Original Manuscript

The International Journal of Aging and Human Development
00(0) 1–19

DOI: 10.1177/0091415020917681
journals.sagepub.com/home/ahd

Positive, but Not Negative, Self-Perceptions of Aging Predict Cognitive Function Among Older Adults

Kellie E. Brown[1], Jeehoon Kim[2], Tara Stewart[3], Erika Fulton[1], and Anna C. McCarrey[1]

Abstract

Self-perceptions of aging (SPA) refer to attitudes about one's aging process and are linked to physical health and longevity. How SPA correlates with cognitive function in older adulthood is less well known. 136 older adults were administered a multifaceted SPA measure, The Brief Ageing Perceptions Questionnaire (B-APQ), in addition to a demographic form and a comprehensive neuropsychological battery. Positive and negative subscales of the B-APQ were correlated with aspects of cognitive function. Regression analyses revealed that only the positive B-APQ subscales predicted mental status (β = .19, p < .05), short-delay memory (β = .16, p < .05), processing speed (β = −.21, p < .05), and two measures of executive function (β = −.21, p < .01; β = .18, p < .05). This is the first study to demonstrate that positive dimensions of SPA relate to cognitive function in older adulthood.

[1]Department of Psychology, Idaho State University, Pocatello, USA
[2]Department of Social Work, Idaho State University, Pocatello, USA
[3]Department of Psychology, University of Manitoba, Winnipeg, Canada

Corresponding Author:
Kellie E. Brown, Department of Psychology, Idaho State University, 921 S 8th Ave, Stop 8112, Pocatello ID 83209, USA.
Email: browkel9@isu.edu

Keywords
aging perceptions, memory, executive function, processing speed, positive psychology

Introduction

Given that rates of Alzheimer’s disease and dementia are set to triple globally by the year 2050 (Alzheimer's Disease International, 2015), understanding psychological predictors of cognitive decline is critical. One such predictor, which can be targeted for psychosocial intervention, is how people perceive the experience of growing older. Some individuals view aging as a time of increased growth and wisdom while others view it as a time of poor health, loss, or decline (Levy & Langer, 1994; Robertson et al., 2016). Attitudes, or stereotypes, toward the aging process and older adults are informed by one’s culture and are salient at an early age, even as early as 6 years (Isaacs & Bearison, 1986). According to stereotype embodiment theory, as people age, internalized age-related stereotypes, whether positive or negative, are eventually applied to the self and translate into expectations and attitudes about one’s aging process (Levy, 2009). Within the psychological aging literature, this introspective belief-set is known as self-perceptions of aging (SPA; Levy & Langer, 1994; Levy, 2003; Robertson et al., 2016). This study aimed to better understand how SPA is associated with cognitive performance in a sample of community-dwelling older adults, in a bid to increase understanding of potential mechanisms that might delay age-related decline in cognition. Prior research has shown that even a 5-year delay in onset of Alzheimer’s disease and dementia would result in a 41% lower prevalence rate, as well as a 40% savings in billion-dollar healthcare costs by the year 2050 (Zissimopoulos et al., 2015).

Previous studies indicate that the SPA is a strong predictor of physical health and longevity. For example, older adults with more positive SPA participate in more preventative health behaviors (Levy & Myers, 2004), report less physical limitations in activities of daily living (Moser et al., 2011), and live longer compared with those with negative SPA (Levy et al., 2002b; Sargent-Cox et al., 2013). What is less well studied, but of critical importance, is how SPA relates to cognitive functioning in older adults. Although not all cognitive abilities change with advancing years, declines are observed in a number of domains such as verbal learning and memory, executive functions, and psychomotor speed (McCarrey et al., 2016). Given that these declines are often understood in terms of biological and physical aging (McCarrey & Resnick, 2015; Pacheco et al., 2015), identifying psychological contributors to cognitive performance, such as SPA, is critically important because of the potential for psychosocial interventions that may help attenuate cognitive declines.

