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## Changes in positive and negative affect as predictors of change in felt age: Results from the Health and Retirement Study

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### ABSTRACT

The present study aimed to examine how changes in positive and negative affect and their interaction predict changes in felt age in a longitudinal design of two waves drawn from the Health and Retirement Study (HRS). Participants ( $n = 4174$ ) at an average age of 67.97 completed the 2008 and 2012 left behind questionnaire of the HRS. Our results showed that an increase in positive affect and a decrease in negative affect from Wave 1 to Wave 2 predicted an accelerated decrease in felt age. There was an interaction effect showing that for those with an increase in negative affect, a higher change in positive affect predicted reduced odds for accelerated increase in felt age. To conclude, improving favorable change in the combination between positive and negative affect might in turn relate to the individual's self-perceptions of aging, in the second half of life.

### ARTICLE HISTORY

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### KEYWORDS

Positive affect; negative affect; subjective age; Health and Retirement Study; older adults

It has lately been shown that the pace of biological aging differs among individuals. Whereas some individuals age biologically according to their chronological age, others show accelerated increase or decrease in their aging process (Belsky et al., 2015). In line with this finding, it is not surprising that individuals may perceive themselves as younger or as older than their chronological age. It has been shown that feeling younger than one's age serves as a cue for adjusted aging and relates to physical functioning, health, and mortality (Choi, DiNitto, & Kim, 2014; Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009; Montepare, 2009). Additionally, since well-being is a central mental system that helps individuals enhance and maintain a favorable psychological environment in the face of actual or potential age-related adversities (Shmotkin, 2005), an interchangeable relationship between the well-being system and subjective age is expected (Westerhof & Barrett, 2005). The present study aimed to examine how changes in psychological resources, namely: the well-being system, may predict change in the subjective perceptions of individuals with regard to their age.

### The well-being system

Positive affect (PA) and negative affect (NA) represent global judgments that individuals make with regard to

their affective lives. NA and PA are defined as parts of the well-being system which functions to maintain and promote an adaptive positive psychological environment (Diener, Lucas, & Scollon, 2006), particularly among older adults (Carstensen, Isaacowitz, & Charles, 1999; Carstensen & Mikels, 2005; Shmotkin, 2005).

PA and NA are known as relatively stable and separate constructs (Diener, Suh, Lucas, & Smith, 1999). Studies have shown that higher PA or alternatively lower NA is related, separately, to better social, cognitive, and physical functioning, to better physical health and mental health adaptations among older adults (Allerhand, Gale, & Deary, 2014; Hirsch, Floyd, & Duberstein, 2012; Segerstrom, 2014), and even to mortality (Mroczek et al., 2015). Furthermore, it has been suggested that the combination between measures of PA and NA can contribute valuable information and can better predict functioning and physical health (Hassett et al., 2008; Hu & Gruber, 2008).

### Theoretical background for the importance of the well-being system

One theory which provides a useful framework for understanding the interpersonal mechanisms that underlie the above-mentioned findings is the broaden-and-build theory (Fredrickson, 2001, 2013a). This theory claims

that PA plays an adaptive evolutionary role by widening one's thinking and behavioral repertoires, which in turn enhances resilience and adaptation to adverse circumstances. Although this theory is less focused on the influence of the social context, it claims that high PA has a social advantage, as it enhances a tendency to engage rather than disengage with the environment (Garland et al., 2010). It has been claimed that PA also serves to loosen or ameliorate the impact of NA on an individual's mindset. As NA has mainly momentary adaptive significance, while PA has more long-term advantages (Fredrickson, 2013b), it is interesting to examine their combined contribution in adaptation to the aging process.

