0.31	-	-	5.59*	0.31	-	-	4.69*	0.37	-	-	4.72*	0.38	-	-
Pseudo R^2 Level 1	0.14	-	-	-	0.14	-	-	-	0.09	-	-	-	0.09	-	-	-
Pseudo R^2 Level 2	0.62	-	-	-	0.62	-	-	-	0.48	-	-	-	0.49	-	-	-

Notes. N = 408 at Baseline. AARC = awareness of age-related change, Est. = estimate, SE = standard error. Pseudo R^2 was calculated based on the proportional change in covariance parameters at Levels 1 and 2 (Singer & Willett, 2003).

*p <.05

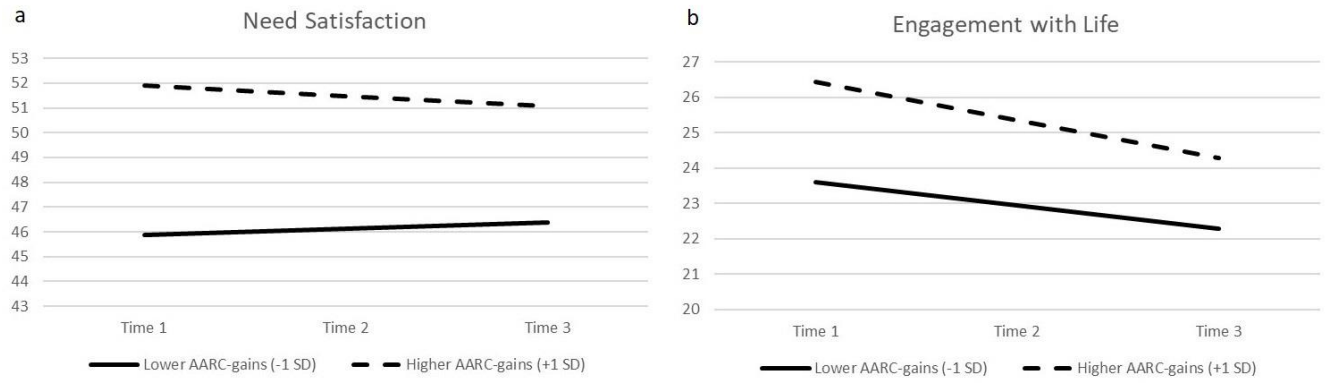

Figure 3.2. Interaction of AARC-gains and Time in the prediction of (a) need satisfaction and (b) engagement with life. Those with higher AARC-gains, while showing higher levels of well-being on these indices at the between-person level- also showed marginally steeper rates of decline over time compared to those with low AARC-gains.

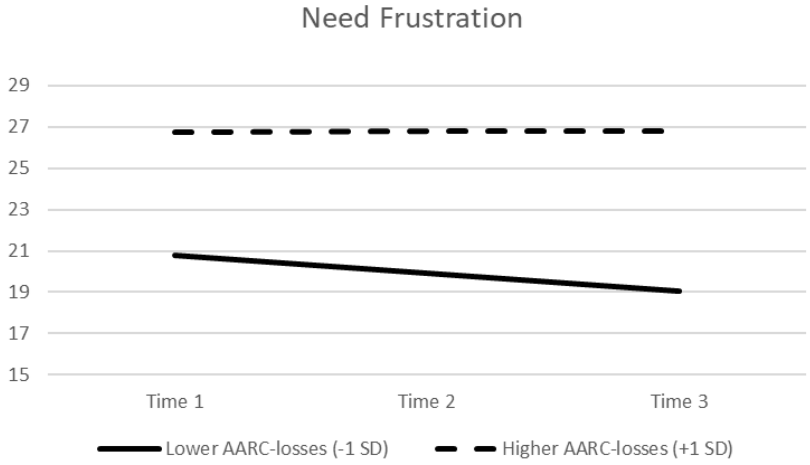

Figure 3.3. Interaction of AARC-losses and Time in the prediction of need frustration. Those higher in AARC-losses showed relative stability in need frustration compared to those with lower AARC-losses who showed slight decline in need frustration over the study period (indicating relative improvements in well-being).

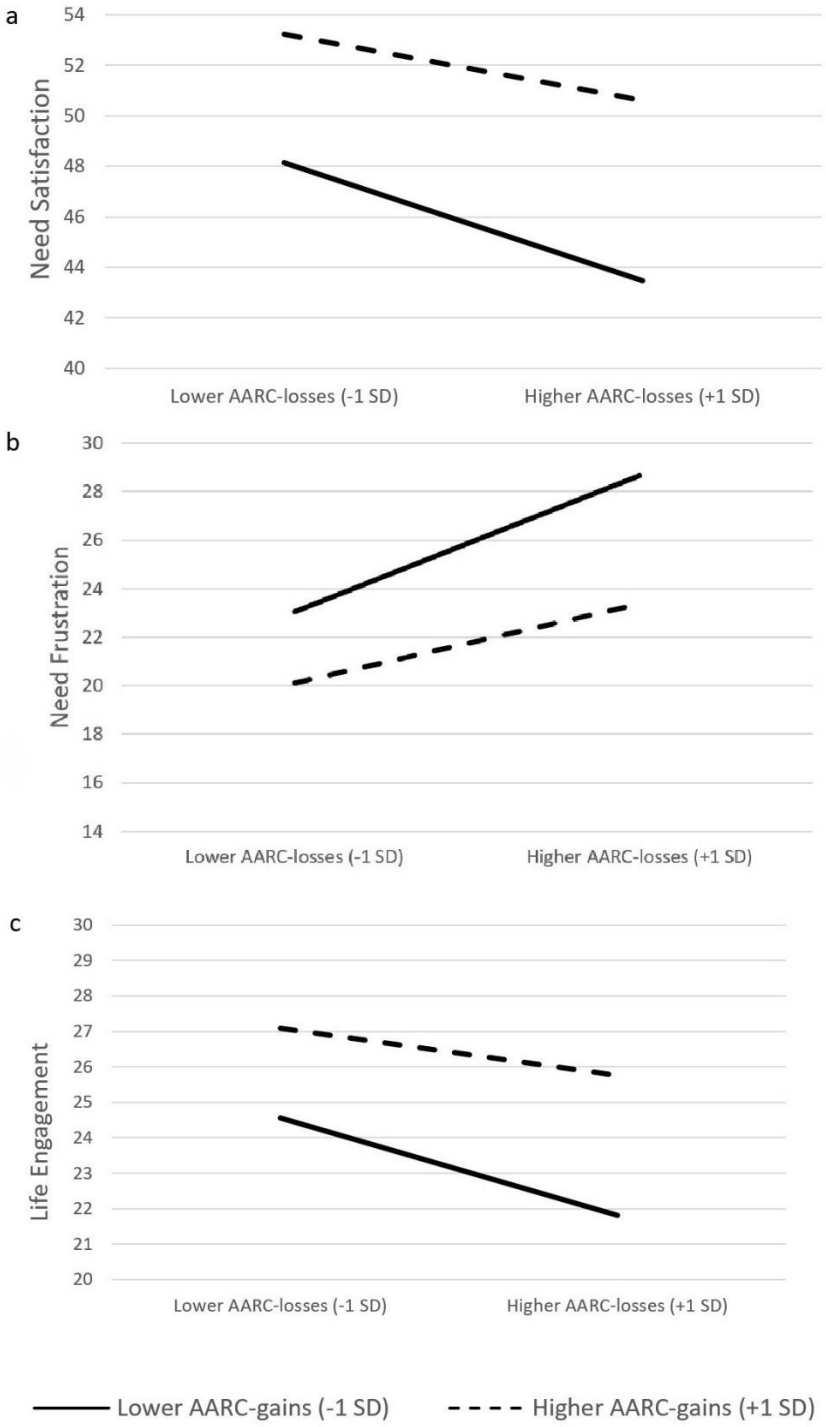

Figure 3.4. Interaction of AARC-gains and AARC-losses in the prediction of (a) need satisfaction, (b) need frustration*, and (c) life engagement. Higher AARC-losses was associated with lower levels of these well-being outcomes. However, this association was weaker among those with higher AARC-gains. *Need frustration showed the opposite pattern of associations, but these findings have similar implications for well-being overall.

higher AARC-gains showed higher PWB overall, but also showed marginally steeper decline in PWB over time.

3.5.1 Awareness of Age-related Change and Associations with Psychological Well-being

Consistent with previous research, findings support that in terms of individual differences, greater well-being is linked to higher AARC-gains and lower AARC-losses. AARC-gains may bring cognizance to older adulthood providing opportunities for growth and development (Diehl & Wahl, 2010). Whereas AARC-losses may compromise well-being by highlighting limited lifetime (Brothers et al. 2016) or undermining self-concept (Diehl & Wahl, 2010), possibly via identification with internalised negative stereotypes regarding ageing (Levy, 2009). Our exploratory follow-up analyses did not reveal any clear differentials in associations of AARC with the individual PWB measures. This suggests that AARC is broadly relevant to processes of need fulfilment and effective functioning in older adulthood, and likely also reflects the substantial degree of conceptual and statistical overlap in our measures.

Overall, AARC showed relatively few associations with change in PWB over time. Those with higher AARC-gains showed relative decline in PWB over the study period compared to those with lower AARC-gains. However, this is unlikely to reflect any causal relationship between AARC-gains and well-being, as those with higher AARC-gains also showed significantly higher levels of PWB compared to those with lower AARC-gains, and extreme scorers are more likely to regress toward the mean over time (Nesselroade et al., 1980). Re-running previous models including standardised scores for both AARC-gains and outcome variables showed that participants one *SD* unit higher in AARC-gains showed only a 0.01 *SD* decrease in PWB, need satisfaction and life engagement per month.

3.5.2 The Interplay Between Awareness of Age-related Gains and Awareness of Age-related Losses and Implications for Between-person Differences in Psychological Well-being

As predicted, at the between-person level, AARC-gains was shown to buffer associations between AARC-losses and individual differences in PWB (for overall PWB, and all individual PWB components except vitality). Overall, while AARC-losses was consistently associated with lower PWB, this association was weaker in the presence of higher AARC-gains. According to Diehl and Wahl (2010), AARC may hinder healthy development if the awareness aligns with purely negative ageing stereotypes (Levy, Slade, Kunkel, & Kasl, 2002). However, AARC-gains may promote identification of opportunities for development and motivate pursuit of meaningful goals (Dutt, Gabrian, & Wahl, 2018b; Wilton-Harding & Windsor, 2021a). Hence, when perceiving positive age-related changes (even in the presence of losses), individuals may retain relatively higher levels of PWB, as perceived gains may reinforce feelings of competence (Ryan & Deci, 2000), self-efficacy (Bandura et al., 1999), or positive self-image (Levy, Slade, Kunkel, & Kasl, 2002) which may act as a motivational force for effective self-regulation (Diehl & Wahl, 2010). It is worth noting that in contrast to some previous studies (e.g., Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018b), AARC-gains and AARC-losses were negatively (albeit weakly) correlated. Further research is needed to establish the consistency of the strength and directionality of relationships between AARC-gains and AARC-losses, especially when using the more recently developed AARC-10 SF (Kaspar et al., 2018).

Despite statistically reliable main effects of both AARC-gains and AARC-losses, their interaction did not predict vitality. Energy levels are often reported to decline in older adulthood (Avlund, 2010), and lower energy is in part captured within the AARC-10 SF scale (Kaspar et al., 2019). Although our results support a possible protective function of AARC-

gains in terms of how people respond to negative aspects of ageing in cognitive-evaluative terms (as reflected by the AARC-gains × AARC-losses interaction consistently predicting the other PWB outcomes), we speculate that protective effects of AARC-gains may be less evident in the case of vitality as this measure more directly taps into physiological aspects of experience that are less subject to change through cognitive reappraisal than other regulatory processes facilitated by AARC-gains described above.

3.5.3 The Interplay Between Awareness of Age-related Gains and Awareness of Age-related Losses and Implications for Longitudinal Changes in Psychological Well-being

There was no evidence to suggest that the interplay of AARC-gains and AARC-losses had implications for *change* in PWB over time. This association may not have been found for several reasons. One possibility is there may not have been sufficient time over the study interval to capture the proposed developmental changes which may occur over years rather than months. Research with longer time intervals is needed to further explore the extent to which AARC-gains may protect well-being in the presence of age-related losses over time. Furthermore, unmeasured confounding variables may exist which could underlie the association between AARC and change in well-being (e.g., neuroticism or age stereotypes). Furthermore, recent research has shown AARC can vary from day-to-day (Neupert & Bellingtier, 2017). Experience sampling methods may be another informative approach when considering AARC and change in well-being, while ruling out personality or environmental variables which are relatively stable over time (Almeida, 2005). Overall, longitudinal studies conducted over varying macro- and micro-time scales are needed to gain further understanding regarding the developmental significance of AARC for well-being in later life.

3.5.4 Limitations and Future Directions

Caution regarding the broad generalisability of the current findings is important for several reasons. First, the time period in which the study was conducted may have been too short to capture meaningful change in well-being. Future research should consider examination of change in well-being over a longer period and/or in samples of oldest-old adults, among whom more significant age-related losses (e.g., P. Baltes & Smith, 2003) may result in stronger associations of AARC with well-being that are detectable over shorter time scales. Better representation of those in late life in studies of AARC would also allow examination of whether possible protective effects of AARC-gains are consistently observable when age-related losses are more common and processes of self-regulation less effective (Gerstorf & Ram, 2009).

Second, the current sample scored relatively high on education and physical functioning, both of which are associated with adaptive ageing (Brandtstädter & Renner, 1990). Individuals with resources such as higher education and better health may subjectively notice more age-related gains but may also be more likely to have a lifestyle conducive to experiencing positive age-related change (such as greater financial stability and ability/opportunity to participate in activities). Furthermore, although internet usage is high among older adults in the United States with 75% of adults aged over 65 years reporting that they use the internet; (Pew Research Centre, 2017), online samples have been found to differ from the general population in certain characteristics related to adaptive ageing. Older adults who participate in online research overall showed higher verbal fluency, depression, and self-rated health and memory compared to a national probability sample (Ogletree & Katz, 2020). Consequently, we advise caution when generalising our findings to non-internet users.

Finally, AARC is an emerging construct, and there are multiple characteristics that may influence AARC itself, as well as how AARC may inform well-being (e.g., personality traits,

age-related stereotypes, chronic illness, depression, loneliness, experiences of ageism). In this study, we controlled for chronological age, gender, education, employment, and physical functioning, but further research is needed to examine if there are additional individual difference characteristics that may have implications for AARC and well-being.

3.5.5 Conclusions

This research adds to the field of subjective ageing by examining combinations of AARC-gains and AARC-losses and the implications for between-person differences and longitudinal changes in well-being. Our findings were generally consistent with those of previous cross-sectional studies, showing that older adults with greater perceptions of age-related gains, and lower perceptions of age-related losses consistently showed higher PWB on a composite measure, and across individual indices. Moreover, our results were consistent with those of emerging research (Wilton-Harding & Windsor, 2021a), suggesting that negative associations of AARC-losses with PWB might be partially offset by high AARC-gains. Future research should focus on the interaction of AARC-gains and AARC-losses predicting well-being across different stages of older adulthood, among older adults from more diverse backgrounds, and using varying time scales.

CHAPTER 4

GOAL RE-ENGAGEMENT AS A MEDIATOR OF LONGITUDINAL ASSOCIATIONS BETWEEN AWARENESS OF AGE-RELATED CHANGE AND PSYCHOLOGICAL WELL-BEING: AN INITIAL EXAMINATION

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Author Contributions

BWH contributed 75% and TDW contributed 25% to the research design, data collection and analysis, and writing and editing of the manuscript, respectively.

4.1 Abstract

Introduction: Although theorised in social gerontological literature, longitudinal links between subjective ageing, self-regulation, and well-being have not previously been examined. The current study considers goal re-engagement as a potential mediator of longitudinal relationships between awareness of age-related change (AARC) and psychological well-being. Overall, we expected positive perceptions of ageing (AARC-gains) would be associated with increases in goal re-engagement and, in turn increases in psychological well-being. On the other hand, we expected that negative perceptions of ageing (AARC-losses) would show the opposite pattern of effects.

Method: A sample of 408 community-dwelling older adults completed three online assessments capturing AARC (gains and losses), goal re-engagement, and developmentally relevant components of psychological well-being over a 12-month period. Complete longitudinal models were conducted using structural equation modelling in Mplus to test for mediation.

Results: In contrast to predictions, goal re-engagement was not shown to mediate longitudinal associations between AARC and psychological well-being. However, a significant mediation relationship was found suggesting that AARC-gains may mediate relationships between psychological well-being and goal re-engagement. No significant mediation results were evident for AARC-losses.

Discussion: Further research using varying time scales is needed to establish longitudinal links and investigate potential feedback loops between AARC, goal adjustment, and well-being.

4.2 Introduction

How individuals perceive their own ageing is an important factor to consider when examining well-being in later life (Diehl et al., 2021). Greater overall well-being has been associated with higher perceptions of positive, and lower perceptions of negative age-related change (Sabatini, Silarova, et al., 2020). In the current study we test Diehl and Wahl's (2010) proposition that relationships between awareness of age-related change (AARC) and psychological well-being (PWB) are mediated by self-regulation of goals (operationalised here in terms of tendencies toward goal re-engagement in response to blocked goals).

4.2.1 Awareness of Age-related Change and Adaptation in Older Adulthood

Awareness of the passing of time and growing older is an important subjective experience during adulthood which plays a significant role in influencing cognition, emotion, and behaviour (Diehl & Wahl, 2010; Fry & Keyes, 2010). Relatively recently in the subjective ageing literature, Diehl and Wahl (2010) developed the construct of AARC, which refers to 'a person's state of awareness that his or her behaviour, level of performance, or way of experiencing life has changed as a consequence of having grown older' (p. 342). In contrast to previous subjective ageing measures, AARC distinguishes between positive (AARC-gains) and negative (AARC-losses) dimensions of subjective ageing. Greater levels of subjective, psychological, and physical well-being have been linked to higher AARC-gains and lower AARC-losses (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a; Sabatini, Silarova, et al., 2020).

In Diehl and Wahl's (2010) original model, self-regulation of goals is implicated as a possible mediator of relationships between AARC and well-being. As a specific form of self-awareness, AARC is presumed to inform intentions and actions surrounding goals and goal striving (Carver, 2004). Previously, more frequent use of adaptive goal regulation strategies has been linked to higher AARC-gains and lower AARC-losses (Dutt, Gabrian, & Wahl,

2018b; Wilton-Harding & Windsor, 2021a). AARC-gains may foster feelings of self-efficacy (Bandura et al., 1999) and competence (Ryan & Deci, 2000) or encourage engagement in activities which support well-being (Windsor et al., 2021). Conversely, AARC-losses may threaten feelings of self-efficacy and self-representation (Diehl & Wahl, 2010), which may limit individuals' motivation to engage in more agentic activities (Dutt, Gabrian, & Wahl, 2018b), and over time result in reduced feelings of purpose and well-being (Wrosch & Scheier, 2020).

Diehl and Wahl's (2010) conceptual model is consistent with empirical research which demonstrates associations between the pursuit and attainment of goals and patterns of successful development and well-being (Barlow et al., 2020; Wrosch & Scheier, 2020). Older adults often effectively adjust personal goals to maximise opportunities for developmental gains and reduce occurrence of developmental losses (P. Baltes et al., 2007; Brandtstädter & Renner, 1990; Heckhausen & Schulz, 1995; Wrosch & Scheier, 2003). According to Diehl and Wahl (2010), AARC may prompt processes of personal meaning-making and self-regulation, with individuals contrasting their current performance in a certain domain with their past performance or the performances of others, which in turn informs processes of goal adjustment (Wrosch et al., 2007) in efforts to stabilise one's sense of self (Greve & Wentura, 2003). For example, in older adulthood, one may choose to take a step back from participating in physically demanding activities and choose to pursue new goals (e.g., participating in new activities, focusing on personal relationships). Detaching from, and devaluing unattainable goals (goal disengagement), and redirecting energy and resources toward achievable goals (goal re-engagement) are both important self-regulatory processes (Wrosch, Scheier, Carver, & Schulz, 2003) which increase in their importance in later life, due to the shifting balance of gains and losses (Brandtstädter & Renner, 1990).