For the last several decades, the stereotype literature has demonstrated that older adults’ general attitudes toward aging is linked to, and can even impact, memory performance (e.g., Levy, 2003). Much of this work has been done by Becca Levy and colleagues. Her group has found that older adults with more positive views of aging outperform those with more negative views of aging on measures of immediate, delayed, learned, and probed-recall memory (Levy & Langer, 1994). Experimentally, Levy (1996) has demonstrated that priming older adults with the aging stereotypes “senility” or “wisdom” influences performance on various memory tasks in the expected direction. The detrimental effect of negative old-age stereotypes is also observed longitudinally, with one study showing that individuals who hold more negative old-age stereotypes in youth demonstrate a greater decline in memory performance 38 years later than individuals who hold more positive age stereotypes in youth (Levy et al., 2011). Levy and colleagues have also identified links between old-age stereotypes and Alzheimer’s disease risk factors; compared with adults aged 50+ with more negative old-age stereotypes, those with more positive old-age stereotypes demonstrated less neuropathological burden 10 years later (Levy et al., 2016), even when genetically at risk for developing dementia (Levy et al., 2018). Taken together, these studies provide support for stereotype embodiment theory (Levy, 2009) such that aging self-stereotypes (a synonym for SPA) may operate unconsciously and act as a self-fulfilling prophecy in terms of cognitive aging trajectories.

Other scholars have found support for the link between SPA and cognition (e.g., Hess et al., 2003). For example, a 2011 meta-analysis revealed that older adults who were primed with negative old-age stereotypes performed worse than those primed with positive old-age stereotypes on various measures of memory, as well as metamemory (Meisner, 2012). Very few studies have demonstrated that SPA influences cognitive ability beyond memory function. Although not explicitly defined as SPA, Haslam et al. (2012) examined the influence of self-categorization and expectation of cognitive decline on a measure of general cognitive ability. Two groups of older adults read an article that described memory decline in older adults; results showed that compared with the group informed that they were in the “Younger” category, the group informed that they were in the “Older” category of participants obtained lower scores on a measure of general cognitive ability (which assessed attention/orientation, memory, verbal fluency, language, and visuospatial ability) as well as immediate and delayed memory. More recently, Seidler and Wolff (2017) demonstrated a bidirectional relationship between SPA and processing speed performance in older adults. Taken together, the beliefs held by older adults about their aging process are a potential mechanism by which cognitive performance can be altered.

It may be the case that cognitive aging is associated with unique subcomponents of SPA beliefs such as awareness of aging, control of aging, or expectations of aging (Barker et al., 2007). Indeed, Barker and colleagues were among the first to conceptualize SPA as a complex and multifaceted reflection of the aging experience, with data supporting the development of a multidimensional instrument of SPA. The Brief Aging Perceptions Questionnaire (B-APQ) is a 17-item scale that assesses individuals’ understanding of their own aging along five distinct dimensions of SPA, both positive and negative (Sexton et al., 2014). The positive scales incorporate aspects of positive control and positive consequences of one’s perceptions of aging, and the negative scales incorporate an awareness of one’s aging, negative control and consequences, and negative emotional representations of self-aging. Participants may endorse some dimensions but not others.

To our knowledge, only one group has examined the relationship between SPA and cognitive outcomes using the B-APQ. In a large sample of community-dwelling older adults from the Irish Longitudinal Study on Aging, Robertson and colleagues tested cross-sectional and longitudinal effects of B-APQ on verbal fluency (using the animal naming task), recall memory, prospective memory, and self-rated memory (Robertson et al., 2016). After controlling for demographics, they found that some positive and negative subscales of SPA uniquely predicted verbal fluency, memory, and self-rated memory in the expected direction. Longitudinally, only the positive control and the negative control and consequences subscales remained predictive of verbal fluency decline over 2 years. The results from this study provide evidence of the relationship between unique dimensions of SPA and verbal fluency and memory. However, there exists a clear gap in the literature regarding the examination of the B-APQ with an objective and comprehensive neuropsychological battery, which measures cognitive functioning beyond memory and verbal fluency.