When growing old, one's external surroundings become more abundant with negative occurrences like illnesses, disabilities, and loneliness. Adaptive adjustment has been found to be related to a focus on positive aspects with a diminishing awareness of negative ones in order to create a favorable psychological environment, especially at an advanced age (Allerhand et al., 2014; Carstensen & Mikels, 2005; Hirsch et al., 2012; Segerstrom, 2014; Shmotkin, 2005). We decided to examine change in PA and NA as it has been found that the direction (increase or decrease) of change in PA and NA over time may also affect one's adjustment to age-related changes (Palgi et al., 2014).

### Subjective age and change in subjective age

One way to evaluate whether individuals in the second half of life succeed in adjusting to the aging process and accommodate to their psychological environment is by examining their Awareness of Aging (AoA; Diehl & Wahl, 2010; Diehl et al., 2014). AoA encompasses self-perceptions that relate to the aging process, such as one's attitudes toward aging, and is thus an important reflection of psychological processes as people age (Diehl et al., 2014). One proxy measure of AoA is felt age, which is a self-perception that is associated with the more general system of regulation and adjustment to the aging process. Felt age (also known as subjective age) is defined as the individual's evaluation of how old one perceives oneself to be (Shrira, Bodner, & Palgi, 2014). Although chronological age is a pivotal measure in understanding developmental processes in younger age groups, this measure becomes less effective in predicting coping with adversities in the second half of life (Baars, 2013; Diehl et al., 2014). From midlife onward, felt age reflects one's regulatory 'secondary control' system (Heckhausen & Schulz, 1995) that promotes adjustment to age-related changes. In the same vein, studies have shown that felt age is associated and in most cases may be even a better predictor than chronological age in relation to physical functioning (Montepare, 2009), physical health (Choi et al., 2014), mortality risk (Kotter-Grühn et al.,

2009), and well-being (Keyes & Westerhof, 2012; Westerhof & Barrett, 2005). As growing old tends to be stigmatized in Western societies, feeling old in relation to one's chronological age might serve as a negative aging cue, priming an adverse aging process. Conversely, a younger felt age than one's chronological age (and not felt age that is consistent with one's chronological age) has been conceived of as an adaptive strategy when growing older, and is interpreted as a compensatory construct that helps maintain a sense of control across the lifespan (Keyes & Westerhof, 2012). Following this idea, it was previously found that an average difference of 13 years remains over time between one's chronological and felt age (Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008). This finding implies that a consistently younger felt age might serve as a protective mechanism against life adversities among older adults. As most of the studies of felt age referred to the difference in years between chronological age and felt age, only a few studies have examined the within-person level of change in felt age, evaluated by the person across the passage of years as a measure of the individual's perception of the aging process (Ayalon, Palgi, Avidor, & Bodner, 2016; Kleinspehn-Ammerlahn et al., 2008; Uotinen, Rantanen, Suutama, & Ruoppila, 2006). Such an approach to felt age allows a more dynamic measurement of the relative changes in the perceptions of age in light of the passage of time. Recently, in a study of daily diary entries, the association between PA and NA with subjective age was examined over eight days. The findings showed a positive association between PA and younger daily subjective age, and a positive association between NA and older daily subjective age (Kotter-Grühn, Neupert, & Stephan, 2015). This study measured daily fluctuations in felt age over a short period of time and can inform us about mechanisms of mood stability and affective regulation. However, changes in felt age over longer periods of time, as measured in years, reflect developmental changes that represent changes in self-perceptions of aging. As the well-being system enhances a favorable psychological environment in the face of age-related adversities (Shmotkin, 2005), it is assumed that favorable changes in PA and NA may predict younger age evaluations over time, which is an adaptive strategy for maintaining good health, functioning, and a reduced mortality risk (Choi et al., 2014; Kotter-Grühn et al., 2009; Montepare, 2009).

### The current study

In the current study, we examine whether intra-individual changes appearing across a time period of four years from 2008 to 2012 in PA and NA are associated with changes in psychological adjustment to the aging processes, measured by felt age during the same time period. We defined

accelerated increase in felt age over the four-year period of the study, when subsequently assessed felt age is greater than the span of chronological years that have passed. An accelerated decrease in felt age was defined as a relative decrease in felt age compared to the span of chronological time passed since the first measurement (Ayalon et al., 2016). To allow for some deviations from this strict definition, we used a confidence interval of plus and minus one year with these definitions.