In the present study, we specifically focus on goal *re-engagement* (the identification and pursuit of new goals; Wrosch, Scheier, Carver, & Schulz, 2003). While goal disengagement may often represent an adaptive response to blocked goals (Brandtstädter & Renner, 1990), it could also be indicative of low motivation or unfulfilled potential when activated routinely or prematurely (Wortman & Brehm, 1975). Furthermore, levels of subjective well-being are particularly low among those who report both high goal disengagement and lower tendencies toward goal re-engagement (Wrosch, Scheier, Carver, & Schulz, 2003). Hence, when considered outside of the context of specific blocked goals or resource limitations, trait-like tendencies toward goal disengagement may not necessarily represent a self-regulatory strength.

In contrast, goal re-engagement involves identification and pursuit of new, attainable goals in the face of blocked goals, more directly facilitating opportunities for continued growth and development (Brandtstädter & Rothermund, 2002). We therefore argue that of the two self-regulation components discussed here (goal disengagement and goal re-engagement), goal re-engagement may more consistently represent tendencies toward using adaptative self-regulatory processes. Additionally, goal re-engagement is more strongly related to components of positive well-being than goal disengagement (with goal disengagement being more strongly linked to reduced negative indicators of well-being such as depression; Barlow et al., 2020). Previous research has shown that AARC-gains is positively, and AARC-losses is negatively associated with both goal re-engagement (Wilton-Harding & Windsor, 2021a), and tenacious goal pursuit (conceptually similar to goal re-engagement; Dutt, Gabrian, & Wahl, 2018b). The current study extends on previous cross-sectional research by considering longitudinal associations between AARC and well-being, and whether these associations are mediated by goal re-engagement. Specifically, we used longitudinal mediation (Jose, 2016) to examine temporal relationships between key

constructs measured at three timepoints to test whether AARC predicts change in goal re-engagement, which in turn predicts change in PWB.

In choosing outcome measures representing well-being in older adulthood, we were initially guided by Diehl and Wahl's (2010) original AARC model, which specifies PWB as a major outcome of AARC. We focused on a composite measure of PWB which consists of developmentally relevant components; life engagement, subjective vitality, and basic psychological need satisfaction and frustration (which were also examined individually in follow-up analyses).

Life engagement refers to the purpose an individual perceives in their life, measured by their subjective engagement in meaningful and valued activities (Scheier et al., 2006), and is explicitly specified as a major outcome of AARC (Diehl & Wahl, 2010). Vitality relates to subjective energy, which is an important resource for adaptation in later life (Cardini & Freund, 2020). Additionally, and in line with self-determination theory (Ryan & Deci, 2000), we considered satisfaction and frustration of basic psychological needs for autonomy (the feeling that one has choices in their life), competence (the feeling of being effective in one's own life) and relatedness (a sense of belonging and connection to others). While satisfaction of these needs is proposed to be consistently important for well-being across the lifespan (Ryan & Deci, 2000), meeting certain needs may become increasingly difficult in older adulthood due to declines in energy or resources (e.g., social status and physical health; Coleman, 2000). Our analysis revealed substantial intercorrelations among PWB indicators (*r*s at baseline ranged from -0.58 to 0.89). Hence, consistent with Brothers et al. (2016) we base our main analysis on a composite measure of PWB, however we also report results for the individual PWB indicators.

Overall, we aimed to further understand *how* AARC may influence PWB in older adulthood, by considering goal re-engagement as a possible mediator. Overall, we expected

that higher AARC-gains would be associated with increases in goal re-engagement, which would in turn be associated with increases in PWB. Conversely, we expected that higher AARC-losses would be associated with decreases in goal re-engagement, which would in turn be associated with decreases in PWB.

4.3 Method

4.3.1 Study Design and Participants

Following approval from the Institutional Research Ethics Committee, an advertisement was placed on CloudResearch, an online crowdsourcing platform (Litman et al., 2017), inviting American workers who met eligibility criteria (aged 60 years and over, completed >100 previous studies, with job approval ratings greater than 95%) to participate in a 15-minute online study focused on coping and well-being across the lifespan. Participants (N = 408) were invited to complete follow-up surveys approximately 6 (N = 361), and 12 (N = 311) months later.

At T1, participants were aged between 60 and 88 years (M = 67.07, SD = 4.57). Just under two-thirds (65.9%) of participants were female (34.1% male, 0% non-binary), and 53.5% were retired. Over half of participants reported completion of tertiary education (58.3%), 49.6% were partnered, and 90% identified as Caucasian (5% African American, 2% Asian American, 3% other). In the absence of widely established and accessible methods for power calculations for longitudinal mediation in the structural equation modelling context, our sample size considerations were based on broad judgements about sample size determination for longitudinal mediation (Pan et al., 2018). Although our methods of analysis are not directly comparable (Pan and colleagues focused on longitudinal mediation using multi-level modelling, while we used structural equation modelling), Pan et al.'s (2018) power tables suggest an indirect effect comprised of small effects for $a + b$ mediation paths

was detectable with 80% power with three measurement occasions and a moderate within-subjects correlation with a sample size approaching 400.

4.3.2 Measures

Awareness of age-related change. The AARC-10 SF (Kaspar et al., 2019) was used to assess perceptions of ageing across two subscales (AARC-gains and AARC-losses). Participants responded to items regarding how their life may have changed due to growing older (e.g., '…I have more experience and knowledge to evaluate things and people'). Scores for each subscale were summed, with higher scores reflecting greater AARC-gains and AARC-losses, respectively. Cronbach's α ranged between .69 and .74 for AARC-gains, and between .82 and .84 for AARC-losses across the three timepoints.

Goal adjustment. Using the six-item goal re-engagement subscale from the Goal Adjustment Scale (Wrosch, Scheier, Carver, & Schulz, 2003), participants rated their agreement with statements regarding how they respond when they have to stop pursuing an important goal ('I convince myself that I have other meaningful goals to pursue', 'I start working on other new goals', 'I think about other new goals to pursue', 'I seek other meaningful goals', 'I tell myself that I have a number of other new goals to draw upon', and 'I put effort toward other meaningful goals'). Scores were summed, with higher scores reflecting higher goal re-engagement tendencies (α range = .84-.87).

Engagement with life. With the Life Engagement Test (Scheier et al., 2006), participants rated their agreement with six statements regarding how much purpose they perceived in their life (e.g., 'I value my activities a lot') on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Appropriate items were reverse coded, then all items summed. Overall, higher scores indicated greater engagement with life (α range = .88-.90).

Vitality. Using the Subjective Vitality Scales (Bostic et al., 2000; Ryan & Frederick, 1997), participants indicated their agreement to six statements concerning their energy (e.g.,

'I look forward to each new day'). Scores were summed, with higher scores reflecting greater subjective vitality (α range = .92-.93).

Need satisfaction and need frustration. The Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015) consisted of two 12-item subscales measuring both satisfaction (e.g., 'I feel a sense of choice and freedom in the things I undertake') and frustration (e.g., 'my daily activities feel like a chain of obligations') of basic psychological needs for autonomy, competence, and relatedness. Scores from each subscale were summed, with higher scores indicating greater need satisfaction and need frustration, respectively (need satisfaction α range = .91-.92, need frustration α range = .89-.90).

4.3.3 Statistical Analysis

As noted above, our measures of PWB were substantially intercorrelated, thus we based our main analysis on a composite measure. To generate the composite, the need frustration scale was reversed (so that higher scores corresponded to higher PWB), then each outcome variable (life engagement, vitality, need satisfaction, and need frustration) was standardised at each assessment using baseline values for the *M* and *SD*. The standardised scores were then converted to a T-metric (*M* = 50, *SD* = 10), and we took the mean of the T-scores across all four PWB components at each assessment (range = 17.01 -64.39; Linley et al., 2009; Mackinnon & Sherry, 2012).

Structural equation modelling with observed variables was conducted in Mplus Version 8 to assess associations and statistical mediation among AARC, goal re-engagement, and PWB. Six possible longitudinal mediation models were examined (T1 AARC > T2 Well-being > T3 Goal re-engagement; T1 AARC > T2 Goal re-engagement > T3 Well-being; T1 Goal re-engagement > T2 AARC > T3 Well-being; T1 Goal re-engagement > T2 Well-being > T3 AARC; T1 Well-being > T2 Goal re-engagement > T3 AARC; T1 Well-being > T2 AARC > T3 Goal re-engagement). This modelling technique allows insight into all possible

longitudinal pathways between key variables to allow for a more complete understanding of the temporal order of associations by evaluating the strength of the product of the *a* and *b* mediation paths (Jose, 2016). Figure 4.1 shows the complete longitudinal mediation model tested in the present analysis. Following Hoyle and Panter (1995), several indices were used to examine model fit, including the root mean square error of approximation (RMSEA; where values lower than 0.06 reflect good fit), the comparative model fit index (CFI; where values greater than 0.95 reflect good fit), and the chi-square test of model fit (where low, non-significant values indicate good fit). Full mediation models were adjusted for chronological age, gender (male = 0, female = 1), education (0 = did not complete tertiary education, 1 = did complete tertiary education), and physical functioning due to previous associations with subjective ageing, goal adjustment, and well-being (Boerner, 2004; Brandtstädter & Renner, 1990; Steptoe et al., 2015). Physical functioning was measured with the 10-item physical functioning subscale from the RAND health survey (M = 70.96, SD = 26.55, range 0-100, with higher scores reflecting better physical functioning; Ware Jr & Sherbourne, 1992). All models were run with 10,000 bootstrap samples. Missing data (11.8% of total data set) were handled with the full information maximum likelihood function.

4.4 Results

Descriptive statistics of key study variables are reported in Table 4.1. Examining structural pathways and indirect effects, no evidence was found for the hypothesised relationship of goal re-engagement mediating associations between AARC and PWB. However, AARC-gains was found to mediate the association between PWB and goal re-engagement (as the 95% confidence intervals for the indirect effect did not cross zero). This finding was consistent for the PWB composite, life engagement, need satisfaction, and need frustration, but not vitality. Tables 4.2 (AARC-gains) and 4.3 (AARC-losses) provide the indirect effects [*a*b*], and path coefficients for the PWB composite while accounting for all

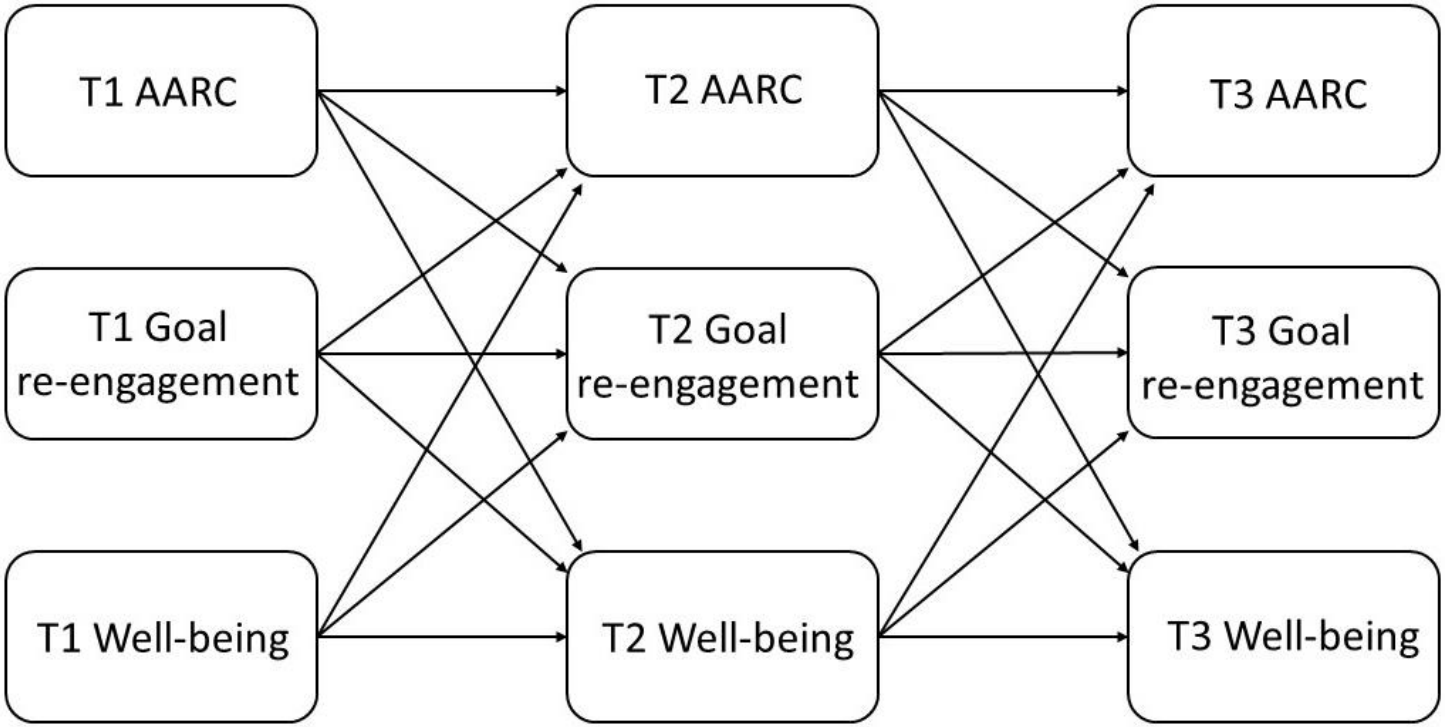

Figure 4.1. Complete longitudinal mediation model.

Notes. Only paths between contiguous variables are displayed here. Not shown in the figure but computed with Mplus are estimations of covariances among variables at T1, and among residuals at both T2 and T3. All possible T1 to T3 paths are estimated in the model but are not displayed here, for graphical clarity. AARC = awareness of age-related change

Table 4.1

Descriptive Statistics of Key Study Variables Across the Three Study Time Points

	M (*SD*) or %		
	T1 (*N* = 408)	T2 (*N* = 361)	T3 (*N* = 311)
Age	67.07 (4.57)		
Gender (female)[a]	66.0%		
Education (university)	58.4%		
Physical functioning[b]	70.96 (26.55)		
AARC-gains	21.42 (2.89)	21.35 (2.93)	21.33 (2.87)
Goal re-engagement	22.37 (4.50)	21.78 (4.86)	21.39 (4.74)
Psychological well-being[c]	50.00 (8.77)	49.70 (9.34)	49.86 (9.25)
Life engagement	24.45 (4.53)	24.27 (4.58)	24.23 (4.61)
Vitality[d]	20.58 (5.65)	20.52 (5.79)	20.16 (5.77)
Need satisfaction	48.41 (7.80)	48.22 (8.40)	48.45 (8.51)
Need frustration	23.98 (8.75)	23.79 (8.90)	22.76 (9.14)

Note. T1 = July 2019, T2 = January 2020, T3 = July 2020, *M* = mean, *SD* = standard deviation, AARC = awareness of age-related change. [a]0 = male, 1 = female, [b]higher values = higher physical functioning, [c]composite measure, [d]vitality was measured on a 5-point scale in the current study: Therefore, the mean for vitality is not comparable to studies where vitality was measured using the standard 7-point scale.

Table 4.2

Unstandardised Structural Equation Model Results for Complete Longitudinal Mediation Analysis for Awareness of Age-related Gains, Goal Re-engagement, and Psychological Well-being (Composite Score)

Psychological well-being (composite score)	*Est. (SE)*	*95% CI*	*a* path	*b* path
T1 AARC-gains > T2 Psychological well-being > T3 Goal re-engagement	<0.001 (0.01)	-0.01, 0.02	-0.14	-0.002
T1 AARC-gains > T2 Goal re-engagement > T3 Psychological well-being	-0.01 (0.01)	-0.04, 0.01	0.05	-0.09
T1 Goal re-engagement > T2 AARC-gains > T3 Psychological well-being	<0.001 (0.004)	-0.01, 0.01	0.02	<0.001
T1 Goal re-engagement > T2 Psychological well-being > T3 AARC-gains	0.001 (0.002)	-0.001, 0.01	0.06	0.02
T1 Psychological well-being > T2 Goal re-engagement > T3 AARC-gains	0.003 (0.003)	-0.002, 0.01	0.11*	0.03
T1 Psychological well-being > T2 AARC-gains > T3 Goal re-engagement	**0.02 (0.01)**	<0.001, 0.04	0.09*	0.18

Note. N = 408 at baseline. AARC = awareness of age-related change, *Est.* = estimate of indirect effect[*a*b*], *SE* = standard error; *CI* = confidence interval. Estimates in boldface indicate significant longitudinal mediation.

Table 4.3

Unstandardised Structural Equation Model Results for Complete Longitudinal Mediation Analysis for Awareness of Age-related Losses, Goal Re-engagement, and Psychological Well-being (Composite Score)

Psychological well-being (composite score)	*Est. (SE)*	*95% CI*	*a* path	*b* path
T1 AARC-losses > T2 Psychological well-being > T3 Goal re-engagement	-0.002 (0.05)	-0.02, 0.004	-0.08	0.02
T1 AARC-losses > T2 Goal re-engagement > T3 Psychological well-being	-0.01 (0.01)	-0.03, 0.004	0.07	-0.09
T1 Goal re-engagement > T2 AARC-losses > T3 Psychological well-being	0.003 (0.01)	-0.002, 0.02	0.04	0.07
T1 Goal re-engagement > T2 Psychological well-being > T3 AARC-losses	-0.002 (0.003)	-0.01, 0.002	0.05	-0.03
T1 Psychological well-being > T2 Goal re-engagement > T3 AARC-losses	0.002 (0.01)	-0.01, 0.01	0.14*	0.01
T1 Psychological well-being > T2 AARC-losses > T3 Goal re-engagement	0.003 (0.01)	-0.01, 0.02	-0.09*	-0.03

Note. N = 408 at baseline. AARC = awareness of age-related change, *Est.* = estimate of indirect effect[*a*b*], *SE* = standard error; *CI* = confidence interval. Estimates in boldface indicate significant longitudinal mediation.

possible orders of the three key variables as shown in Figure 4.1 (see Tables 4.4 and 4.5 for results for the individual PWB components). The nature of associations was such that higher PWB at Time 1 predicted increases in AARC-gains at Time 2, which in turn predicted increases in goal re-engagement at Time 3. While the indirect effect was statistically reliable, the *b* path linking T2 AARC-gains with goal re-engagement fell short of significance in the PWB composite model (although T2 AARC-gains did reliably predict T3 need satisfaction and T3 need frustration as shown in Table 4.4). No significant mediation results were evident for AARC-losses. Table 4.6 provides the fit indices for each model. See Figures 4.2 (AARC-gains) and 4.3 (AARC-losses) for longitudinal associations between key variables.