More specifically, we hypothesize that indications of positive adjustment of the well-being system, represented by an increase in PA and a decrease in NA over a four-year period, would separately predict an accelerated decrease in felt age (tendency to feel younger along the same four-year period) and will be negatively associated with an accelerated increase in felt age (tendency to feel older along the same four-year period). Furthermore, as previous studies have shown that the interaction between PA and NA holds an additional advantage in predicting better adjustment to aging, beyond that of these factors alone (see e.g. Bodner, Palgi, & Kaveh, 2013), we also examined the interaction between PA and NA, as predictors of change in felt age. It is expected that the interaction between changes in PA and NA (in which high PA and low NA will be related to better adjustment) will be positively associated with an accelerated decrease and negatively associated with an accelerated increase in felt age. Higher levels of increased PA and decreased NA are expected to predict accelerated decreased change and inversely increased change in felt age, respectively.

## Methods

### *Participants and procedure*

Using a US nationally representative panel, participants were recruited by the Health and Retirement Study (HRS). This is a biannual longitudinal survey of older adults at the age of 50 or above and their spouses of any age. The HRS is supported by the National Institute on Aging (NIA U01AG009740) and the Social Security Administration. In the core questionnaire, information about income, work, assets, health, and disability was collected over a face-to-face or a phone-administered interview. However, since 2006, the HRS has added the leave-behind questionnaire, a self-administered psychosocial questionnaire to a rotating 50% of the core panel participants, who receive the same questionnaire every four years. The leave-behind questionnaire evaluates psychosocial measures and includes subjective well-being as well as felt age as part of its items. The current study is based on the 2008 and 2012 data, which represent a longitudinal panel of individuals who completed two waves of the psychosocial questionnaire.

In 2008, 7500 individuals were eligible to complete the psychosocial questionnaire. Of these, 6479 completed and returned the questionnaire and 97 completed it by phone with an interviewer. We excluded 78 individuals who were not assigned to the psychosocial questionnaire and completed it, and 846 individuals who did not return the questionnaire. In 2012, 5235 individuals completed the questionnaire and 302 had someone else complete it for them. For 82 individuals, the person assigned to receive the psychosocial questionnaire did not answer it and, thus, were excluded.

In the present study, we analyzed the data from 4174 individuals, between the ages of 50–96, who completed both waves of the leave-behind questionnaire and provided a response to the question regarding one's felt age. Listwise deletion was used in the main analysis so that only individuals with complete data participated in the study.

In order to better delineate those eligible to participate in the study but did not respond, a pre-study comparison was conducted. Accordingly, we compared those who were eligible to complete the leave-behind questionnaire in 2008 and did not respond, with those who responded to the question about felt age in 2008 and in 2012. This comparison shows that those who completed the 2008–2012 questionnaires were younger ( $M = 70.4[11.5]$  vs.  $M = 67.6[9.3]$ ,  $t[df] = 12.1[7654]$ ,  $p < 0.001$ ), had a higher level of education ( $M = 11.9[3.5]$  vs.  $M = 12.9[2.9]$ ,  $t[df] = -12.9[7643]$ ,  $p < 0.001$ ), reported a lower number of medical conditions ( $M = 2.2[1.4]$  vs.  $M = 1.9[2.9]$ ,  $t[df] = 7.8[7653]$ ,  $p = 0.02$ ), and fewer depressive symptoms ( $M = 1.7[2.2]$  vs.  $M = 1.2[1.8]$ ,  $t[df] = 10.6[7506]$ ,  $p < 0.001$ ). In addition, the percentage of women was higher in this group, compared with those who were eligible to complete the psychosocial questionnaire in 2008 and did not respond (60.7% vs. 58.3%,  $\chi^2[df] = 4.7[1]$ ,  $p = 0.03$ ).