4.5 Discussion

To our knowledge, this is the first study to examine potential longitudinal links between AARC, processes of self-regulation (operationalised here as goal re-engagement), and well-being, as proposed in Diehl and Wahl's (2010) original model. Overall, we found no evidence for the hypothesised mediating role of goal re-engagement in longitudinal associations between AARC (gains or losses) and PWB. The proposed pattern of associations may not have been evident for several reasons. One possibility is there may not have been enough time between measurement occasions to capture longer-term developmental changes (Jose, 2016), and it may be more gradual processes of subjective ageing and self-regulatory changes that are reflected in Diehl and Wahl's (2010) model. Alternatively, AARC has recently been found to vary significantly from day-to-day (Neupert & Bellingtier, 2017). Hence, it is also possible that processes linking AARC to subsequent goal adjustment strategies may be better captured over shorter time scales. Similarly, the pursuit and attainment of personal goals may have more immediate implications for well-being, which may not have been adequately captured with the current study design. Future studies may

Table 4.4

Unstandardised Structural Equation Model Results for Complete Longitudinal Mediation Analysis for Awareness of Age-related Gains, Goal Re-engagement, Individual Psychological Well-being Components

Psychological well-being component	*Est. (SE)*	*95% CI*	*a* path	*b* path
Engagement with life				
T1 AARC-gains > T2 Engagement with life > T3 Goal re-engagement	-0.001 (0.01)	-0.02, 0.01	0.03	-0.02
T1 AARC-gains > T2 Goal re-engagement > T3 Engagement with life	-0.001 (0.01	-0.02, 0.01	0.09	-0.01
T1 Goal re-engagement > T2 AARC-gains > T3 Engagement with life	<0.001 (0.003)	-0.01, 0.004	0.03	-0.01
T1 Goal re-engagement > T2 Engagement with life > T3 AARC-gains	0.003 (0.003)	-0.001, 0.01	0.07	0.04
T1 Engagement with life > T2 Goal re-engagement > T3 AARC-gains	0.01 (0.01)	-0.003, 0.02	0.19*	0.03
T1 Engagement with life > T2 AARC-gains > T3 Goal re-engagement	**0.03 (0.02)**	**0.002, 0.06**	0.14*	0.18
Vitality				
T1 AARC-gains > T2 Vitality > T3 Goal re-engagement	-0.003 (0.01)	-0.03, 0.01	-0.05	0.01
T1 AARC-gains > T2 Goal re-engagement > T3 Vitality	0.003 (0.01)	-0.02, 0.003	0.09	-0.04
T1 Goal re-engagement > T2 AARC-gains > T3 Vitality	0.003 (0.04)	-0.002, 0.02	0.09	0.06
T1 Goal re-engagement > T2 Vitality > T3 AARC-gains	0.001 (0.01)	-0.01, 0.01	0.17*	0.01
T1 Vitality > T2 Goal re-engagement > T3 AARC-gains	0.01 (0.01)	-0.002, 0.02	0.18*	0.04
T1 Vitality > T2 AARC-gains > T3 Goal re-engagement	0.01 (0.01)	-0.002, 0.03	0.09*	0.14
Need satisfaction				
T1 AARC-gains > T2 Need satisfaction > T3 Goal re-engagement	<0.001 (0.01)	-0.01, 0.01	-0.02	-0.02
T1 AARC-gains > T2 Goal re-engagement > T3 Need satisfaction	-0.01 (0.01)	-0.06, 0.004	0.10	0.12
T1 Goal re-engagement > T2 AARC-gains > T3 Need satisfaction	0.001 (0.01)	-0.01, 0.02	0.03	0.03
T1 Goal re-engagement > T2 Need satisfaction > T3 AARC-gains	<0.001 (0.001)	-0.01, 0.04	0.01	0.01
T1 Need satisfaction > T2 Goal re-engagement > T3 AARC-gains	0.002 (0.003)	-0.001, 0.01	0.07	0.03
T1 Need satisfaction > T2 AARC-gains > T3 Goal re-engagement	**0.02 (0.01)**	**0.003, 0.04**	0.08*	0.20*
Need frustration				
T1 AARC-gains > T2 Need frustration > T3 Goal re-engagement	<0.001 (0.004)	-0.01, 0.01	0.02	0.02
T1 AARC-gains > T2 Goal re-engagement > T3 Need frustration	0.001 (0.01)	-0.02, 0.03	0.13	0.01
T1 Goal re-engagement > T2 AARC-gains > T3 Need frustration	-0.003 (0.01)	-0.02, 0.01	0.05	-0.05
T1 Goal re-engagement > T2 Need frustration > T3 AARC-gains	<0.001 (0.002)	-0.002, 0.01	-0.02	0.02
T1 Need frustration > T2 Goal re-engagement > T3 AARC-gains	-0.002 (0.002)	-0.01, 0.001	0.07*	0.03
T1 Need frustration > T2 AARC-gains > T3 Goal re-engagement	**-0.01 (0.01)**	**-0.03, -0.001**	-0.06*	0.19*

Note. N = 408 at baseline. AARC = awareness of age-related change, *Est.* = estimate of indirect effect [*a*b*], SE = standard error, CI = confidence interval, Estimates in boldface indicate significant longitudinal mediation.

Table 4.5

Unstandardised Structural Equation Model Results for Complete Longitudinal Mediation Analysis for Awareness of Age-related Losses, Goal Re-engagement, and Individual Psychological Well-being Components

Psychological well-being component	*Est. (SE)*	*95% CI*	*a* path	*b* path
Engagement with life				
T1 AARC-losses > T2 Engagement with life > T3 Goal re-engagement	-0.001 (0.004)	-0.02, 0.01	-0.05	-0.06
T1 AARC-losses > T2 Goal re-engagement > T3 Engagement with life	<0.001 (0.003)	-0.01, 0.003	0.04	-0.01
T1 Goal re-engagement > T2 AARC-losses > T3 Engagement with life	<0.001 (0.002)	-0.002, 0.01	0.01	0.04
T1 Goal re-engagement > T2 Engagement with life > T3 AARC-losses	-0.004 (0.004)	-0.02, 0.001	0.05	-0.06
T1 Engagement with life > T2 Goal re-engagement > T3 AARC-losses	0.003 (0.01)	-0.01, 0.02	0.22*	0.01
T1 Engagement with life > T2 AARC-losses > T3 Goal re-engagement	0.01 (0.01)	-0.01, 0.03	0.11*	-0.04
Vitality				
T1 AARC-losses > T2 Vitality > T3 Goal re-engagement	-0.01 (0.01)	-0.05, 0.001	0.12	0.11
T1 AARC-losses > T2 Goal re-engagement > T3 Vitality	-0.003 (0.01)	-0.02, 0.003	0.09	-0.03
T1 Goal re-engagement > T2 AARC-losses > T3 Vitality	0.001 (0.003)	-0.002, 0.01	0.04	0.03
T1 Goal re-engagement > T2 Vitality > T3 AARC-losses	-0.01 (0.01)	-0.03, 0.003	0.17*	-0.05
T1 Vitality > T2 Goal re-engagement > T3 AARC-losses	0.002 (0.01)	-0.01, 0.02	0.23*	0.01
T1 Vitality > T2 AARC-losses > T3 Goal re-engagement	-0.004 (0.01)	-0.03, 0.02	-0.17*	0.02
Need satisfaction				
T1 AARC-losses > T2 Need satisfaction > T3 Goal re-engagement	-0.001 (0.01)	-0.02, 0.01	0.16	0.01
T1 AARC-losses > T2 Goal re-engagement > T3 Need satisfaction	<0.001 (0.01)	-0.02, 0.02	-0.003	-0.12
T1 Goal re-engagement > T2 AARC-losses > T3 Need satisfaction	<0.001 (0.003)	-0.01, 0.01	0.02	0.01
T1 Goal re-engagement > T2 Need satisfaction > T3 AARC-losses	<0.001 (0.002)	-0.004, 0.003	0.001	-0.02
T1 Need satisfaction > T2 Goal re-engagement > T3 AARC-losses	<0.001 (0.003)	-0.01, 0.01	0.09*	0.002
T1 Need satisfaction > T2 AARC-losses > T3 Goal re-engagement	0.003 (0.01)	-0.01, 0.02	-0.07*	-0.04
Need frustration				
T1 AARC-losses > T2 Need frustration > T3 Goal re-engagement	0.002 (0.01)	-0.01, 0.02	0.15	0.01
T1 AARC-losses > T2 Goal re-engagement > T3 Need frustration	<0.001 (0.01)	-0.01, 0.01	0.02	0.01
T1 Goal re-engagement > T2 AARC-losses > T3 Need frustration	<0.001 (0.004)	-0.01, 0.01	-0.001	0.06
T1 Goal re-engagement > T2 Need frustration > T3 AARC-losses	<0.001 (0.002)	-0.01, 0.004	-0.01	0.02
T1 Need frustration > T2 Goal re-engagement > T3 AARC-losses	<0.001 (0.003)	-0.01, 0.01	-0.09*	0.001
T1 Need frustration > T2 AARC-losses > T3 Goal re-engagement	-0.004 (0.01)	-0.02, 0.004	0.06*	0.06

Note. N = 408 at baseline. AARC = awareness of age-related change, *Est.* = estimate of indirect effect [*a***b*], SE = standard error, CI = confidence interval, Estimates in boldface indicate significant longitudinal mediation.

Table 4.6

Model Fit Indices for Mediation Models

Outcome	AARC-gains			AARC-losses		
	RMSEA	*CFI*	*Chi-square (p-value)*	*RMSEA*	*CFI*	*Chi-square (p-value)*
Psychological well-being (composite measure)	0.035*	0.999*	8.92 (.178)*	0.051*	0.998*	12.26 (.056)*
Life engagement	<0.001*	1.00*	4.91 (.056)*	0.023*	0.999*	7.34 (0.290)*
Vitality	0.070	0.993*	17.47 (.008)	0.064	0.996*	15.93 (.014)
Need satisfaction	0.055*	0.997*	13.28 (.004)	0.040*	0.998*	9.83 (.131)*
Need frustration	<0.001*	1.00*	3.40 (.760)*	0.032*	0.999*	8.43(.208)*

Note. N = 408 at baseline. *RMSEA* = root mean square error of approximation, *CFI* = comparative model fit index. *indicates good model fit according to Hoyle and Panter's (1995) criteria.

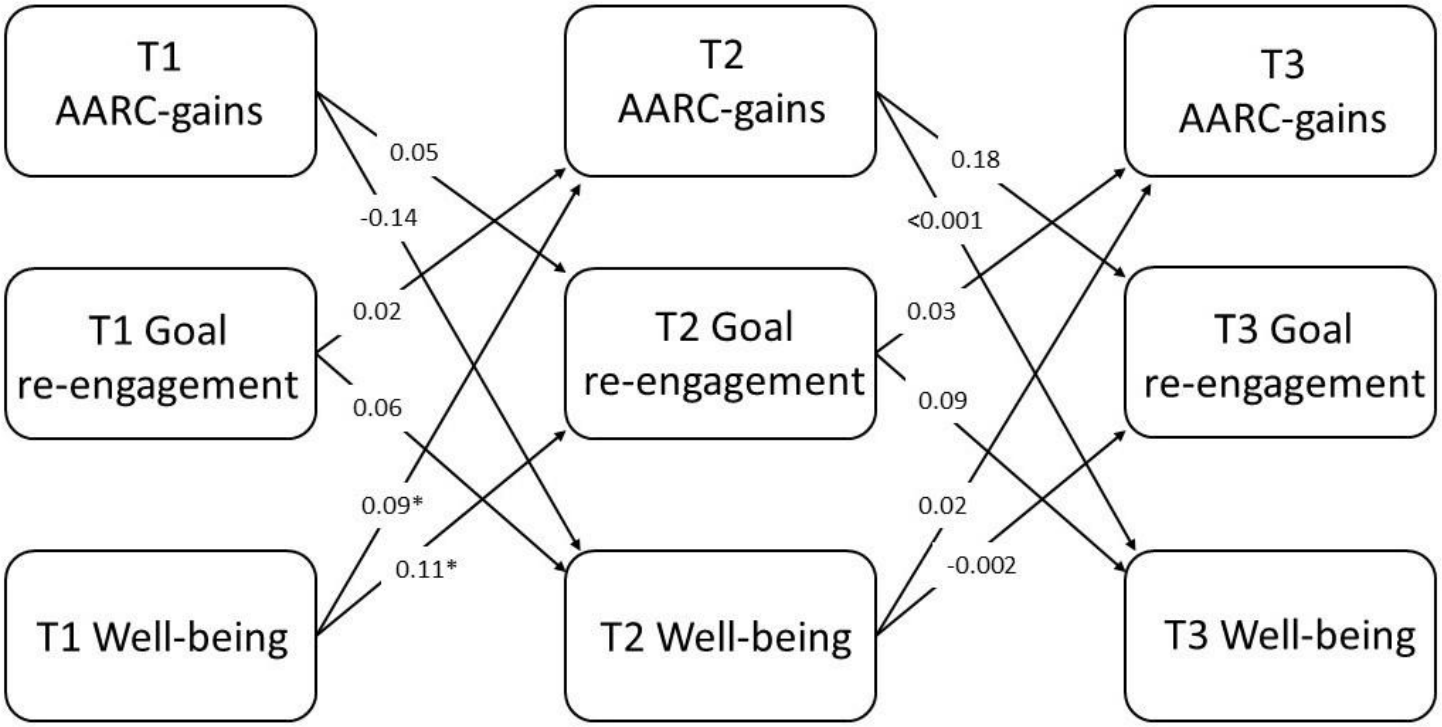

Figure 4.2. Longitudinal associations between AARC-gains, goal re-engagement, and psychological well-being, data shown are coefficients, *p <.05

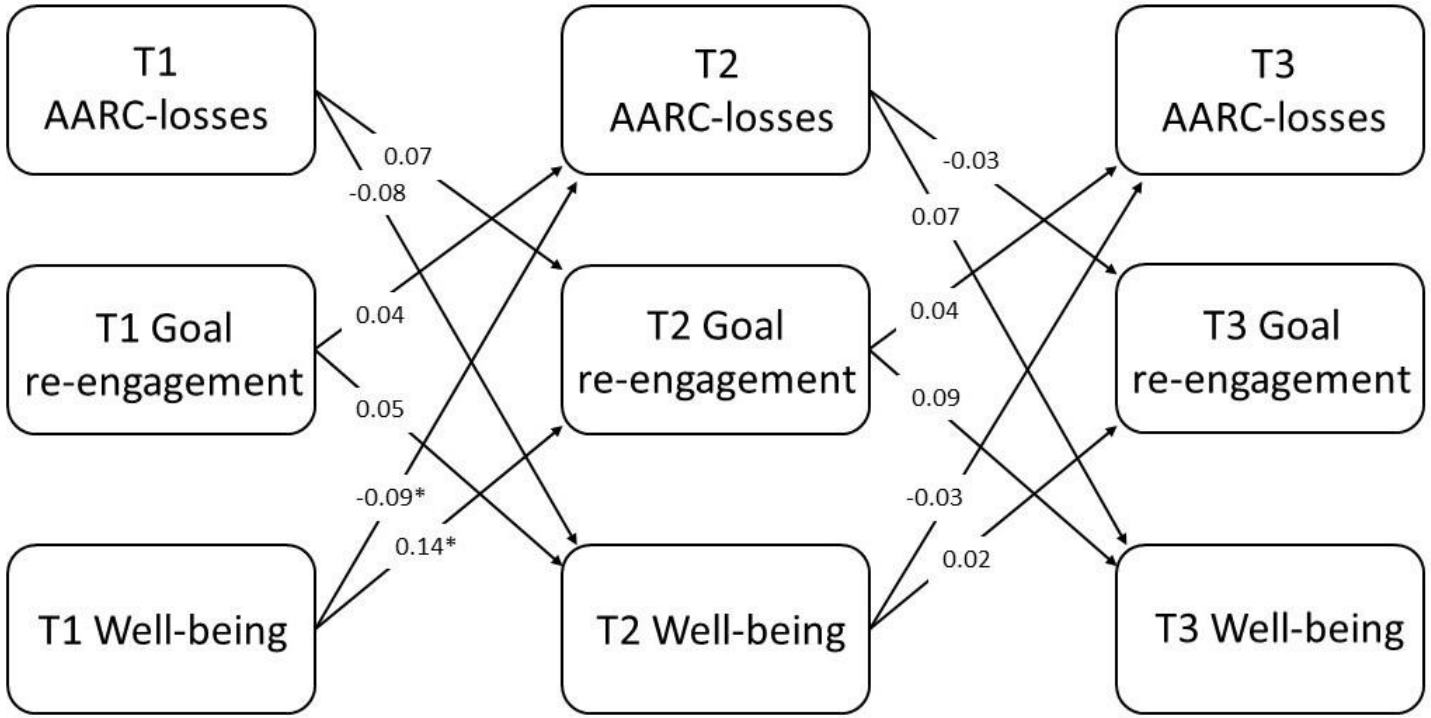

Figure 4.3. Longitudinal associations between AARC-losses, goal re-engagement, and psychological well-being, data shown are coefficients, *p <.05

benefit from implementing varying time scales to better examine longitudinal relationships between the key variables (e.g., measurement burst designs). Furthermore, potential positive links between goal re-engagement and subsequent well-being may not necessarily be captured by goal re-engagement tendencies in and of themselves. According to Brandtstädter (2009), the alignment between individuals' selected goals and their personal capacity for pursuit and potential attainment of these goals is of particular importance to experience feelings of meaning and personal development. Future research may benefit from focusing on whether attempts at goal re-engagement need to be successful in order to predict future well-being.

Another possible reason we did not find evidence of goal re-engagement mediating relationships between AARC and PWB may have been an under-representation of old-old and oldest-old adults in our sample (less than 20% of the current sample were aged over 70). While awareness of growing older is present as early as middle-adulthood (Kornadt et al., 2018), AARC may show stronger associations with goal adjustment processes later in life when aspects of ageing become more salient. In older adulthood, AARC-losses are viewed as less controllable, and are potentially more threatening to goal-related behaviour and well-being (Heckhausen & P. Baltes, 1991). Furthermore, AARC-gains may be less common in advanced older adulthood (Kite et al., 2005), and therefore particularly valued (Dutt, Gabrian, & Wahl, 2018a), possibly more reliably triggering processes of goal re-engagement and feelings of well-being.

While our hypothesised pattern of results was not found, a significant longitudinal mediation relationship was evident suggesting that AARC-gains may mediate associations between PWB and goal re-engagement. This finding may indicate that higher PWB allows older adults to perceive more age-related gains in their life and aligns with emerging research suggesting that states of well-being can influence how individuals perceive and judge their

own ageing. More specifically, experimentally induced mood states have been shown to impact subjective age, with those in a negative mood condition reporting higher subjective age relative to a neutral mood group (Dutt & Wahl, 2017). Furthermore, a recent longitudinal study found that both between-person differences and within-person changes in affective well-being predicted self-perceptions of ageing, with higher positive affect, and lower negative affect associated with more positive self-perceptions of ageing (Diehl et al., 2021).

Somewhat in line with our original prediction, in the models examining need satisfaction and need frustration, those who increased in AARC-gains from T1 to T2 were more likely to subsequently increase in the extent to which they re-engaged in new goals at T3, supporting Diehl and Wahl's (2010) proposition that AARC informs processes of personal meaning-making and self-regulation by directing goal-related behaviour, or fostering feelings of competence and self-efficacy (Bandura et al., 1999; Carver, 2004; Greve & Wentura, 2003; Ryan & Deci, 2000; Windsor et al., 2021). It is important to note that this relationship was not found for the PWB composite, life engagement, or vitality. However, our results provide preliminary evidence to suggest that AARC may have implications for future goal re-engagement in some contexts.

Overall, while the temporal order of associations was not as we anticipated, the current findings are not necessarily inconsistent with broader perspectives on subjective ageing, self-regulation and well-being, including that of Diehl and Wahl (2010). Although Diehl and Wahl (2010) emphasise the extent to which AARC is likely to shape processes of self-regulation which in turn affects well-being outcomes, the associations among the variables of key interest may be complex and bi-directional. Both theoretical (Wrosch, Scheier, Carver, & Schulz, 2003; Wrosch & Scheier, 2020), and empirical work points to goal re-engagement predicting subsequent changes in well-being (Barlow et al., 2020), but it is also possible that processes of goal adjustment play a role in shaping perceptions of ageing. For example, how

people regulate their goals could have a bearing on experiences of limitations (e.g., failure to re-engage after abandoning a blocked goal could increase the salience of age-related restrictions), and experience of limitations is identified as a proximal antecedent to AARC (Diehl & Wahl, 2010). Future research with longer time intervals between baseline and final follow-up, and more frequent assessments in-between may allow the examination of potential feedback loops linking well-being to AARC, and to goal re-engagement.

4.5.1 Limitations and Future Directions

It is important to consider the current findings in the context of several limitations. First, the current sample reported relatively high levels of education and physical functioning; which are both associated with outcomes related to ageing well (Boerner, 2004; Brandtstädter & Renner, 1990). People with higher educational and physical resources may be more likely to pay attention to personal goals and show greater discernment regarding processes of AARC and goal adjustment. Furthermore, online samples of older adults have been shown to differ from national probability samples in multiple constructs (such as verbal fluency, depressive symptoms, self-rated health/memory; Ogletree & Katz, 2020. Due to the select nature of the current sample, we advise caution when generalising our findings to the broader population. Furthermore, there are multiple individual characteristics which could influence the relationships investigated in the current study. We controlled for age, gender, education, and physical functioning. Other confounding variables may exist which could assist in explaining the current findings (such as personality traits, feelings of loneliness, attitudes toward ageing, chronic illness), and controlling for these additional factors was beyond the scope of the present study.

4.5.2 Conclusion

To our knowledge, this study is the first to examine longitudinal inter-relationships among AARC, self-regulation of goals and well-being in middle-aged and older adults. The

hypothesised temporal order of relationships was not evident in the current findings, which may be due to the time scales used, or our relatively young sample. Furthermore, our finding that AARC-gains mediated the relationship between PWB and goal adjustment is in line with emerging research regarding well-being states influencing the formation of self-perceptions of ageing. In addition, the mediation findings may point to feedback loops between AARC, goal re-engagement and aspects of well-being. Future research across varying time scales and including samples that better represent the oldest-old is needed to further examine the temporal order of associations of these key constructs in middle- and older-adulthood.

CHAPTER

5

AWARENESS OF AGE-RELATED CHANGE AND IMPLICATIONS FOR DAILY STRESS REACTIVITY: A DAILY DIARY STUDY

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Author Contributions

BWH contributed 75% and TDW contributed 25% to the research design, data collection and analysis, and writing and editing of the manuscript, respectively.

5.1 Abstract

Objectives: Associations between awareness of one's own ageing and well-being have received increasing attention in the field of gerontology over the last decade. The current study examines how between-person differences and within-person fluctuations of awareness of age-related change (AARC) may moderate relationships between daily stressors and affective well-being during middle- and older-adulthood. We predicted that higher positive perceptions of ageing (AARC-gains) would buffer the relationship between daily stressors and affect. Conversely, we expected that higher negative perceptions (AARC-losses) may exacerbate the relationship between daily stressors and affect.

Method: Data were collected from a community-based sample of 152 Australian adults aged 53-86 (M = 69.18, SD = 5.73). For 10 consecutive days, participants completed surveys on their smartphones measuring daily stressors, AARC, and affect (positive and negative). Multilevel models were conducted to examine whether AARC-gains and AARC-losses moderated within-person associations of daily stressors and affect (i.e., stress reactivity).

Results: At the between-person level, reactivity to daily stressors did not vary as a function of individual differences in AARC (gains or losses). Analysis of within-person associations suggested that on days when AARC-gains was higher-than-usual, participants showed less affective reactivity to daily stressors (represented by lower negative affect), and that on days when AARC-losses was higher-than-usual, participants showed increased reactivity to daily stressors (represented by higher negative affect). However, interactions of daily stress with within-person AARC were not statistically reliable when controlling for between-person stress × within-person AARC, indicating that both between- and within-person variance captured by assessments of daily stress were implicated in the AARC moderation effects.

Discussion: Results indicate that short-term fluctuations in AARC may be implicated in processes of regulating affective responses to stressor exposure in middle- and older-adulthood.

Keywords: Affective well-being, Awareness of ageing, Daily stressors, Subjective ageing

5.2 Introduction

Awareness of one's own ageing has been of increasing interest in gerontological research over the past decade. Greater well-being has been linked to higher awareness of positive age-related changes, and lower awareness of negative age-related changes (Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a). The current study focused on between-person differences and within-person fluctuations in awareness of age-related change to consider whether relationships between daily stressors and affective well-being may vary as a function of perceptions of age-related change in mid-life and older-adulthood.

5.2.1 Reactivity to Daily Stressors in Older Adulthood

Daily stressors refer to everyday hassles which occur in day-to-day life. While singular daily stressors are unlikely to impact well-being to the extent that major life events can, they may nevertheless have a considerable cumulative effect over time (Almeida, 2005). On days when individuals report experiencing a stressor, they typically exhibit a corresponding increase in negative affect (and/or decrease in positive affect; Almeida & Kessler, 1998; Stawski et al., 2008). How individuals respond to daily stressors has long-term implications for mental health. Specifically, individuals with greater affective reactivity to stress have an increased likelihood of reporting an affective disorder a decade later (Charles et al., 2013). There are multiple constructs which moderate the daily stress-affect association including age, gender, neuroticism (Mroczek & Almeida, 2004), and perceived control (Diehl & Hay, 2010; Ong et al., 2005).

Research regarding age differences in reactivity to stressors is somewhat inconsistent (Stawski et al., 2008). Older adults have been found to report fewer stressors, and perceive these stressors as less severe than younger and middle-aged adults (Almeida & Horn, 2004; Birditt et al., 2005; Uchino et al., 2006). Often, older adults show decreased affective reactivity to daily stressors in comparison to their younger counterparts (Hay & Diehl, 2010;

Uchino et al., 2006). This may be because older adults develop effective emotion regulation abilities with experience in dealing with stressors over time (Charles, 2010; Lawton, 1996), or become increasingly proficient in pursuing goals and valued outcomes (P. Baltes & M. M. Baltes, 1990; Brandtstädter et al., 1993). Conversely, other studies have found that older adults show higher affective (Mroczek & Almeida, 2004), and physical (Uchino et al., 2005) reactivity to daily stress. While findings regarding age-differences in stress reactivity are mixed, they may reflect the substantial heterogeneity of development in older adulthood (P. Baltes, 1987). Growing older is experienced differently both between individuals (Steptoe et al., 2015), and within individuals over time (Neupert & Bellingtier, 2017). The current research moves beyond a focus on chronological age differences in stress reactivity, by considering whether stress reactivity may vary as a function of daily perceptions of age-related change.

5.2.2 Awareness of Age-related Change

Relatively recently in the subjective ageing literature, Diehl and Wahl (2010) conceptualised the model of awareness of age-related change (AARC). AARC refers to 'all those experiences that make a person aware that his or her behaviour, 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 is one of the first models of subjective ageing to distinguish between positive (AARC-gains) and negative (AARC-losses) components of growing older. AARC-gains may involve acknowledgement that one has greater freedom to spend their days how they want. AARC-losses may involve noticing that one needs to limit their activities with increasing age. AARC has been consistently associated with well-being in previous research, with higher AARC-gains and lower AARC-losses each being associated with greater well-being (for a review, see Sabatini, Silarova, et al., 2020).

While AARC has been predominantly considered a trait-like construct in previous literature, it has recently been found that perceptions of both age-related gains and losses fluctuate across moderately short time scales (8 consecutive days), demonstrating that age-related changes do not necessarily need to be extreme or infrequent to be measurable (Neupert & Bellingtier, 2017; Zhu & Neupert, 2021). Furthermore, negative affect was found to increase on days when AARC-losses was higher-than-usual (Neupert & Bellingtier, 2017). In another study, the relationship between stressors and negative affect was found to be moderated by general attitudes toward one's own ageing assessed at the between-person level. Specifically, reactivity to daily stressors was stronger among those who had more negative attitudes toward their own ageing at baseline than for those with more positive attitudes (Bellingtier & Neupert, 2018). The current study aims to extend this emerging line of work concerned with AARC and daily well-being by considering both AARC-gains and AARC-losses as possible moderators of affective reactivity to daily stressors.

5.2.3 Awareness of Age-related Change and Reactivity to Daily Stressors

While ageing attitudes have been linked to greater reactivity to daily stress (Bellingtier & Neupert, 2018), and daily AARC has been linked to changes in affect (Neupert & Bellingtier, 2017), associations between AARC and stress reactivity have not yet been examined. There are several theoretical arguments as to why both individual differences and within-person fluctuations in AARC may have implications for stress reactivity. First, Diehl and Wahl (2010) proposed that as a particular form of self-awareness, AARC is linked to other self-related constructs which are implicated in the stress reactivity process, such as perceived control, self-efficacy, self-concept clarity, and self-representation. Second, societal stereotypes regarding ageing are often internalised by older adults (Hess, 2006), which can lead to negative self-stereotyping, which may have implications for behavioural outcomes (Diehl & Wahl, 2010). Subliminally primed age-related self-stereotypes have been shown to

impact walking speed (Hausdorff et al., 1999), memory (Levy, 1996), handwriting, and the endorsement of hypothetical life-prolonging interventions (Levy, Ashman, & Dror, 2000). Furthermore, individuals exposed to negative ageing stereotypes showed greater physical response to stress compared to those exposed to positive stereotypes (Levy, Hausdorff, et al., 2000). However, we acknowledge that there is evidence of selective reporting of significant effects in the field of subliminal priming (Weingarten et al., 2016), and advise a degree of caution when taking these findings into account. Third, according to Diehl and Wahl (2010), if perceptions of age-related change are linked to negative perceptions and outcomes, they may impose developmental limitations which can lead to lower well-being. Conversely, if AARC is based on positive perceptions, this may enhance well-being by enabling appreciation of life experiences and resources (Hobfoll, 2002), and motivating adaptive processes of self-regulation (Diehl & Wahl, 2010; Dutt, Gabrian, & Wahl, 2018b; Wilton-Harding & Windsor, 2021a; Wrosch, Scheier, Carver, & Schulz, 2003).

At the between-person level, reactivity to daily stressors has been found to be greater among those who reported more negative attitudes toward their own ageing at baseline (Bellingtier & Neupert, 2018). There may be conceptual differences in measures of ageing attitudes and AARC (see Diehl et al., 2014). However, consistent with previous research regarding positively and negatively valenced subjective ageing (e.g., Bellingtier & Neupert, 2018; Levy, Ashman, & Dror, 2000) we propose that affective reactivity to daily stress would be lower among those with higher overall AARC-gains, and higher among those with higher overall AARC-losses.

In terms of constructs related to self-awareness, perceived control has received the most research attention as a moderator of stress reactivity at the daily level. Overall, reactivity to stressors appears to be lower on days when individuals perceive higher-than-usual personal control (Diehl & Hay, 2010; Ong et al., 2005). As awareness of ageing impacts individuals'

social contexts, expectations, behaviour, and resources (Kornadt et al., 2019), AARC is likely to also influence perceptions of personal control (Zhang & Neupert, 2021). AARC and control beliefs have been found to covary at the daily level, such that on days when AARC-gains was higher-than-usual, and on days when AARC-losses was lower-than-usual, individuals reported higher control beliefs (Zhang & Neupert, 2021). Given that more positive perceptions of ageing have been linked to adaptive outcomes, higher-than-usual AARC-gains could act as a resource that protects individuals from reactivity to stressors (Bellingtier & Neupert, 2018; Levy, Hausdorff, et al., 2000). Daily AARC-gains may increase feelings of personal control due to reinforced feelings of competence (Ryan & Deci, 2000), self-efficacy (Bandura et al., 1999), or positive self-image (Levy, Slade, Kunkel, & Kasl, 2002). Furthermore, higher-than-usual AARC-gains may enable individuals to evaluate their ageing in a more favourable light (Diehl & Wahl, 2010), affording continued opportunities for growth which could provide respite from negative events (Hobfoll, 2002). While AARC-gains has been shown to vary significantly within-person (Neupert & Bellingtier, 2017), another novel aspect of the current research is that we examine this further, by considering how AARC-gains relates to daily well-being, and the extent to which it may buffer the stress-affect relationship. Specifically, we expected that reactivity to daily stressors would be weaker on days when participants report higher-than-typical AARC-gains.

Conversely, daily experiences which bring awareness to possible future limitations due to ageing (i.e., AARC-losses) may prompt individuals to feel less in control of their life and outcomes (Brothers et al., 2016; Heckhausen & P. Baltes, 1991; Wilton-Harding & Windsor, 2021a). Furthermore, higher-than-usual AARC-losses may lead to identification with internalised negative ageing stereotypes (Levy, 2009), which is linked to increased stress reactivity (Levy, Hausdorff, et al., 2000). Hence, we expected reactivity to daily stressors would be greater on days when participants report higher-than-typical AARC-losses.

5.2.4 The Present Study

Previous research has considered between-person differences in ageing attitudes in the prediction of stress reactivity (Bellingtier & Neupert, 2018), and the within-person covariance between AARC-losses and negative affect (Bellingtier & Neupert, 2018). To be consistent with emerging work in this field, we combined these approaches in the current analyses by considering daily stressors and between- and within-person differences in AARC in their prediction of daily affect (positive and negative). Consistent with previous research (Miche et al., 2014; Neupert & Bellingtier, 2017), we predicted higher AARC-gains and lower AARC-losses would be associated with higher average positive affect, and lower average negative affect respectively at the between-person level. Furthermore, we expected affective reactivity to daily stressors (less positive, or more negative) would be (a) lower among those with higher levels of AARC-gains, and (b) higher among those with higher levels of AARC-losses. At the within-person level, we expected the relationship between daily stressors and affect would vary as a function of both daily AARC-gains and AARC-losses. Specifically, we expected the relationship between stressors and (less positive, or more negative) affect would be (a) buffered by higher-than-usual daily AARC-gains, and/or (b) exacerbated by higher-than-usual daily AARC-losses.

5.3 Method

5.3.1 Participants and Study Design

A community-based sample of 163 middle-aged and older adults was recruited through distribution of a study advertisement in May-June 2020. Participants were recruited via a tiered approach. First, an email was distributed to the Flinders University *Adult Development Lab* mailing list of individuals who had previously expressed interest in research participation. Second, an advertisement was placed in *Weekend Plus*, an online newsletter for Seniors Card holders in South Australia. Third, an email was sent to South Australia's *Office*

for Ageing Well feedback network, a list of individuals who had previously indicated a willingness to provide feedback on policies and programs.

Following approval by the Institutional Ethics Committee, an advertisement recruiting participants for a study focusing on 'Well-being in Daily Life' was distributed via the networks outlined above. Potential participants were invited to read the study information, provide informed consent, and complete a screener survey (via Qualtrics) to ensure eligibility (aged over 50, regular access to phone with text message/internet capability). Eligible participants were then automatically emailed a link to the baseline survey (approximately 20 minutes). Upon completion of the baseline survey, participants were given a unique, randomly generated code, then redirected to sign up to the registration page for the mobile component of the study, a short message service (SMS) platform to receive daily Qualtrics survey links via text message (SurveySignal; Hofmann & Patel, 2015). Here, participants were asked to provide their contact details, study code, and verify their smartphone.

Commencing the following day, and for 10 consecutive days, participants received a link to the evening survey at approximately 8:00pm, which was available for three hours. The survey measured daily stressors, AARC, and affect. Participants also received survey links at randomly spaced intervals four times per day for other research unrelated to the present study (see Mahlo & Windsor, 2021b). A response-based compensation approach was offered as follows: Participants received $10 AUD as base compensation, with tiered incentives offered for greater completion of daily surveys (over 60% = an additional $25, over 80% = an additional $40). Total possible compensation was $50 AUD per participant. For the 10 evening measurements, participants completed an average of 8.33 surveys (range 1-10), with over 80% of participants completing eight or more assessments, totalling 1266 observations. In the absence of widely established and accessible methods for power calculations in the multilevel modelling context, we consulted Arend and Schafer's (2019) Monte Carlo

simulation results to determine minimum detectable effect sizes given our number of observations at Level 1 (10) and Level 2 (*N* = approximately 150). With >80% power and an assumption of medium random slope variance, the present sample allowed for detection of cross-level interaction effect sizes as small as 0.33 (a medium effect; Arend & Schafer, 2019).

Of the 163 eligible individuals who registered interest in participating, five did not proceed to the baseline survey. Data from one individual who self-reported a diagnosis of mild cognitive impairment/dementia were excluded. A further five individuals did not complete any evening surveys. The final sample consisted of 152 participants aged between 53 and 86 (*M* = 69.18, *SD* = 5.73). Approximately two-thirds of participants were female (66.4% female; 33.6% male; 0% non-binary), and the majority were retired (85.5%). Around half (49.3%) of participants reported completion of tertiary education. Participants were approximately 98.7% Caucasian, and 1.3% Asian Australian. Over two-thirds of respondents were partnered (67.8%).

5.3.2 Measures

Awareness of Age-related Change. Daily AARC was measured using the AARC-10 SF (Kaspar et al., 2019), with two five-item subscales measuring both AARC-gains and AARC-losses across the domains of health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive and socio-emotional functioning, and lifestyle and engagement (Diehl & Wahl, 2010). Following Neupert and Bellingtier (2017), participants were presented with the item stem 'with my awareness of ageing today…' and asked to rate on a scale from 1 (*not at all*) to 5 (*very much*), the extent to which each item applied to them that day (e.g., '…I have a better sense of what is important to me'). Scores were summed for each subscale, with higher scores representing greater daily AARC-gains (day 1 Cronbach's α =.68, day 10 α =.78) and AARC-losses (day 1 α =.76, day 10 α =.87), respectively.

Affective well-being. Daily affect was measured using the Scale of Positive and Negative Experiences (SPANE; Diener et al., 2010). The 12-item scale required participants to rate the extent to which they experienced both positive and negative feelings (e.g., 'happy', 'contented', 'angry', 'unpleasant') in the previous 24 hours on a scale from 1 (*very rarely or never*) to 5 (*very often or always*). Scores for each subscale were summed, with higher scores reflecting higher positive (day 1 α =.92, day 10 α =.94) and negative affect (day 1 α =.85, day 10 α =.88), respectively.

Daily stressors. Daily stressors were assessed with a modified version of the Daily Inventory of Stressful Events (Almeida et al., 2002; Silwinski et al., 2006). Participants were asked to report whether they had experienced certain stressors across five domains (e.g., arguments, health-related, social network) in the previous 24 hours (*yes/no*). Consistent with Hoffman and Stawski (2009), stressor days were coded as 0 = no stressors reported, and 1 = one or more stressor(s) reported.

Control variables. Analyses controlled for time-related effects, including day in study (coded as 0-9), and weekend (0 = weekday, 1 = weekend). We controlled for baseline chronological age, gender (0 = male, 1 = female), education (0 = completed tertiary education, 1 = did not complete tertiary education), within-person stressors, between-person differences in stress exposure, and mean-centred physical functioning. Physical functioning was measured using the 10-item physical functioning subscale from the RAND health survey (Ware Jr & Sherbourne, 1992). Participants rated the extent to which their health limits them from participating in certain activities (e.g., climbing several flights of stairs) on a three-point scale with answers ranging from 'no, not limited at all' to 'yes, limited a lot'; recoded scores range = 0-100, M = 79.77, SD = 20.46, α = 0.90; with higher scores reflecting better physical functioning). These variables were statistically controlled due to previous associations with

subjective ageing (Steptoe et al., 2015), stressor experience (Charles et al., 2013) and affective well-being (Charles, 2010).