### *Measures*

#### *Demographics*

Age, gender, and years of education were gathered from participants. Additionally, in order to control for age differences in felt age, the difference score between one's chronological and felt age, as reported in 2008, was calculated and served as a covariate. In this way, we controlled for the tendency of older participants to have a larger difference between their chronological and felt age at baseline.

#### *Change in number of medical conditions*

Due to potential changes in medical conditions between middle-aged and older adults, we decided to control for medical conditions. Respondents were asked to report whether or not a physician had told them that they suffer from the following seven medical conditions: high blood

pressure, diabetes, cancer, lung disease, heart condition, stroke, and arthritis. The scores ranged between 0 and 7, with a higher score indicating worse medical condition. A change in the number of medical conditions was calculated by subtracting the number of medical conditions reported in 2008 from the 2012 score.

### **Felt age**

Respondents were asked to indicate at what age they feel most of the time (Shrira et al., 2014). In the present study, we excluded extreme responses (less than 1% of the sample), and included scores of felt age that ranged between 15 and 120 years.

### **Change in felt age**

The change in felt age score was calculated by subtracting the felt age provided in 2008 from that provided in 2012. A change in score that ranged between 3 and 5 years was coded as 0 = changes in felt age, which is chronologically consistent with changes in the passage of time between the two waves. As felt age was measured with round numbers and the two waves of measurement were only on average four years apart from each other, in some cases, the time passed in round numbers was three years and in other cases five years. Therefore, a change in score that was lower than 3 years was coded as 1 = an accelerated decrease in felt age, whereas a change in score greater than 5 years was coded as 2 = an accelerated increase in felt age.

### **Change in positive and negative affect**

A 12-item version adapted from the Positive and Negative Affect Scale (PANAS; Mroczek & Kolarz, 1998) was used to assess PA and NA. Six items indicated PA items (e.g. 'calm and peaceful'; 'in good spirits') and six indicated negative affect (e.g. 'nervous'; 'worthless'). Participants were asked to report how often they felt, in the last month, specific affects, on a scale ranging from 1 – 'all of the time' – to 5 – 'none of the time'. A higher average score indicated higher PA or NA accordingly. Change in PA and NA was calculated by subtracting the score reported in 2008 from that reported in 2012. Cronbach's alpha for PA and NA was 0.92 and 0.89 in 2008, and 0.93 and 0.90 in 2012, respectively.

### **Data analysis**

First, we examined differences between the three groups (changes in felt age consistent with changes in chronological age, accelerated felt age increase, and accelerated felt age decrease). Hence, we ran descriptive statistics, using  $\chi^2$  and one-way ANOVAs, to examine differences in categorical variables and continuous variables, respectively. Next, we conducted hierarchical multinomial regression

analysis, with group membership in one of the three changes in felt age groups as the outcome variable. A consistent felt age identity was used as a reference category. In the first step, we entered demographics and covariates (age, gender, and education, the difference score between one's chronological age and felt age in 2008, and changes in medical conditions between 2008 and 2012). In addition, we entered the main effects, i.e. changes in PA and NA between 2008 and 2012 as potential predictors of group membership. In the second step, we entered the interaction between changes in PA and NA. In order to better interpret the source of the interaction, NA and PA scores were divided into three categories: for participants that are  $-1$  SD or less, central range SD, and  $+1$  SD or more scores of change in NA and PA.

## **Results**

### **Descriptive results**

When looking at the distributions of participants divided by the three felt age groups, we can see that about a quarter of the participants (24.7%;  $n = 1033$ ) reported relatively consistent changes between their felt age and their chronological age over the four-year period. More than one-third of the participants (36.2%;  $n = 1509$ ) reported an accelerated increase in their felt age, whereas 39.1%;  $n = 1632$  of the participants reported an accelerated decrease in their felt age compared to the change in their chronological age during this four-year period.