5.3.3 Statistical Analysis

Multilevel models with restricted maximum likelihood estimation were run in IBM SPSS 25.0 to predict daily affect. This method offers the advantage of a flexible approach to model hierarchies within the data and accommodates missing data under missing-at-random assumptions (Schafer & Graham, 2002). Unconditional models (with measurement occasions at Level 1 nested within individuals at Level 2) were estimated for both positive and negative affect. In Model 1, AARC predictors were examined at the between-person level (Level 2) by centring person-specific means (each person' mean score calculated across available assessments) on the sample mean, and at the within-person level (Level 1), by subtracting person-specific means from daily scores (representing day-specific fluctuations from the person mean; see Hoffman & Stawski, 2009). Stress predictors were examined at the between-person level by centring person-specific means on the sample mean (grand-mean-centred) and at the within-person level with participants' binary time-varying daily stressor scores. Interaction terms were added in Model 2 to assess whether associations of daily stressors with affect varied as a function of between-person differences or within-person fluctuations in AARC. To partial out between-person stress effects when estimating interactions of AARC with daily stress reactivity, a total of 8 interaction terms were included (all possible combinations of between-person and within-person AARC and stress predictors). To simplify final models, non-significant interactions terms were progressively removed from the analyses. Random effects for the intercept only were included in each model.

5.4 Results

Descriptive statistics and bivariate correlations of associations of the key variables (with data in long-form) are provided in Table 5.1. Age was negatively associated with AARC-gains, negative affect, and stressors, and positively associated with AARC-losses. AARC-gains was positively associated with positive affect, and negatively associated with negative affect and stressors. AARC-losses showed the opposite pattern of associations, corresponding with higher negative affect, lower positive affect, and more frequent stressors. Similar to Bellingtier and Neupert (2018), most days were free of stressors across the study period (current study = 63.4%, Bellingtier & Neupert = 64%).

Intraclass correlations obtained from fully unconditional multilevel models showed substantial between- and within-person variation in both positive and negative affect. For positive affect, 78.13% of variance was between-person (21.87% within-person). For negative affect, 67.34% of variance was between-person (32.66% within-person). Daily AARC-gains and AARC-losses also showed appreciable intra-individual variability. Of note, AARC showed substantially higher within-person fluctuation compared to previous daily AARC research. Specifically, 25% of variance in AARC-gains, and 20% of variance in AARC-losses was within-person (within person variability for AARC-gains ranged from approximately 9-10%, and AARC-losses from 8-9% in previous daily AARC research (e.g., Neupert & Bellingtier, 2017; Zhang & Neupert, 2021; Zhu & Neupert, 2021). However, these studies assessed daily AARC using different measures with the current study using the AARC-10 SF (Kaspar et al., 2019), and previous daily AARC research using a 20-item measure (Neupert & Bellingtier, 2017; Zhang & Neupert, 2021; Zhu & Neupert, 2021).

Models examining key relationships of conceptual interest to the present investigation are presented in Tables 5.2 (positive affect) and 5.3 (negative affect). In terms of between-

Table 5.1

Correlations of Awareness of Age-related Change, Stressors, Affect, and Control Variables(Data in Long-Form)

Variable	*M* (*SD*) or %	1	2	3	4	5	6	7	8	9
1. Age	69.18 (5.73)	-								
2. Gender (Female)[a]	66.5%	-.14**	-							
3. Education (University)[b]	49.3%	.04	.03	-						
4. Physical functioning[c]	69.77 (20.52)	-.27**	.002	.15**	-					
5. AARC-gains[d]	20.95 (2.62)	-.08**	.16**	.07*	.04	-				
6. AARC-losses[d]	10.13 (3.23)	.24**	-.17*	-.05*	-.53**	-.25**	-			
7. Positive affect	23.37 (4.32)	.02	-.06*	.03	.19**	.38**	-.38**	-		
8. Negative affect	9.96 (3.71)	-.07**	.02	-.06*	-.14**	-.20**	.25**	-.62**	-	
9. Average stressor days	0.37 (0.30)	-.05*	.04	-.01	-.17**	-.21**	.09**	-.35**	.30**	-

Note. N = 152, AARC = awareness of age-related change, M = mean, SD = standard deviation. Covariate descriptive statistics are based on the baseline measurement, dependent variable (affect) descriptive statistics are based on day one of study (day = 0), for AARC and average stressor days, descriptive statistics are based on the person means across assessments, [a]0 = male, 1 = female, [b]0 = did not complete tertiary education, 1 = completed tertiary education, [c]Higher values = higher physical functioning, [d]Daily AARC was measured using the AARC-10 SF in the current study: Therefore, the mean for daily AARC-gains and AARC-losses is not directly comparable to studies where AARC was assessed using a different measure.

*p < .05, **p < .01

Table 5.2

Regression Models with Positive Affect as the Criterion: Separate Models to Test for Moderation (N = 152)

Positive Affect	Model 1			Model 2		
	B	*SE*	*95% CI*	*B*	*SE*	*95% CI*
Intercept	23.96***	0.43	23.10, 24.82	23.90***	0.43	23.06, 24.74
Control Variables						
Age	0.09*	0.04	0.01, 0.17	0.08*	0.04	0.001, 0.15
Gender	-1.16*	0.45	-2.05, -0.26	-1.13*	0.44	-2.00, -0.25
Education	0.55	0.43	-0.30, 1.39	0.49	0.42	-0.35, 1.31
Physical functioning	-0.01	0.01	-0.03, 0.02	-0.002	0.01	-0.03, 0.02
Day in study	-0.03	0.02	-0.07, 0.01	-0.03	0.02	-0.06, 0.01
Weekend	0.16	0.12	-0.07, 0.40	0.16	0.12	-0.08, 0.40
BP stressors	-0.64	0.76	-2.14, 0.86	-0.92	0.75	-2.41, 0.56
Main Predictors						
BP AARC-gains	0.79***	0.09	0.61, 0.96	0.89***	0.09	0.71, 1.07
BP AARC-losses	-0.46***	0.07	-0.60, -0.33	-0.44***	0.07	-0.57, -0.31
WP AARC-gains	0.25***	0.04	0.17, 0.34	0.25***	0.04	0.17, 0.33
WP AARC-losses	-0.22***	0.03	-0.29, -0.16	-0.20***	0.03	-0.26, -0.13
Stressor day	-1.02***	0.15	-1.31, -0.73	-1.02***	0.15	-1.31, -0.74
Interaction terms						
Stressor day × BP AARC-gains	-	-	-	-	-	-
Stressor day × BP AARC-losses	-	-	-	-	-	-
Stressor day × WP AARC-gains	-	-	-	-	-	-
Stressor day × WP AARC-losses	-	-	-	-	-	-
BP stressors × BP AARC-gains	-	-	-	-0.75**	0.26	-1.26, -0.24
BP stressors × BP AARC-losses	-	-	-	-	-	-
BP stressors × WP AARC-gains	-	-	-	-	-	-
BP stressors × WP AARC-losses	-	-	-	-0.27*	0.11	-0.47, -0.06
Variance components	-	-	-	-	-	-
Residual	3.81***	0.16	3.51, 4.15	3.80***	0.16	3.50, 4.14
Intercept	6.08***	0.80	4.70, 7.86	5.82***	0.80	4.69, 7.85
WP pseudo R^2	0.11	-	-	0.12	-	-
BP pseudo R^2	0.58	-	-	0.60	-	-

Note. BP = between-person, WP = within-person, AARC = awareness of age-related change, SE = standard error, CI = confidence interval. Pseudo R^2 was calculated based on the proportional change in variance components at Levels 1 and 2 (Singer & Willett, 2003). *p < .05, **p < .01, ***p < .001

Table 5.3

Regression Models with Negative Affect as the Criterion: Separate Models to Test for Moderation (N = 152)

Negative Affect	Model 1			Model 2		
	B	*SE*	*95% CI*	*B*	*SE*	*95% CI*
Intercept	9.24***	0.42	8.42, 10.07	9.25***	0.42	8.42, 10.07
Control Variables						
Age	-0.08*	0.04	-0.15, -0.01	-0.08*	0.04	-0.15, -0.004
Gender	0.50	0.43	-0.35, 1.37	0.52	0.44	-0.35, 1.38
Education	-0.59	0.41	-1.39, 0.22	-0.60	0.41	-1.41, 0.21
Physical functioning	0.02	0.01	-0.01, 0.04	0.01	0.01	-0.01, 0.04
Day in study	-0.06**	0.02	-0.10, -0.02	-0.07**	0.02	-0.11, -0.03
Weekend	-0.09	0.12	-0.33, 0.14	-0.07	0.12	-0.31, 0.16
BP stressors	0.60	0.73	-.84, 2.04	0.58	0.73	-.86, 2.02
Main Predictors						
BP AARC-gains	-0.36***	0.08	-0.52, -0.20	-0.36***	0.08	-0.53, -0.20
BP AARC-losses	0.35***	0.07	0.22, 0.48	0.35***	0.07	0.22, 0.48
WP AARC-gains	-0.17***	0.04	-0.25, -0.09	-0.02	0.06	-0.14, 0.09
WP AARC-losses	0.18***	0.03	0.12, 0.25	0.11**	0.04	0.03, 0.20
Stressor day	1.07***	0.14	0.78, 1.35	1.07***	0.14	0.78, 1.35
Interaction terms						
Stressor day × BP AARC-gains	-	-	-	-	-	-
Stressor day × BP AARC-losses	-	-	-	-	-	-
Stressor day × WP AARC-gains	-	-	-	-0.28**	0.08	-0.45, -0.11
Stressor day × WP AARC-losses	-	-	-	0.14*	0.07	0.01, 0.28
BP stressors × BP AARC-gains	-	-	-	-	-	-
BP stressors × BP AARC-losses	-	-	-	-	-	-
BP stressors × WP AARC-gains	-	-	-	-	-	-
BP stressors × WP AARC-losses	-	-	-	-	-	-
Variance components	-	-	-	-	-	-
Residual	3.77***	0.16	3.47, 4.10	3.79***	0.16	3.48, 4.12
Intercept	5.53***	0.72	4.29, 7.13	5.82***	0.76	4.50, 7.52
WP pseudo R^2	0.10	-	-	0.11	-	-
BP pseudo R^2	0.36	-	-	0.35	-	-

Note. BP = between-person, WP = within-person, AARC = awareness of age-related change, SE = standard error, CI = confidence interval. Pseudo R^2 was calculated based on the proportional change in variance components at Levels 1 and 2 (Singer & Willett, 2003). *p < .05, **p < .01, ***p < .001

person differences, positive affect was higher among those with higher AARC-gains, and lower among those with higher AARC-losses. Negative affect was higher among those with lower AARC-gains and those with higher AARC-losses. In terms of within-person associations, positive affect was higher on days when AARC-gains was higher, on days when AARC-losses was lower, and on days when no stressor was reported. Higher negative affect was reported on days when AARC-losses was higher, and when a stressor was reported. Daily AARC-gains showed no associations with negative affect.

5.4.1 Associations of AARC, stressor exposure and positive affect

Of central interest to our investigation were the interactions of stressor day with both between-person and within-person AARC-gains and AARC-losses in the prediction of affective well-being; however, after progressively excluding non-significant interaction terms, none of the aforementioned interaction terms remained in the model that included positive affect as the dependent variable. Two interactions were retained in the final model. A cross-level between-person stress × within-person AARC-losses interaction indicated that the negative association of higher average stress exposure with positive affect was stronger on days when AARC-losses was higher. An additional between-person stress × between-person AARC-gains interaction at Level 2 indicated that the positive association between higher average stressor exposure and positive affect was weaker among those who reported higher average levels of AARC-gains. Using a calculation of pseudo R^2 based on the proportion change in variance components (Singer & Willett, 2003), final models accounted for 60% of the between-person variability, and 12% of the within-person variability in positive affect.

5.4.2 Associations of Awareness of Age-related Change, stressor exposure and negative affect

For negative affect, after progressively excluding non-significant terms, we arrived at a final model that included interactions of within-person AARC-gains × stressor day, and

within-person AARC-losses × stressor day. Although our earlier model testing showed non-significant associations of the within-person AARC-losses × between-person stress (*B* = 0.13, *SE* = 0.14, *p* = .36 at exclusion from the model) and within-person AARC-gains × between-person stress interactions (*B* = -0.15, *SE* = 0.18, *p* = .41 at exclusion from the model), we re-entered these terms in the final model to partial out between-person stress effects when estimating interactions of within-person AARC-gains and within-person AARC-losses with daily stressors. Upon re-entering the within-person AARC × between-person stress terms, the coefficients for both interactions reported in Table 5.3 were reduced in magnitude and became non-significant (within-person AARC-gains × stressor day: *B* = - .21, *SE* = 0.11, *p* = .07; within-person AARC-losses × stressor day *B* = 0.10, *SE* = 0.09, *p* = .26). This pattern of findings pointed to substantial shared variance between the within-person AARC × daily stressor and within-person AARC × between-person stress interactions. In turn, this suggested that within-person associations of AARC-gains and AARC-losses with daily negative affect vary as a function of both daily fluctuations in stress exposure (at Level 1) and between-person differences in average stress exposure (Level 2) as the daily stress variable captures both sources of variation (see Hoffman & Stawski, 2009).

To further examine the nature of the shared variance, we compared models (not shown) just including the main effects and specific interaction terms (within-person AARC × between-person stress and within-person AARC × stressor day) both individually and entered together and assessed changes in the model coefficients. Focusing first on AARC-gains, the within-person AARC-gains × stressor day interaction coefficient was reduced by 43% (*B* = -0.28 vs. *B* = -0.16) after controlling for within-person AARC-gains × between-person stress. Conversely, the within-person AARC-gains × between-person stress coefficient was reduced by 44% (*B* = -0.39 vs. *B* = -0.22) when controlling for within-person AARC-gains × stressor day. This broadly suggests that the statistically reliable within-person AARC-gains × stressor

day interaction reflects effects of both daily stress and between-person stress of similar magnitude on the within-person AARC-gains-negative affect association. Turning our attention to within-person AARC-losses, model comparisons indicated that the within-person AARC-losses × stressor day interaction coefficient was reduced by 27% (B = 0.15 vs. B = 0.11) after controlling for within-person AARC-losses × between-person stress. In contrast the within-person AARC-losses × between-person stress
coefficient was reduced by 45% (B = 0.22 vs. B = 0.12) after controlling for within-person AARC-losses × stressor day. Thus, in the case of within-person AARC-losses × stressor day, the interaction appears driven by daily fluctuations in stress exposure to a greater relative degree than between-person differences in stress.

To simplify our approach considering the complex pattern of findings described above, we proceeded by examining and interpreting the within-person AARC × stressor day interactions only (as shown in Table 5.3). However, as outlined above, this meant that the interactions reported in Table 5.3 and illustrated in Figures 5.1 and 5.2 cannot be regarded as pure assessments of the extent to which daily stress reactivity varies as a function of daily fluctuations in AARC, but also partly capture effects of between-person differences in stress on the associations of within-person AARC-losses and within-person AARC-gains with negative affect.

Interactions were plotted by calculating predicted negative affect scores for hypothetical individuals on stressor vs. non-stressor days, and at relatively higher (+1 *SD*) and lower (-1 *SD*) levels of within-person AARC (gains or losses). On days when AARC-gains was lower, participants showed increased reactivity to daily stressors (i.e., exhibited a steeper within-person slope) compared to days when AARC-gains was higher (see Figure 5.1). Furthermore, on days when AARC-losses was higher, participants showed increased

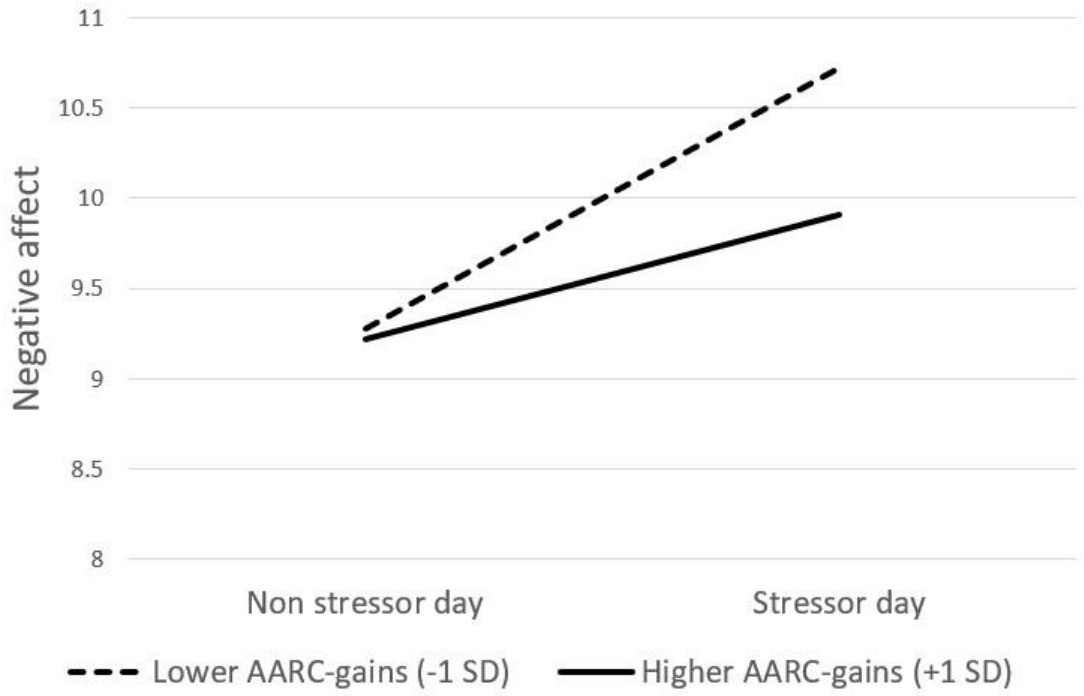

Figure 5.1. Daily AARC-gains as a moderator of the association between daily stressors and negative affect.*AARC* = awareness of age-related change, *SD* = standard deviation

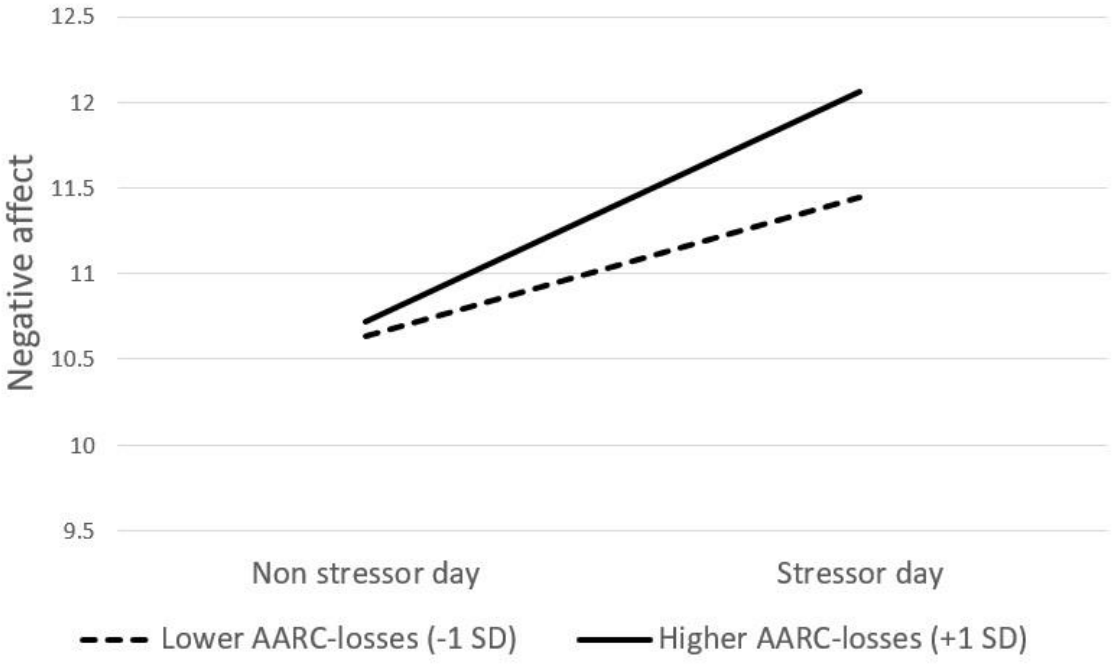

Figure 5.2. Daily AARC-losses as a moderator of the association between daily stressors and negative affect *AARC* = awareness of age-related change, *SD* = standard deviation

reactivity to daily stressors compared with days when AARC-losses was lower (Figure 5.2). Pseudo R^2 calculations showed that final models accounted for 35% of the between-person variability, and 11% of the within-person variability for negative affect (Singer & Willet, 2003).

5.5 Discussion

The current study investigated whether individuals' affective reactivity to daily stressors may vary as a function of between-person differences or dynamic fluctuations in AARC. To our knowledge, this study is the first to use micro-longitudinal methods to examine links between AARC and stressor reactivity in the daily lives of middle-aged and older adults. We expected relationships between daily stressors and affective well-being would be (a) buffered by higher levels of between-person AARC-gains, and higher-than-usual daily AARC-gains, and (b) exacerbated by higher levels of between-person AARC-losses, and higher-than-usual daily AARC-losses. There was no evidence that between-person differences in AARC impacted the daily stress-affect relationship. In terms of within-person fluctuations, our findings were partially in line with expectations and support our argument that daily AARC could be implicated in processes of stress reactivity. To our knowledge, our results are also the first to indicate that intra-individual fluctuation in AARC-gains may have implications for daily fluctuations in well-being.

5.5.1 Between-person Differences in Awareness of Age-related Change and Stressors

Consistent with previous research (e.g., Brothers et al., 2016; Sabatini, Silarova, et al., 2020), between-person differences in AARC consistently predicted between-person differences in well-being, with greater well-being associated with higher AARC-gains and lower AARC-losses. However, reactivity to daily stressors did not vary as a function of between-person differences in AARC-gains or AARC-losses. Findings from the current study

suggest that more dynamic day-to-day AARC experiences may be more important than individual differences in AARC for moderating daily stress responses. The non-significant between-person findings are somewhat inconsistent with Bellingtier and Neupert (2018), who found that reactivity to daily stressors was greater among those who reported more negative attitudes toward their own ageing at baseline. However, while both AARC and attitudes toward own ageing fall under the umbrella term of subjective ageing (Kastenbaum et al., 1972), the two measures assess theoretically different concepts which impact behaviour in different ways. According to Diehl et al. (2014), both attitudes toward own ageing and AARC are person-centred measures that involve judgements regarding developmental gains and losses. However, they differ in their dimensionality and how they are processed. While attitudes toward own ageing can be multidimensional, scores derived from standard measures are typically unidimensional (i.e., capturing where an individual sits on a continuum ranging from positive to negative attitudes). Furthermore, similar to ageing stereotypes, attitudes toward ageing can operate at a pre-conscious level (Levy, 1996), and usually focus on negative components of getting older (Hess, 2006; Hummert, 2011). Conversely, AARC reflects conscious and explicit awareness of changed experience, behaviour, or performance, and captures perceptions of gains and losses separately across multiple domains (Diehl et al., 2014). The somewhat disparate findings between the current and previous research (Bellingtier & Neupert, 2018) indicate that between-person differences in perceptions of age-related change in behaviour, performance, or experiences may not be as crucial for daily stress responses when compared to overall judgements about ageing which are often disproportionately informed by negative ageing stereotypes. It is worth noting that the current study used a 5-item version of the Daily Inventory of Stressful Events measure (see Silwinski et al., 2006), whereas Bellingtier and Neupert (2018) used a 7-item version. In addition, the current study used binary coding to distinguish between stress days and non-stress days,

whereas Bellingtier and Neupert (2018) summed a total stressor score for each day. A consideration for future research may be how the type or number of stressors relate to AARC and stress reactivity.

5.5.2 Within-person Differences in Reactivity to Daily Stressors

Our findings were complicated as a result of the use of a binary daily stress variable that captured both between- and within-person variation in stress exposure. As outlined in the results, although interactions involving the time-varying daily stress variable with within-person measures of AARC change were statistically reliable in the prediction of negative affect, the broader pattern of findings pointed to the interactions being driven by both between- and within-person sources of variance in stress exposure. This limitation notwithstanding, our results provide preliminary evidence to suggest that on days when AARC-gains is higher-than-usual, individuals show less negative reactivity to daily stressors. AARC-gains may promote feelings of competence (Ryan & Deci, 2000), positive self-image (Diehl & Wahl, 2010), or self-efficacy (Bandura et al., 1999), potentially bringing awareness to coping resources. Hence, on days when individuals have more positive perceptions of their own ageing, they may be more optimistic in their evaluations of their abilities to face stressful situations. Additionally, these positive self-evaluations may function as a key driver of adaptive processes of self-regulation (Diehl & Wahl, 2010) which are likely to reduce reactivity to daily stressors (Lazarus & Folkman, 1987; Wrosch & Scheier, 2020).

While once again acknowledging the confounding of between- and within-person stress effects noted above, the results also provide preliminary support for stronger negative emotional reactivity to stress on days of higher AARC-losses. Higher-than-usual AARC-losses may align with more negative evaluations of one's ability to handle current stressors (Levy, Hausdorff, et al., 2000), or may reflect reduced confidence in exercising self-regulatory agency through goal pursuit (Dutt, Gabrian, & Wahl, 2018b; Wilton-Harding &

Windsor, 2021a). The extent to which daily stressors were attributed to ageing was not measured in the current study. However, findings may indicate that stressors which threaten one's self-awareness in ways that relate to subjective ageing may pose particular risks for affective well-being in later life. Additionally, the measure of daily stress used in the current study did not differentiate between mild and severe stress. According to the Strength and Vulnerability Model (Charles, 2010), older adults may regulate emotion relatively well to a certain point, but more severe or prolonged stressors may be particularly detrimental to well-being.

Overall, findings suggest that AARC varies over short time scales, and is important to consider in the context of affective reactivity to stress in later life. Recent research has shown that cognitive behavioural therapy techniques focused on recognising and challenging ageing stereotypes were successful in changing adults' overall self-perceptions of ageing (Beyer et al., 2019). Accordingly, interventions that assist individuals to notice or retain positive perceptions of ageing (along with related psychological resources e.g., competence, perceived control, self-efficacy), or avoid the salience of AARC-losses in the context of day-to-day life, could assist in preserving affective well-being in later life).

5.5.3 Limitations and Future Directions

Our results should be considered alongside several limitations. First, the study design required participants to own and operate smartphones. Those confident in their smartphone use and willing to participate in this research are unlikely to be representative of the general population of middle- and older-adults. Future research should focus on whether the reported associations between AARC and stress reactivity are replicable in more diverse samples such as those who are less confident with technology, or among advanced older adults (aged over 85 years) when AARC-losses may be increasingly common, and AARC-gains may be more infrequent (Heckhausen et al., 1989). Additionally, data collection occurred during the

relatively early months (May-June 2020) of COVID-19 being declared a global pandemic by the World Health Organisation. While Australia experienced overall less-extreme consequences (lower infection rates/fatalities, and a partially government-funded healthcare system), participants' daily lives were likely disrupted to some degree during data collection and this may have had implications for self-perceptions of ageing (Terracciano et al., 2021).

While micro-longitudinal study designs provide high ecological validity, reduce recall bias, and allow more nuanced understanding of relationships between AARC, stressors, and well-being than cross-sectional research, the nature of our data remains correlational, limiting the ability to determine causal relationships for the constructs of interest. As self-perceptions of ageing and AARC may be modifiable through intervention (e.g., Beyer et al., 2019; Brothers & Diehl, 2017), relationships between AARC and well-being should be further investigated with experimental studies, or by modelling lagged or cross-correlational effects to enable more compelling evidence regarding the directionality of effects (Sargent-Cox et al., 2012; Wurm et al., 2007).

Finally, future research may benefit from exploring potential processes underlying associations between AARC and stress reactivity found in the current study. For instance, AARC may moderate stress reactivity via associations with self-regulation, feelings of competence, self-efficacy, or personal control. Future micro-longitudinal research should assess these constructs as potential mediators of relationships between AARC and stress reactivity.

5.5.4 Conclusion

The present study contributes knowledge regarding individual differences and within-person fluctuations in AARC and well-being in middle- and older-adulthood. Overall, daily perceptions of positive age-related change may be protective for affective reactivity to daily stressors. Conversely, daily perceptions of negative age-related change may contribute to

increased reactivity to daily stressors. Future research should examine associations between AARC and stress reactivity in more diverse samples, using experimental or time-lagged study designs, and consider potential processes through which AARC may have implications for stressor reactivity.

CHAPTER 6

DISCUSSION

6.1 Summary of Research Findings and Original Contributions

The aim of current thesis was to contribute to the field of subjective ageing by broadly considering the role of awareness of age-related change (AARC) as it relates to certain adaptive outcomes in midlife and older adulthood; specifically, goal adjustment, affective reactivity to daily stress, and psychological well-being. The research questions covered the following four broad topics (1) the relationship between AARC and goal adjustment strategies, (2) implications of AARC for change in psychological well-being, (3) longitudinal associations between AARC, self-regulation, and psychological well-being, and (4) the role of AARC in moderating affective responses in the context of daily stress.

Overall, findings from the previous chapters provide support for the claim that as a fundamental experience of the ageing self, AARC is an important construct to consider in relation to self-regulation and well-being in older adulthood (Diehl et al., 2015; Diehl & Wahl, 2010). Consistent with theory and previous research (e.g., Brothers et al., 2016; Diehl & Wahl, 2010; Dutt, Gabrian, & Wahl, 2018a, 2018b), the findings generally pointed to better developmental outcomes being associated with higher AARC-gains and lower AARC-losses. In addition, Chapters 2 and 3 demonstrated that the interplay between AARC-gains and AARC-losses has implications for both goal adjustment strategy use and aspects of psychological well-being. Furthermore, Chapter 4 was the first to consider longitudinal inter-relationships between the constructs of psychological well-being, AARC, and goal re-engagement, and may indicate potential dynamic feedback loops between these key constructs. Finally, Chapter 5 demonstrated that daily fluctuations in AARC (gains and losses) were related to emotional responses to daily stressors. Together, these studies make an original and novel contribution to knowledge by addressing gaps in the literature regarding cross-sectional and longitudinal correlates of AARC over different time scales. The following sections provide a summary of the research findings from Chapters 2-5 and situate these

findings within the broader context of the current theoretical and empirical subjective ageing research. Following this, implications of the current findings are discussed. Finally, possible pathways for future research within the area of subjective ageing and adaptation are discussed.

6.1.1 Associations Between Awareness of Age-related Change and Goal Adjustment

As discussed in Chapter 1, while it is theoretically well-established that the way in which people experience their own ageing impacts their selection and pursuit of personal goals, empirical research examining how both positive and negative perceptions of one's own ageing relate to goal adjustment is in its relative infancy (e.g., Dutt, Gabrian, & Wahl, 2018b). Moreover, research considering the interplay between AARC-gains and AARC-losses in their association with processes of goal adjustment is needed (Diehl & Wahl, 2010). The first study of this thesis (Chapter 2) utilised cross-sectional data from a community-based sample to examine whether (a) AARC has implications for flexible goal adjustment, (b) AARC-gains and AARC-losses interact in their associations with goal adjustment, and (c) relationships between AARC and goal adjustment are mediated by future time perspective.

The initial aim for Chapter 2 (Wilton-Harding & Windsor, 2021a) was to examine whether AARC had implications for flexibility in goal adjustment strategy use. To operationalise flexibility in goal adjustment strategies, a flexibility metric which aligned with previously used measures of coping flexibility was calculated (see Chapter 2 *Method*; Bonanno et al., 2011). Overall, findings showed that those with higher perceptions of positive age-related change (AARC-gains), and those with lower perceptions of negative age-related change (AARC-losses), showed greater flexibility in their endorsement of goal disengagement and goal re-engagement. Overall, those who possess what Dutt, Gabrian, and Wahl (2018b) have labelled *higher resources* (i.e., high AARC-gains and low AARC-losses)

were more likely to flexibly utilise goal disengagement and goal re-engagement strategies as required. Furthermore, those with higher AARC-gains, and those with lower AARC-losses reported higher utilisation of goal re-engagement. AARC did not show any associations with goal disengagement.

Overall, these findings support the relevance of AARC to the use of developmental regulation strategies in older adulthood. Using an alternative (but conceptually similar) measure of goal adjustment, the results share some similarities with recent findings reported by Dutt, Gabrian, and Wahl (2018b). In the findings reported in Chapter 2, higher AARC-gains and lower AARC-losses were found to be associated with higher levels of goal re-engagement. Similarly, Dutt, Gabrian, and Wahl, (2018b) found that higher AARC-gains, and lower AARC-losses predicted higher levels of assimilative coping (analogous to goal re-engagement).

However, while Dutt, Gabrian, and Wahl (2018b) found that those with higher AARC-gains and lower AARC-losses reported higher levels of accommodative coping, there was no association between AARC (gains or losses) and goal disengagement in the results reported in Chapter 2. A potential explanation for these differing findings relates back to points made in sections 1.4.1 and 2.5.1. In summary, both the goal disengagement and accommodative coping measures capture how individuals respond to blocked goals. However, goal disengagement (Wrosch, Scheier, Carver, & Schulz, 2003) focuses more on the regulation of goal-oriented behaviours (e.g., ceasing engagement in unachievable goals), whereas accommodative coping captures disengagement alongside cognitive processes of *reorientation* and *acceptance* (Brandtstädter & Renner, 1990). Hence, current findings indicate that AARC may not directly inform *behavioural processes* of goal disengagement, but may relate to how people appraise and reorient themselves in the presence of unachievable goals (Dutt, Gabrian, & Wahl, 2018b). Future research should investigate

different components of awareness of ageing which vary in their socio-cultural influences, and conscious processing (Diehl et al., 2014) to further understand how different experiences of subjective ageing may relate to both goal-directed behaviour, and processes of re-evaluation or acceptance after goals are blocked.

Furthermore, the finding that goal re-engagement is associated with higher AARC-gains and lower AARC-losses aligns with Levy's (2009) stereotype embodiment theory, which proposes that negative societal stereotypes about age and ageing become increasingly self-relevant in later life, and these self-stereotypes can impact functioning and behaviour. Previous research has shown that those with more negative self-perceptions of ageing showed less use of adaptive self-regulation strategies (reflected by selective optimisation with compensation; P. Baltes & M. M. Baltes, 1990) than those with more positive perceptions (Wurm et al., 2017). Overall, those who perceive greater negative age-related change may be less likely to use adaptive strategies, potentially due to lower levels of perceived control (Levy, Slade, & Kasl, 2002), or self-efficacy (Levy, 1996; Levy, Hausdorff, et al., 2000). The current findings also broadly align with previous work suggesting that awareness of positive and negative age-related changes could influence goal-directed behaviour through different mechanisms. Over time, negative perceptions of ageing can become self-fulfilling, undermining efforts toward striving for new, achievable goals that have the potential to lessen the impact of age-related resource losses (e.g., Levy & Leifheit-Limson, 2009; Wurm et al., 2013). On the other hand, those who are more aware of personal strengths due to ageing are more likely to engage in developmentally relevant goals and to view older adulthood as a time for continued personal development, thereby potentially perceiving greater positive age-related change in the future (Diehl & Wahl, 2010; Dutt, Gabrian, & Wahl, 2018b). Future research should consider longitudinal relationships between AARC and goal regulation over

time to capture potential feedback loops between perceptions of positive or negative age-related change and goal directed outcomes.

In addition to examining main effects of AARC-gains and AARC-losses, Chapter 2 also addressed questions regarding the interaction of positive and negative perceptions of ageing in their prediction of goal adjustment strategies (e.g., Diehl & Wahl, 2010; Sabatini, Silarova, et al., 2020). While those with higher AARC-losses reported overall lower levels of both goal flexibility and goal re-engagement, this relationship was weaker among those with higher AARC-gains. These findings indicate that AARC-gains may act as a buffer in the relationship between AARC-losses and flexible strategy use in goal adjustment and goal re-engagement.

To my knowledge, findings from Chapter 2 are among the first to provide empirical support to Diehl and Wahl's (2010) postulation that perceptions of positive age-related change may act as a motivational force in later life that counterbalances negative perceptions of age-related change. While the potential protective effect of AARC-gains in the relationship between AARC-losses and adaptive outcomes has not been examined previously, it has been implicated in social gerontological literature for some time. P. Baltes' lifespan development framework focuses on understanding the dynamic interplay between gains and losses which accompany development across the lifespan. While the balance may shift toward more frequent losses and fewer gains to some extent in later life, development is proposed to consist of both components at all points in the lifespan (P. Baltes, 1987; Labouvie-Vief, 1980). Overall, this multidirectionality of development is proposed to inform goal selection and compensatory efforts when goals become unattainable (P. Baltes, 1987). As discussed in Chapter 1 (Section 1.2) measures of subjective ageing did not explicitly capture separate gain and loss components until relatively recently (Diehl et al., 2015; Diehl & Wahl, 2010).

Hence, the interplay of developmental gains and losses had not previously been considered alongside processes of goal adjustment.

AARC-gains may act as a buffer of relationships between AARC-losses and goal adjustment for several reasons which are elaborated on in Chapters 1 and 2. Overall, AARC-gains may directly inform goal adjustment (e.g., perceived gains in social skills could facilitate social engagement), or be protective of feelings of self-efficacy or competence to achieve goals which may otherwise be threatened by perceptions of negative age-related change (e.g., Bandura et al., 1999; Brandtstädter & Rothermund, 2002; Ryan & Deci, 2000). The findings reported in this thesis also align with the Conservation of Resources theory (Hobfoll, 2002) which states that the impact of resource loss on goal-related behaviour is mitigated when resource gain is high. More specifically, Hobfoll states that resource gain (e.g., valuing relationships more with increasing age) may not inherently have a significant, direct impact on emotional and functional processes. Nonetheless, when resource loss is perceived (e.g., health problems or cognitive losses), gains may be particularly salient and reduce the negative impact of loss-based experiences by facilitating emotional respite from goal failure and encouraging future goal re-engagement (Hobfoll, 2002). Furthermore, as processes of goal adjustment are informed by individuals' assessment of the resources they can commit toward the goal, perceptions of age-related strengths may allow them to be more selective and autonomous in the use of goal adjustment strategies in the presence of negative age-related change (Bandura et al., 1999; Carver & Scheier, 1998).

The final aim for Chapter 2 was to examine whether relationships between AARC and goal adjustment strategies were mediated by future time perspective. In terms of goal flexibility, while AARC-gains was positively, and AARC-losses was negatively associated with more expansive perceptions of future time, future time perspective showed no associations with goal flexibility. This may be due to FTP being more relevant to the separate

dimensions of goal disengagement and goal re-engagement, rather than the flexible use of both strategies in combination.

However, future time perspective was shown to mediate relationships between AARC and both goal disengagement and goal re-engagement. Specifically, those with higher AARC-gains, and those with lower AARC-losses reported more expansive perceptions of future time. In turn, those with greater future time perspective were more likely to report lower levels of goal disengagement, and higher levels of goal re-engagement. Associations between AARC and future time perspective are consistent with Brothers et al. (2016) and suggest that perceptions of remaining lifetime are tied to the changes individuals perceive in their life due to growing older. Furthermore, and consistent with socio-emotional selectivity theory (Carstensen, 2006; Carstensen et al., 2003), When time horizons become shorter, individuals tend to shift focus away from future-oriented goals (e.g., experiencing novelty or expanding knowledge), while placing greater importance on present-focused goals from which they gain emotional meaning (e.g., fostering important relationships).