Participants from the three groups of change in felt age differed on all demographic variables and all covariates assessed. One exception is the change in the number of medical conditions which was only marginally significant. Participants with an accelerated increase in felt age reported in 2008 a younger felt age compared with their chronological age, and included a higher percentage of men compared to the other felt age groups. Furthermore, they had lower PA and higher NA compared with their counterparts. Participants from the consistent change group had higher education compared with the other groups. For further information see Table 1.

### **PA and NA as predictors of change in felt age**

In order to examine our hypotheses, we conducted hierarchical multinomial analyses. After controlling for demographics (age, gender, and education), covariates (the difference between one's chronological and felt age, as reported in 2008, and change in number of medical conditions), and main effects (change in PA and NA) in the first step, a higher change in PA was associated with higher odds to be included in the accelerated decrease

**Table 1.** Sample characteristics as a function of changes in subjective age.

	Overall sample (4174)	Accelerated decrease (1632; 39.1%)	Consistent felt age (1033; 24.7%)	Accelerated increase (1509; 36.2%)	Difference test
Age	67.97 (8.82)	67.79 (8.81)	67.04 (8.74)	68.80 (8.81)	$F(4171, 2) = 12.89^{***}$
Sex					$\chi^2(2) = 8.41^*$
Male	1654	602 (36.4%)	427 (25.8%)	625 (37.8%)	
Female	2520	1030 (40.9%)	606 (24.0%)	884 (35.1%)	
Education	12.89 (2.94)	12.77 (3.06)	13.17 (2.84)	12.82 (2.86)	$F(4167, 2) = 6.61^{**}$
Age – felt age in 2008	10.86 (10.96)	7.54 (11.16)	8.12 (8.50)	16.34 (10.04)	$F(4171, 2) = 344.38^{***}$
Change in number of medical conditions between 2008 and 2012	0.28 (0.74)	0.25 (0.71)	0.29 (0.75)	0.31 (0.76)	$F(4170, 2) = 2.76$
Change in positive affect between 2008 and 2012	-0.08 (0.70)	0.03 (0.68)	-0.10 (0.64)	-0.19 (0.73)	$F(4093, 2) = 36.34^{***}$
Change in negative affect between 2008 and 2012	0.01 (0.54)	-0.07 (0.56)	0.03 (0.50)	0.09 (0.53)	$F(4091, 2) = 34.32^{***}$

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

**Table 2.** Hierarchical multinomial regression analysis, predicting accelerated decrease and increase in felt age relative to consistent change in felt age with the passage of time (reference category).

	Accelerated decrease <i>B</i> , OR (95%CI)	Accelerated increase <i>B</i> , OR (95%CI)
First step		
Age 2008	0.21, 1.01 (1.01–1.02)**	0.01, 1.01 (1.00–1.02)*
Sex (women)	-0.20, 0.81 (0.69–0.96)*	0.05, 1.05 (0.88–1.25)
Education	-0.04, 0.96 (0.93–0.99)**	-0.07, 0.93 (0.90–0.96)***
Age – felt age 2008	-0.00, 1.00 (0.99–1.00)	0.09, 1.09 (1.08–1.10)***
Change in number of medical conditions between 2008 and 2012	-0.97, 0.91 (0.81–1.01)	0.02, 1.02 (0.91–1.14)
Change in positive affect between 2008 and 2012	0.22, 1.25 (1.10–1.41)***	-0.09, 0.91 (0.80–1.04)
Change in negative affect between 2008 and 2012	-0.27, .76 (0.65–0.89)**	0.13, 1.13 (0.96–1.34)
Second step		
Change in positive affect × change in negative affect	0.02, 1.02 (0.86–1.20)	-0.18, 0.84 (0.70–0.99)*