While AARC and processes of self-regulation have been linked in previous theoretical and empirical literature (Diehl & Wahl, 2010; Dutt, Gabrian, & Wahl, 2018b), the current findings further suggest that future time perspective may be a potential mechanism linking perceptions of age-related change and self-regulation of goals. This finding is broadly in line with Diehl and Wahl's (2010) conceptual model of AARC, which proposes that AARC has implications for personal meaning making and self-regulation. Given that age-related losses are often unavoidable (P. Baltes & Smith, 2003; Heckhausen et al., 1989), establishing a better understanding of how older adults maintain a sense of purpose through flexible processes of goal disengagement and goal re-engagement represents an important focus for future social gerontological research. Previous research has found that AARC-gains mitigates the relationship between limited future time perspective and well-being (Brothers et al.,

2016). Future research may also consider whether the indirect effect found in the current research (AARC-losses > FTP > goal adjustment) is conditional on AARC-gains. Specifically, extending the follow-up analyses reported in Chapter 2, which focused on AARC-gains as a possible moderator of associations between AARC-loss and future time perspective, future research might consider AARC-gains as a moderator of associations between future time perspective and goal adjustment.

6.1.2 Awareness of Age-related Change as a Predictor of Between-person Differences and Longitudinal Change in Well-being Outcomes

As discussed in Chapters 1 and 3, research interest in subjective ageing and developmental outcomes has increased in recent years (Diehl et al., 2015). According to a recent systematic review, greater well-being in older adulthood is associated with higher awareness of positive age-related changes, and lower levels of perceived negative age-related changes (Sabatini, Silarova, et al., 2020). Furthermore, AARC has shown greater predictive power over well-being outcomes than chronological age (Brothers et al., 2017). AARC-gains may be linked to higher well-being via positive self-appraisal such as heightened feelings of self-efficacy, control, competence, or greater appreciation of current resources (Bandura et al., 1997; Hobfoll, 2002; Levy, Slade, Kunkel, & Kasl, 2002; Ryan & Deci, 2000), whereas AARC-losses may threaten these feelings and lead to negative self-evaluations, or prompt older adults to self-identify with negative ageing stereotypes (Hummert, 2011). Furthermore, as the awareness of growing older is tied to personal meaning making and subsequent goal setting and actions (Diehl & Wahl, 2010; Wurm et al., 2010), this awareness may inform changes in well-being over time. AARC-losses may limit engagement in certain health-promoting actions or other activities that foster engagement with life. On the other hand, AARC-gains may motivate pursuit of meaningful goals which in turn may improve or maintain levels of well-being.

Similar to Chapter 2, a key focus of Chapter 3 was the interplay of AARC-gains and AARC-losses in their prediction of between-person differences and longitudinal changes in well-being to examine if AARC-gains may play a protective role in the relationship between AARC-losses and adaptive outcomes. To my knowledge, previous research has not examined the interaction of positive and negative perceptions of ageing in the prediction of well-being outcomes. Thus, the second study in this thesis is important as it aims to further test Diehl and Wahl's (2010) proposition that AARC-gains may be 'an important counterbalancing factor to perceived negative age-related changes' (p. 342).

To summarise, findings from Chapter 3 (Wilton-Harding & Windsor, 2021b) indicated that AARC showed minimal associations with rates of change in psychological well-being over the one-year study period. Overall, those with higher AARC-gains, while showing higher levels of well-being overall, showed steeper decline in some well-being outcomes over time than those lower in AARC-gains. However, as mentioned in Section 3.5.1, this finding may not necessarily indicate a causal relationship between AARC-gains and decline in well-being, but rather may reflect that more extreme scorers are more likely to demonstrate regression to the mean over time (Nesselroade et al., 1980).

To my knowledge, Chapter 3 was the first study to assess whether AARC predicts longitudinal change in positive well-being outcomes. Only one previous study has examined the predictive power of AARC informing change in well-being-related outcomes over time. Specifically, Dutt, Gabrian and Wahl (2018a) found that those with higher AARC-losses at T1 showed greater increase in depressive symptoms over 2.5 years than those lower in AARC-losses. Hence, the more restricted one-year timeline of the current study may not have been sufficient to capture the predicted longitudinal changes.

A key finding in this study was the buffering effect of AARC-gains on the relationship between AARC-losses and between-person differences in psychological well-being. Overall,

while those with higher AARC-losses showed lower levels of well-being, this association was weaker among those with higher AARC-gains. In line with findings from Chapter 2, these results suggest that AARC-gains may attenuate the negative association between AARC-losses and adaptive outcomes in older adulthood. Similar to processes of goal adjustment, the awareness of positive age-related change may help to preserve feelings of self-efficacy, competence, or positive self-image (Bandura et al., 1999; Levy, Slade, Kunkel, & Kasl, 2002), thereby directly increasing well-being, or potentially reducing the impact of AARC-losses. Given societal stereotypes about age and ageing are often negative, perceptions of losses due to ageing are likely to prompt identification with these negative stereotypes which cast one's self-concept in a negative light (Diehl & Wahl, 2010). In this case, co-occurring AARC-gains may enable individuals to have greater awareness of the multidimensionality of growing older, potentially encouraging feelings of personal control over their own ageing process (P. Baltes et al., 1998; Levy, Slade, Kunkel, & Kasl, 2002; Wurm et al., 2013). Specifically, when age-related losses are perceived, accompanying perceptions of age-related gains may allow re-evaluation of the proportion of gains and losses expected in older adulthood (Heckhausen et al., 1989) and prompt individuals to evaluate their own ageing more positively. Finally, another potential mechanism linking AARC-gains to greater levels of well-being in the presence of age-related losses may be that AARC-gains encourages processes of effective self-regulation (Wurm et al., 2013). As demonstrated by findings from Chapter 2, AARC-gains buffers the relationship between AARC-losses and processes of goal re-engagement. Hence, the pursuit and attainment of developmentally appropriate goals may promote feelings of purpose and more general well-being (Carver & Scheier, 1998; Wrosch & Scheier, 2020).

6.1.3 Longitudinal Associations Between Awareness of Age-related Change, Goal Adjustment, and Psychological Well-being

Findings from the first two studies indicate that AARC has implications for both goal adjustment and psychological well-being in older adulthood. However, in their conceptual model of AARC, Diehl and Wahl (2010) postulate that relationships between AARC and well-being outcomes may be *mediated* by self-regulation of goals (see Figure 1.1). Overall, as perceptions of age-related change are usually considered alongside individuals' previous performances or the performances of peers, AARC is said to prompt reactions relating to personal meaning making and self-regulation. Furthermore, as AARC becomes a crucial part of older adults' self-awareness (Diehl et al., 2014; Diehl & Wahl, 2010), individuals' perceptions of age-related change are important for their selection of personal goals and informing subsequent actions (Carver, 2004). Furthermore, there is a strong body of research demonstrating links between re-engagement in important developmental goals and benefits for well-being (e.g., Barlow et al., 2020; Carver & Scheier, 1998; Wrosch & Scheier, 2020). Overall, it was anticipated that higher AARC-gains would be associated with increases in goal re-engagement and, in turn, increases in psychological well-being. It is worth noting that the findings from Chapter 3 indicated that those with higher AARC-gains at T1 showed a slight decrease in psychological well-being at T3. It is possible that people with high awareness of positive age-related change may have relatively little scope to improve in psychological well-being over time, as high AARC-gains is usually indicative of high psychological well-being (e.g., Brothers et al., 2016). Additional measurement occasions should be considered in future research, such that the predictor in the mediation model represents change in AARC-gains (i.e., from T1 to T2), rather than initial level of AARC-gains (i.e., T1 only) as was the case with the data in Chapter 4. Additionally, it was expected

that higher AARC-losses would be associated with decreases in goal re-engagement, and hence decreases in psychological well-being.

Chapter 4 aimed to tie together conceptual links between the key constructs of AARC, self-regulation of goals, and psychological well-being. Using the same data source as Chapter 3, complete longitudinal mediation analyses were conducted to examine the temporal order of associations between AARC, goal re-engagement, and psychological well-being. Overall, the proposed temporal order of associations (T1 AARC > T2 goal re-engagement > T3 psychological well-being) was not evident. However, one mediation pathway emerged as significant (T1 psychological well-being > T2 AARC-gains > T3 goal re-engagement), indicating that AARC-gains may mediate longitudinal associations between psychological well-being and goal re-engagement. Overall, those with higher psychological well-being at T1 were more likely to increase in AARC-gains at T2, and in turn, more likely to show higher goal re-engagement at T3 (although it is noted that while the *a* path in the mediation model from T1 well-being to T2 AARC-gains was significant, the *b* path from T2 AARC-gains to T3 goal re-engagement was not significant in the PWB composite model, despite the significant *a*b* indirect effect).

While these findings did not reflect the expected temporal order of effects such that goal re-engagement mediated longitudinal associations between AARC and psychological well-being, this may have been due to the relatively few measurement occasions over a relatively short time interval. The developmental processes underlying links between AARC and self-regulation reflected in Diehl and Wahl's (2010) AARC model may be more gradual and therefore measurable over years rather than months. However, the finding that higher psychological well-being at baseline may allow older adults to perceive greater positive age-related change is in line with emerging research which suggests that states of well-being can influence subjective ageing. Recently, both at the between- and within-person level, both

positive and negative affect were associated with self-perceptions of ageing. More specifically, those with higher (or higher-than usual) positive affect, and lower (or lower-than-usual) negative affect showed greater perceptions of positive age-related change and lower perceptions of physical and social age-related losses (Diehl et al., 2021). Furthermore, mood induction has been shown to impact subjective ageing, such that those primed to feel sadness reported a higher subjective age than those in the neutral mood condition (Dutt & Wahl, 2017).

While the hypothesised pattern of results was not evident in the current study, the combination of these findings alongside previous theoretical and empirical research indicates that relationships between the key constructs of AARC, goal re-engagement, and psychological well-being may not be simply linear, but part of interrelated systems of cognition, behaviour and well-being that reinforce each other and unfold over time. Research has demonstrated that AARC predicts change in certain well-being components over time (e.g., Dutt, Gabrian, & Wahl, 2018a), that goal adjustment capacities predict change in well-being outcomes (Haase et al., 2020) and that subjective ageing may impact future goal-related behaviour (Barlow et al., 2020; Brandtstädter & Renner, 1990; Carstensen, 2006; Carver & Scheier, 1998; Wrosch & Miller, 2009). While findings from Chapter 4 may not have demonstrated the proposed temporal order of associations, future research over longer intervals and with more frequent assessments is needed to more thoroughly investigate the possibility of dynamic feedback loops linking AARC, self-regulation and well-being.

6.1.4 Awareness of Age-related Change and Daily Stress Reactivity

Chapter 5 moved beyond the previous focus of assessing AARC as a trait-level construct, with AARC measured at the daily level to examine whether between-person differences and within-person processes of AARC-gains and AARC-losses may play a role in reactivity to daily stress. The measurement of AARC at the daily level is relatively new in

social gerontological literature. However, daily fluctuations in AARC-losses have been shown to predict multiple outcomes such as daily inductive reasoning, negative affect, perceived control, and cognitive interference (Neupert & Bellingtier, 2017; O'Brien et al., 2021; Zhang & Neupert, 2021; Zhu & Neupert, 2021). Thus far, AARC-gains has not received as much attention as a predictor of outcomes at the daily level (with the exception of Zhang & Neupert, 2021). Most relevant to the current research, AARC-losses has been shown to covary with daily negative affect (Neupert & Bellingtier, 2017). Furthermore, while not measured at the daily level, more negative overall attitudes toward ageing have been shown to predict increased reactivity to daily stressors (Bellingtier & Neupert, 2018).

In Chapter 5, analysis of daily diary data showed that reactivity to daily stressors did not vary as a function of between-person differences in average AARC across the 10-day study period. While the exploration of how subjective ageing relates to daily well-being and stressor reactivity is relatively new, these findings differed somewhat from those of Bellingtier and Neupert's (2018), who found that more negative attitudes toward ageing at baseline predicted greater reactivity to daily stress. However, there are multiple measures under the umbrella term of *awareness of ageing* and the measurement of overall ageing attitudes and everyday perceptions of age-related change capture conceptually different phenomena (see Diehl et al., 2014). Overall, between-person differences in perceptions of daily age-related change do not appear to be as crucial for stress reactivity in comparison to overall judgements about age and ageing which are often informed by negative stereotypes about ageing which may have been internalised over time. These findings reaffirm that the consideration of different conceptualisations of subjective ageing is crucial when it comes to understanding why certain individuals may adapt differently to age-related challenges.

Analysis of within-person associations suggested that on days when AARC-gains was higher than-usual, individuals showed decreased reactivity to daily stressors (indicated by

lower negative affect), and on days when AARC-losses was higher than usual, individuals showed increased reactivity to daily stressors (indicated by higher negative affect). I note the important caveat that we were not able to model statistically reliable interactions of within-person AARC with daily stress effects independent of the effects of between-person stress (see Chapter 5); however, these findings offer some useful preliminary insights into possible dynamic processes linking short-term changes in AARC, stress exposure and affect. Overall, both trait- and state-like components of AARC may inform individuals' self-concept or evaluations of their ability to handle current stressors (Diehl & Wahl, 2010; Ryan & Deci, 2000). Furthermore, given AARC and perceptions of control have been shown to covary at the daily level (Zhang & Neupert, 2021), AARC may inform individuals' sense of control over their life and outcomes. The investigation of mediating mechanisms between daily AARC and stress reactivity was not an objective of the present thesis but should be on the agenda for future research. Overall, as affective reactivity to daily stressors predicts future well-being (Charles et al., 2013), daily perceptions of age-related change may be a productive avenue for further inquiry regarding resilience in older adulthood. As subjective ageing is modifiable though intervention (e.g., Beyer et al., 2019; Brothers & Diehl, 2017), future research should explore whether focusing on reframing day-to-day perceptions of age-related losses and re-directing attention to positive aspects of life and experience that grow stronger with age may be beneficial for well-being in older adulthood.

6.2 Contributions of the Current Thesis to the Broader Literature

The manuscripts included in the current thesis contribute to social gerontological literature by addressing several key questions on the topic of awareness of age-related change and implications for adaptation. The following sections aim to situate the key findings from the current thesis within the context of the broader literature.

6.2.1 Differential Role of Awareness of Age-related Gains and Awareness of Age-related Losses

In contrast to many previous measures of subjective ageing, which have viewed positive and negative subjective ageing as two ends of the one continuum, the previous manuscripts considered positive and negative perceptions of age-related change individually and in combination in their prediction of adaptive outcomes. The overall pattern of findings regarding the different roles of AARC-gains and AARC-losses was consistent with previous research in the field, with higher AARC-gains positively associated, and AARC-losses negatively associated with adaptive outcomes (e.g., Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a, 2018b; Neupert & Bellingtier, 2017; Sabatini, Silarova, et al., 2020).

In previous AARC research, AARC-losses has often been found to be a stronger predictor of well-being outcomes compared to AARC-gains. Previously, researchers have argued that negative experiences of subjective ageing (i.e., AARC-losses) have a stronger impact on well-being than positive ones (i.e., AARC-gains). The difference in the strength of relationships may be due to negative events having greater predictive power over outcomes than positive events (Baumeister et al., 2001), or the prevalence of negative ageing stereotypes in society making negative self-perceptions of ageing more behaviourally relevant (Hummert, 2011), and more likely to impact one's self-concept than positive self-perceptions (Diehl & Wahl, 2010). Furthermore, negative age-related priming effects on behaviour and performance have been found to be almost three times larger than positive priming effects (Meisner, 2012).

In contrast to previous arguments that AARC-losses is a stronger predictor of outcomes than AARC-gains, a recent meta-analysis (Sabatini, Silarova, et al., 2020) found that AARC-gains and AARC-losses showed relatively similar associations with emotional well-being outcomes (r = .33 for AARC-gains, and r = -.31 for AARC-losses). Previous perspectives

which have suggested that negative self-perceptions of ageing have a stronger impact on well-being than positive have often referred to physiological or behavioural outcomes, or negative components of well-being (e.g., depression; Brothers et al., 2017; Dutt, Gabrian, & Wahl, 2018a; Hummert, 2011). However, several of the outcome measures examined in the current thesis showed slightly stronger associations with AARC-gains than AARC-losses. More specifically, AARC-gains showed similar or stronger associations than AARC-losses with measures of goal flexibility, goal re-engagement (Chapter 2), the composite psychological well-being measure, need satisfaction, need frustration, engagement with life (Chapters 3 and 4), and positive affect (Chapter 5). AARC-losses was more strongly associated with future time perspective and vitality than AARC-gains.

When it comes to assessing positive aspects of well-being (e.g., satisfaction with life, positive affect, psychological well-being), the strength of associations between AARC and well-being tends to be more equal across gain and loss components, especially when considered across distinctive domains of AARC (e.g., Brothers et al., 2017), or individual components of well-being (e.g., Kaspar et al., 2019). Overall, AARC-gains and AARC-losses may have different implications for different well-being outcomes, further justifying the importance of considering both positive and negative perceptions of growing older.

Furthermore, Chapters 3 and 4 in the current thesis focused on previously unexplored facets of psychological well-being in the context of AARC research. Specifically, engagement with life, vitality, need satisfaction and need frustration were considered as theoretically relevant indicators of psychological well-being. In terms of main effects, AARC-gains and AARC-losses showed the expected pattern of results when predicting well-being outcomes. Consistent with previous research (e.g., Brothers et al., 2016; Dutt, Gabrian, & Wahl, 2018a; Sabatini, Silarova, et al., 2020), greater levels of well-being were associated with higher AARC-gains and lower AARC-losses. Overall, there were no obvious differences

in patterns of associations between positively or negatively valenced AARC and individual well-being outcomes, with AARC-gains and AARC-losses showing relatively similar predictive power to each outcome. In Chapters 3 and 4, the satisfaction and frustration of basic psychological needs were considered as a whole. However, recent findings indicate that certain needs may be more important for well-being in later life (e.g., competence; Neubauer et al., 2017). Future research may benefit from consideration of how AARC may relate to each individual psychological need (autonomy, competence, and relatedness).

6.2.2 Interplay of Awareness of Age-related Gains and Awareness of Age-related Losses

The measurement of both positive and negative perceptions of growing older has been an important step forward in the subjective ageing literature. Not only does the AARC construct allow the separate consideration of AARC-gains and AARC-losses, but it also provides the opportunity to consider the interplay of the two in the prediction of relevant developmental outcomes. To my knowledge, the research in the current thesis is among the first to examine the interaction of AARC-gains and AARC-losses in the context of adaptive ageing (see also Windsor et al., 2021). However, it is worth noting that different approaches to examining the combination of AARC-gains and AARC-losses are beginning to emerge in the literature. Recent work by Sabatini and colleagues has used latent profile analysis to characterise individuals by varying combinations of AARC-gains and AARC-losses in the prediction of physical, cognitive, and mental health outcomes (using the AARC-10 SF; Sabatini, 2021; Sabatini, Ukoumunne, Ballard, Diehl, et al., 2020). Overall, those with both higher AARC-gains and lower AARC-losses were more likely to have better health outcomes. However, consistent with Chapters 2 and 3 in the current thesis, among those with greater AARC-losses, poor outcomes for health were offset in a sub-group who also reported higher AARC-gains (Sabatini, Ukoumunne, Ballard, Diehl, et al., 2020).