Notes:  $-2ll = 8059.95$ ; OR = Odds Ratio, CI = Confidence Interval. Changes in felt age are consistent with the passage of time = subjective age increased by 3–5 years over the four-year period; Accelerated decrease = felt age decreased over the four-year period; Accelerated increase = felt age increased by more than 5 years over the four-year period.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

in felt age group (i.e. a change in felt age that was lower than 3 years) compared with the consistent change group (OR = 1.260, 95%CI = 1.114–1.426,  $p < 0.001$ ). Reporting a higher level of change in NA, on the other hand, was associated with reduced odds of being included in the above-mentioned group (OR = 0.76, 95%CI = 0.65–0.89,  $p < 0.01$ ). Both changes in PA and NA were not significantly associated with accelerated increase in felt age. For further details see Table 2.

### **The interaction between PA and NA as a predictor of change in felt age**

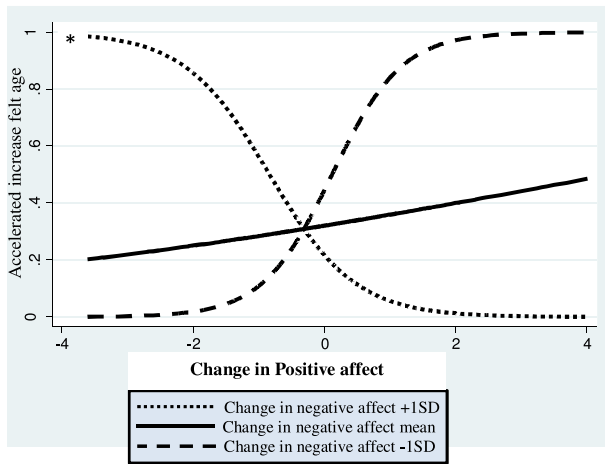
In order to examine the second hypothesis, we assessed the effect of the interaction between change in PA and NA on group membership. This interaction was significant in predicting membership in the accelerated increase in felt age group only ( $B = -0.18$ , OR = 0.836, 95%CI = 0.704–0.993,  $p < 0.05$ ). Searching for the source

of the interaction showed that only among participants who had +1 SD of change in NA, a higher change in PA has mitigated the accelerated increase in felt age (OR = 0.562, 95%CI = 0.357–0.884,  $p < 0.05$ ). See Figure 1.

The interaction did not predict an accelerated decrease in felt age.

## **Discussion**

The present study examined how changes over time in positive and negative aspects of the well-being system affect the way individuals construct their self-perceptions of aging. The results showed that higher levels of change in PA and NA were associated with an accelerated decrease in felt age. Specifically, a greater change in PA was associated with higher odds of being included in the accelerated decrease felt age group and a higher change in NA was associated with lower odds of being included in the accelerated decrease felt age group. The interaction between



**Figure 1.** Accelerated increase in felt age as a function of changes in positive and negative affect.

Notes: The y-axis shows the probability of belonging to the 'accelerated increase felt age category' compared to the category 'consistent felt age',  $*p < 0.05$ .

change in PA and NA, however, was associated with higher odds of being included in the accelerated increase in the felt age group. A stronger negative association between change in PA and reporting an accelerated increase in felt age was found among those with higher levels of change in NA.

As expected, a positive change in PA was associated with an accelerated decrease in felt age. This means that those who reported a higher positive change in PA over a period of four years also reported a change in feeling their age as younger. This association is well embedded within the frameworks of PA research (Westerhof & Barrett, 2005). Theoretically, this finding is in line with the positive illusion theory (Alloy & Abramson, 1988; Baumeister, 1989), which suggests that seeing things as only slightly better than they really are (similar to experiencing higher PA) has adjustable merits. It promotes the ability to maintain positive self-perceptions, such as feeling younger than one's age (Westerhof & Barrett, 2005).

Furthermore, according to the broaden-and-build theory (Fredrickson, 2001, 2013a), it can be assumed that accumulative effects of PA over time create a broadened array of perceptions, thoughts, and actions that help older individuals cope with NA and thereby better adapt to their aging process, as reflected by an accelerated decrease in younger felt age.

The association between NA and felt age is a mirror image of the results pertaining to PA. These results are in line with previous findings showing that lower levels of NA were associated with lower felt age (Westerhof & Barrett, 2005). Nevertheless, our finding regarding PA and NA are the first to demonstrate these associations when accounting for change in subjective well-being and felt

age over time. These findings are in line with the theorizing that more favorable self-perceptions of aging are closely linked with the subjective well-being system that enhances the creation of a positive psychological environment (Shmotkin, 2005).

When examined separately, change in PA and NA is associated with favorable self-perceptions of aging. However, the interaction found in this study between change in PA and NA predicts an increase rather than a decrease in felt age. This could indicate that under a specific combination, when change in NA is high, lower levels of change in PA may be deleterious and result in an increase in felt age. This interaction, therefore, perhaps represents cases of more severe psychological acceleration in felt age. It is possible that under more chronic adversities, there are reductions to the well-being system, which, in turn, manifest in more negative psychological processes such as an acceleration in felt age. Several studies have shown that as people age, or, rather, approach their death, they report higher levels of deterioration in their well-being system (Charles, 2010; Palgi et al., 2010). This possible connection between the well-being system (Gana, Saada, & Amieva, 2015) and felt age might be the underlying explanation for the accelerated increase in felt age found in this study.

Finally, our results revealed an unexpected incidental finding. It was found that younger felt age in 2008 predicts accelerated increase in felt age. One possible explanation for this finding is a statistical regression to the mean. Those who evaluated themselves as younger in 2008 had higher odds to have accelerated increase in felt age than those who evaluated themselves as older. A second explanation can be that an exaggerated and inappropriate evaluation of felt age as too young might represent difficulties in one's perception and acceptance of aging. These assumptions should be further investigated in future studies.

Several caveats should be noted. First, although we used a longitudinal design in the present study, we had only two time measurements. Hence, it is impossible to determine trajectories of change in well-being and felt age. Moreover, although this study was meant to examine the association between well-being and felt age, using additional predictors of personality or adding other perceptions relating to time and aging such as the evaluation of perceived distance-to-death, which was found to be linked to the individual's well-being (Palgi et al., 2014), could broaden our view on these associations.

Additionally, it should be noted that felt age was assessed with a global measure, perhaps not covering the full range of experiences related to different domains of subjective age (Diehl et al., 2014). Drawing from the social judgment tradition, the use of a single item that measures global felt age demands a complex cognitive judgment, which might have primed a recent report made regarding

one's affect (Schwarz & Strack, 1991). Such a judgment heuristic might have accounted for part of the association found in this study between reporting on PA and younger age identity, or alternatively on NA and older age identity. This idea needs to be further explored in future studies.

Furthermore, as is usually the case in panel studies, our longitudinal sample was younger and healthier than the original sample. This could have biased the results. Finally, as in other studies which are based on large samples, the effects of main factors and especially the interaction between them were low and could have reached significance due to the relatively large sample size.

Nonetheless, the findings of the present study have both theoretical and practical implications. Theoretically, the current results demonstrate that whereas changes in PA and reverse changes in NA are associated with favorable changes in self-perceptions of aging, their interaction is associated with changes in negative perceptions of aging (in this case – in felt age). Therefore, measuring the relationship between PA and NA and felt age separately provides only a partial view on the more complicated association between them with felt age. Future research that refers to the long-lasting effect of PA and NA may benefit from including the effect of their interaction on various perceptions of aging, as part of the study. From a practical viewpoint, these results suggest that interventions that can strengthen the regulatory role of PA and NA are warranted and should focus not only on the level of these measures but rather on the direction of their change in order to improve and better predict the subjective life trajectories of older adults. Thus, a concluding theoretical and practical thought should be that clinical interventions may aim to reduce negative self-perceptions regarding one's own aging, and enhance acceptance of one's chronological age as an adaptive strategy.

## Disclosure statement

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