Overall, findings suggest that AARC-gains may attenuate the effect of AARC-losses on adaptive outcomes. At the cross-sectional level, this finding was consistent for goal flexibility, goal re-engagement, and the psychological well-being composite (as well as the components of engagement with life, need satisfaction, and need frustration). The finding that AARC-gains may mitigate the impact of AARC-losses on adaptive outcomes was not found for goal disengagement, future time perspective, or vitality. However, reported processes of goal disengagement did not vary as a function of AARC-losses in Chapter 1 (therefore there was potentially no relationship to attenuate). In terms of future time perspective, AARC-gains was positively, and AARC-losses was negatively associated with a more open-ended future time perspective. However, the relationship between AARC-losses and future time perspective was not moderated by AARC-gains.

Finally, AARC-gains did not buffer the relationships between AARC-losses and vitality (Chapter 3). Overall, potential protective effects of AARC-gains may not apply to vitality due to subjective energy being quite closely aligned and possibly perceived according to perceptions of age-related change (Avlund, 2010). Therefore, other aspects of well-being may be more amenable to reappraisal through appreciating age-related gains in the context of age-related losses. When age-related losses are experienced, individuals may use goal adjustment strategies to reduce discrepancies between available resources and desired outcomes (Brandtstädter & Renner, 1990). This may be the case for well-being indicators which are more susceptible to re-evaluation (e.g., life engagement, need satisfaction), where individuals' valued activities or basic psychological needs may change depending on their current situation and subsequent appraisals. However, the more physiological, energy-oriented aspects of well-being captured by vitality may be less prone to re-evaluation as a function of perceiving greater positive age-related changes.

A greater understanding of how experiences of subjective ageing impact adaptive outcomes may lend support to previous models of developmental self-regulation. The shifting balance of co-existing gains and losses across the lifespan is central to several major developmental theories such as Brandtstädter and Renner's (1990) dual process model of assimilative and accommodative coping, Heckhausen and Schulz's (1995) lifespan theory of primary and secondary control, and P. Baltes et al.'s (2007) theory of selective optimisation with compensation (Diehl et al., 2015). These perspectives have focused on age differences in self-regulation and acknowledge that age-related gains and losses play a major role in shifting processes of self-regulation. However, given the relative delay in the explicit measurement of individuals' perceived age-related change, relationships between awareness of how gains and losses change with ageing, and how these impact developmental self-regulation, have been understudied (Diehl et al., 2015). Findings from the current study support the notion that AARC offers an important perspective on age differences in self-regulation and well-being.

6.3 Implications of Research Findings

Taken together, findings from the current thesis may have theoretical implications for the understanding of the multidimensionally of subjective ageing, and possibly contribute to the development of intervention programs for adaptation and resilience in older adulthood (Infurna, 2021). In particular, these studies provide knowledge surrounding the potential protective effect of AARC-gains in promoting successful outcomes at both the state and trait level.

6.3.1 Modifiability of Awareness of Age-related Change

The current findings add to previous research regarding possible protective mechanisms in the relationship between negative perceptions of ageing and subsequent well-being. Overall, findings from Chapters 2 and 3 suggest that perceptions of positive age-related change may buffer the relationship between AARC-losses and the adaptive outcomes of goal

adjustment and psychological well-being. This could inform interventions concerned with targeting self-perceptions of ageing, an endeavour that has been recognised as a potentially important pathway for promoting successful ageing (Diehl et al., 2014).

With recent research demonstrating that subjective ageing is modifiable through intervention (e.g., Beyer et al., 2019; Brothers & Diehl, 2017), establishing a better understanding of how self-perceptions of ageing relate to adaptive outcomes represents a promising avenue for future research. Interventions targeted at improving experiences of subjective ageing and/or how they are perceived by individuals may help to promote greater physical, cognitive, and psychological health in older adulthood. In many cultures, views and perceptions of age and ageing are largely negative (Alonso Debreczeni & Bailey, 2021; North & Fiske, 2015), and these negative views are often consolidated into the way older adults view themselves as they grow older (Kotter-Grühn, 2015). Despite advances in the field of subjective ageing, research regarding interventions aimed at shifting societal views of older adults are not currently in a position to provide solutions for improving these views (Miche et al., 2015). Hence, researchers need to focus on other ways to foster more positive views of ageing for individuals and populations (Miche et al., 2015).

Interventions targeting individuals' subjective ageing are in their relative infancy (see Beyer et al., 2019; Brothers & Diehl, 2017; Klusmann et al., 2019; Levy et al., 2014; Sarkisian et al., 2007; Wolff et al., 2014). These interventions have mostly focused on shifting negative ageing stereotypes toward more neutral or positive stereotypes or increasing engagement in physical activity (e.g., Beyer et al., 2019; Brothers & Diehl, 2017; Levy et al., 2014). In most studies, self-perceptions of ageing were often shown to improve over the study period (e.g., Beyer et al., 2019; Brothers & Diehl, 2017; Levy et al., 2014; Wolff et al., 2014). For example, Beyer et al. (2019) showed that after a 12-week intervention which focused on improving self-perceptions of ageing, participants in the intervention group

reported greater ongoing development (conceptually similar to AARC-gains), and lower subjective physical losses. Overall, previous interventions focused on changing age stereotypes show promising results as they demonstrate the relative modifiability of subjective ageing, which may result in greater physical and mental health outcomes among older adults (Kotter-Grühn, 2015).

The findings from Chapters 2 and 3 suggest that increasing positive self-perceptions of ageing may have a role to play in reducing the negative impact of AARC-losses on well-being. Furthermore, findings from Chapter 5 suggest that not only between-person differences in AARC have implications for developmental outcomes, but that short-term changes in AARC may also impact well-being. Given that increased reactivity to daily stressors is associated with higher future affective distress, and an increased likelihood of an affective disorder diagnosis (Charles et al., 2013), targeting daily AARC may also be an efficacious avenue for intervention studies. Future interventions may benefit from not only targeting general age stereotypes, but also from helping individuals to notice small, day-to-day positive age-related change, or focusing on reframing day-to-day negative age-related changes which may accumulate over time to impact overall well-being (Almeida, 2005; Charles et al., 2013).

Overall, previous studies have shown that it is possible to both (a) decrease negative views of ageing (e.g., Wolff et al., 2014), and (b) increase positive views of ageing (Beyer et al., 2019). However, when considering future avenues for subjective ageing interventions, it is important to keep in mind that while negative subjective ageing has been linked to overall poorer developmental outcomes, reporting of high AARC-losses may not necessarily reflect maladaptive developmental outcomes. According to Dutt, Wahl and Diehl (2018), AARC-losses may be high for two possible reasons. First, negative societal stereotypes and personal expectations about ageing may lead individuals to underestimate positive age-related change

and/or overestimate negative age-related change, resulting in a relatively despondent view of the ageing process. On the other hand, when individuals have objectively suboptimal resources, their high reported perceptions of age-related losses may be relatively accurate (Dutt, Wahl & Diehl, 2018), and may even be protective in terms of their expectations for the future or for processes of accommodative coping (Dutt, Gabrian, & Wahl, 2018b). Global pessimistic perceptions of ageing may benefit from interventions which focus on reframing age-related stereotypes and encouraging older adults to not necessarily view negative age-related changes as uncontrollable and irreversible (Sarkisian et al., 2007). However, individuals with negative, yet realistic perceptions of their own ageing may not necessarily benefit from interventions targeted at reducing or reframing negative ageing experiences. Furthermore, attempts to reframe negative aspects of ageing may be counterproductive in this instance, as they may further reinforce societal stereotypes pertaining that the ageing process is something to be avoided (Kotter-Grühn, 2015). In this situation, interventions might be best placed by focusing on potential moderators (e.g., AARC-gains, self-efficacy, optimism or accommodative coping) of the relationship between negative self-perceptions of ageing to support older adults in strengthening their capacities of resilience (Dutt, 2018; Dutt, Wahl, & Rupprecht, 2018; Dutt, Gabrian, & Wahl, 2018b, 2018a; Wilton-Harding & Windsor, 2021b). For instance, future interventions may benefit from assessing the protective role of AARC-gains in the context of the more pervasive losses that often occur in the fourth age (e.g., oldest-old, 85+; P. Baltes & Smith, 2003), when health problems, cognitive losses and deaths of loved ones become increasingly common.

6.4 Limitations and Future Research Directions

As outlined in each empirical chapter (Chapters 2-5), there are several research limitations associated with the studies reported in the current thesis, which might be addressed in future research in the field of AARC. First, the research reported here made use

of two convenience samples of midlife and older adults who accepted invitations to participate in online research. Across the two studies, participants were mostly Caucasian (90.0 - 98.7%), female (65.9 - 66.4%), well educated (49.3 - 58.3% completed tertiary education) and were recruited online. Adapting to the ageing process is often easier if individuals are in good health and without financial constraints (Steverink et al., 2001). Hence, given the select nature of both of the current samples, it is not known whether the findings reported in the current thesis would generalise to broader, more representative samples with greater socioeconomic, gender, and cultural diversity, and those with less access to, or confidence in using technology. Given that perspectives of ageing vary across cultures (Hummert, 2011), future research should prioritise inclusion of a broader range of cultural and ethnic groups so that conclusions regarding AARC and adaptation are more generalisable. So far, the AARC scale has been used in the United States of America and Germany (Brothers et al., 2019; Wahl et al., 2013), and more recently in the United Kingdom (Sabatini, Ukoumunne, Ballard, Brothers, et al., 2020) and Portugal (Neri et al., 2021). To my knowledge, Chapter 5 of the current thesis is the first to explore AARC using an Australian sample. Future research might investigate the validity, reliability, and measurement invariance of the AARC scale in other countries and among individuals from more diverse backgrounds.

Participation in research which requires technology use is limited by multiple factors such as age, education, income, and gender (Fang et al., 2019). While approximately 75% of adults aged over 65 years from the United States report that they use the internet (Pew Research Center, 2017), online samples are still likely to differ from the general population in important adaptive ageing characteristics (Ogletree & Katz, 2020; Pruchno, 2019). Future research might consider recruitment of individuals who are less likely to be captured using online recruitment and data collection. Similarly, as suggested throughout previous chapters,

it may be useful for future research to include adults in advanced older age (i.e., 85+), when age-related changes may become more salient, to further understand how AARC may relate to goal-directed behaviour and well-being. However, awareness of growing older is present as early as middle adulthood (Kornadt et al., 2018), and people consistently report feeling approximately 20% younger than their actual age from around 40 years of age (Rubin & Berntsen, 2006). Future research should also measure AARC at younger ages, and across longer time periods to further understand how this awareness may relate to adaptive ageing from midlife onwards.

It is important to acknowledge that much of the data from both samples included in the current thesis were collected during the relatively early months of the COVID-19 pandemic. Specifically, the first two measurements from the CloudResearch sample (Chapters 2-4) occurred before the World Health Organisation declared COVID-19 a global pandemic on March 11, 2020. However, the final wave occurred in July 2020, near the beginning of the second wave of infections in the United States (Meyer & Madrigal, 2020). While increased stressors which may relate to COVID-19 were statistically controlled in the analyses in Chapter 4, it is important to keep in mind the context of the disruptions to daily life, and potential changes to subjective ageing as a result of the pandemic (Terracciano et al., 2021). The entirety of data collection for the daily diary sample was conducted within the relatively early months of COVID-19. However, at the time of the study (May-June 2020), parts of Australia were generally experiencing associated consequences (e.g., infection rates, deaths, lockdowns) to a less severe extent than many other parts of the world (Australian Government Department of Health, 2020). Furthermore, participants showed relatively high levels of well-being throughout the study period. Nevertheless, it is important to keep the historical context of the current research in mind when interpreting the broader findings.

Additionally, the data and analyses in Chapter 2 were cross-sectional. Given that this is the first study to indicate that future time perspective may partially mediate associations between AARC and components of goal adjustment, this finding nevertheless makes a unique contribution. However, future research may build on these findings and consider whether longitudinal associations between AARC and goal regulation are mediated by changes in future time perspective, and whether these relationships are amenable to change in the context of interventions.

An additional limitation of the current research is the relatively short time scale of the longitudinal study. In Chapter 3, AARC showed little predictive power over change in well-being over time (12 months). Moreover, in Chapter 4, the hypothesised pattern of temporal associations between AARC, self-regulation of goals and psychological well-being was not evident. Overall, the study design may not have incorporated sufficient measurement occasions over a long enough time period to capture the temporal processing of AARC proposed by Diehl and Wahl (2010). Future research should focus on both intra-individual variability and longer-term developmental change in AARC and adaptive outcomes. For instance, measurement burst designs may provide reliable and sensitive assessments of short-term fluctuations within the context of longer-term changes in key outcomes (Neupert & Carr, 2018; Rast et al., 2012). Overall, future research may consider varying macro and micro time scales for assessing AARC and its implications for change in well-being over time, as well as examining the temporal order of AARC, goal regulation and well-being to capture potential feedback loops between the key constructs.

While the current thesis has several limitations, it also features some important strengths. One such strength is the use of both longitudinal and micro-longitudinal data to examine the implications of AARC for long- and short-term changes in well-being outcomes. Using multiple timepoints to examine associations between AARC and well-being allowed

demonstration that daily fluctuations in AARC (both gains and losses) may influence daily stress reactivity, further supporting the idea that dynamic short-term processes may be implicated in links between AARC, coping and adaptation (Neupert & Bellingtier, 2017). These findings suggest that while AARC may be informative to consider at the between-person level, further examination of within-person processes involving AARC are needed to better understand adaptation in older adulthood.

A further strength of the previous studies is the consideration of relatively underexplored aspects of psychological well-being in the context of ageing and self-regulation. Some facets of well-being have been shown to improve in older adulthood, at least prior to very late life (e.g., affect balance; Ryff, 1989), whereas others have been suggested to decline with age (e.g., purpose in life and personal growth; Ryff, 1989). Well-being outcomes assessed in the current study (components of the psychological well-being composite used in Chapters 3 and 4) included engagement with life, vitality, and the satisfaction and frustration of basic psychological needs. These well-being outcomes are proposed to have important implications for well-being throughout the lifespan (Rowe & Kahn, 1997; Ryan & Deci, 2000), yet remain underexplored in gerontological research (Cardini & Freund, 2020; Coleman, 2000). While associations between AARC (gains and losses) and individual well-being components were relatively consistent, exploration of multiple components of well-being allows researchers to further understand how perceptions of age-related change may relate to separate domains of successful ageing, thereby potentially capturing aspects of multidirectionality of development (P. Baltes, 1987). Future research may consider examining other well-being outcomes to gain greater understanding of how AARC relates to adaptive outcomes.

Moving forward, subjective ageing researchers should further consider the theoretical and practical implications of the current findings regarding the potential protective role of

AARC-gains in both the relationship between AARC-losses and adaptation, and the relationship between daily stressors and affective well-being. Future research could focus on whether particular dimensions of AARC are particularly important for adaptation in later life. Personal experiences of ageing likely differ across different behavioural domains, and these differences likely impact self-knowledge or self-representations of older adults in distinctive ways (P. Baltes & M. M. Baltes, 1990; Diehl et al., 2015; Diehl & Wahl, 2010). Further exploration of the separate dimensions of AARC may allow researchers to ascertain whether awareness of gains in specific domains is especially effective in buffering the effects of AARC-losses. For example, age-related gains in social-cognitive and social-emotional functioning may be particularly valuable over and above gains in cognitive functioning. Furthermore, future research may consider whether perceptions of age-related gains in one domain (e.g., health and physical functioning) are particularly protective of perceptions of age-related losses in the same domain, or whether protective effects are present across alternate domains. A more nuanced understanding of particular mechanisms of AARC-gains which operate to protect adaptive outcomes in the presence of AARC-losses and stressors may allow researchers to make more informed decisions regarding which aspects of positive self-perceptions of ageing should be targeted in future interventions targeting subjective ageing.

In acknowledging potential issues surrounding the measurement or modifiability of AARC-gains and AARC-losses, it should be noted that many of the arguments in this thesis are based on the broad assumption that having higher AARC-gains and lower AARC-losses is associated with positive outcomes, and therefore interventions should focus on increasing AARC-gains and decreasing AARC-losses. However, as mentioned previously, high AARC-gains and low AARC-losses may not always be reflective of adaptive ageing. Future research should focus on identifying under what circumstances higher or lower perceptions of positive

and negative age-related change may reflect denial of the ageing process or accurately reflect the individual's current resources or objectively assessed age-related change (Diehl et al., 2014).

Furthermore, given that negative self-perceptions of ageing may be the result of either pessimistic views on ageing or they may align with individuals' reality and available resources, it may be difficult or potentially problematic to provide the same intervention focused on changing or reframing negative age-related change (see Dutt, Wahl & Diehl, 2018). However, individuals in either of the above scenarios may benefit from interventions focused on fostering resilience capacities in older adulthood by focusing on potential moderators of the association between negative self-perceptions of ageing and well-being outcomes. The current findings suggest that AARC-gains may serve as one such moderator and that focusing on highlighting positive aspects of ageing may be a fruitful avenue for future intervention research.

As mentioned, AARC captures individuals' subjective ageing experiences, and there are likely individual differences in the extent to which people notice age-related gains and losses. For example, those higher in neuroticism are more likely to report lower AARC-gains and higher AARC-losses (Rupprecht et al., 2019). In addition, there are likely individual difference traits which are susceptible to change which researchers may wish to focus on in the context of increasing AARC-gains. Previously, those with higher reported levels of mindfulness reported higher AARC-gains (Dutt, Wahl, & Rupprecht., 2018). Furthermore, higher levels of mindfulness buffered the relationship between AARC-losses and increases in depressive symptoms over a 4.5-year period (Dutt, Wahl, & Rupprecht, 2018). Components of mindfulness (such as present-moment attention, decentring, or non-judgemental acceptance) may play a role in informing how individuals evaluate and respond to perceptions of age-related change. For example, one may need to have relatively high present

moment attention in order to appreciate positive age-related changes (e.g., having a better sense of what is important in life in the here-and-now). Similarly, when experiencing negative age-related change, components of decentring (the ability to view experiences more objectively) or acceptance may allow individuals to not dwell on negative age-related change (e.g., Mahlo & Windsor, 2020, 2021b). Furthermore, mindfulness interventions in the context of older adulthood have shown promising results when it comes to increasing aspects of well-being (see Geiger et al., 2016; Mahlo & Windsor, 2021a). Overall, future research should consider the potential role of mindfulness in AARC and the extent to which interventions which include components of mindfulness may assist in encouraging awareness of positive age-related change.

6.5 Conclusion

Overall, this thesis contributes to the current literature surrounding subjective ageing and adaptive functioning, and further demonstrates the value of considering subjective ageing as multidimensional. Although the findings do not allow us to make causal conclusions about key relationships, they nonetheless suggest that both AARC-gains, AARC-losses, and their interaction may be crucial for adaptive outcomes in later life. A finding of central interest is that the interplay of AARC-gains and AARC-losses has implications for adaption in older adulthood. Overall, associations between AARC-losses and adaptive outcomes were found to be attenuated by higher levels of AARC-gains. Hence, focus on increasing AARC-gains may be an efficacious avenue for future intervention-focused research. Furthermore, preliminary findings suggest that longitudinal relationships between AARC, self-regulation of goals, and well-being should be further examined to gain understanding of how processes of subjective ageing and adaptation unfold over shorter and longer time scales. Finally, current findings suggest that AARC is important to consider at a daily level, as how people evaluate their ageing from day-to-day may have implications for how individuals respond to stress in ways

that contribute to longer term health and well-being. Taken together, the findings presented in this thesis may help to inform future research directions or the potential development of interventions or programs aimed at promoting the awareness of positive age-related change, flexible adaptation, and well-being in middle and older adulthood.

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