Thus, the goal of the present study was to further prior research by investigating the relation between multiple facets of SPA and domain-specific cognitive performance in a sample of clinically normal community-dwelling older adults. To our knowledge, the present study is the first to report the relationship between subscales of the B-APQ and performance on a detailed neuropsychological battery consisting of attention, immediate, short-delay, long-delay recall, and recognition memory, category and phonetic fluency, tests of executive function, and processing speed. This research provides an opportunity to determine whether unique positive or negative aspects of people's expectations and attitudes toward their own aging, namely SPA, predict domain-specific cognitive abilities. Should we find that uniquely negative subscales of the B-APQ relate to cognition, it may be the case that ageist prejudices, which are highly prevalent in older populations (Giles & Reid, 2005), are internalized, and subsequently used to inform expectations in cognitive performance. On the other hand, should we uncover that uniquely positive aspects of aging perceptions predict cognition, this might reasonably be interpreted in terms of positive psychology, which includes "how optimism and hope affect health" (Seligman & Csikszentmihalyi, 2000, p. 5). Fredrickson's (1998) broaden-and-build theory provides a mechanism by which positive beliefs and emotions may confer benefits to cognitive abilities. This theory suggests that when people experience positive emotions, their scope of attention, cognition, and action are broadened, thus allowing for physical, intellectual, and social resources to build (Fredrickson, 2001). Taken together, our hypotheses were as follows.

In terms of the memory and category fluency measures, in keeping with the Robertson et al. (2016) findings, it was hypothesized that both positive and negative SPA subscales would be uniquely predictive in the expected direction, after controlling for sociodemographic covariates. Although exploratory, it was thought that the other cognitive domains may relate to negative dimensions of SPA, given prior research that has indicated the negative subscales (specifically negative control and consequences) to have marginally greater predictive utility for cognition than the positive scales (Robertson et al., 2016).

Method

Participants

Participants were community-dwelling older adults from the Southeastern Idaho region, recruited as part of the larger "Aging in Idaho" study, a study of psychological aging from the Laboratory of Aging Science and Health at Idaho State University. Older participants (n = 154) were recruited via university networks, word of mouth, and ads posted on the university Facebook page from May 2017 until December 2018. Participants were screened over the phone or via email for the following: 60 years of age or older; have learned English before the age of 5 years; have no cognitive impairments; have no visual impairments that were not corrected by glasses or contacts; and be able to sit and move around the testing room for the duration of the study. Human Subjects Committee approval was obtained from the university in May 2017. Upon entering the laboratory and prior to testing, participants provided informed consent. Following testing, participants were debriefed, thanked, and compensated for their time. Compensation was provided in the form of either $10 cash or a $10 gift card for each hour with testing sessions lasting no more than 2 hours.

Four participants were excluded due to scores <24 on the Mini Mental State Examination (MMSE; see section "Materials"), suggesting suspected cognitive impairment, and 14 participants were further excluded due to missing cognitive battery data, bringing the total $N = 136$. All remaining participants were considered cognitively healthy at the time of testing. The mean age was $M_{\text{age}} = 70.18$, $\text{SD}_{\text{age}} = 5.79$ years. On average, participants had 16 years of education ($M_{\text{edu}} = 16.29$, $\text{SD}_{\text{edu}} = 2.98$ years), 85.2% were retired, 52.6% were female, and the vast majority identified as White (93.2%).

Materials

The B-APQ (Sexton et al., 2014) is a 17-item questionnaire which requires participants to rate the extent to which they agree or disagree with statements concerning their own aging process using a five-point Likert scale ("Strongly Disagree" = 1 to "Strongly Agree" = 5). The B-APQ captures five distinct dimensions; two of which are positive aspects of SPA: *positive consequences* (e.g., "As I get older I get wiser") and *positive control* (e.g., "Whether I continue living life to the full depends on me"), and three of which are negative aspects of SPA: *awareness of aging* (e.g., "I feel my age in everything that I do"), *negative emotional representations* (e.g., "I feel angry when I think about getting older"), and *negative consequences and control* (e.g., "Slowing down with age is not something I can control"; Sexton et al., 2014). Higher scores indicate greater endorsement of each subscale. The B-APQ has good psychometric properties and has been validated in older populations across the globe including Irish, Malaysian, and Persian older adults (Jaafar et al., 2018; Sadegh Moghadam et al., 2016; Sexton et al., 2014). Similar to prior studies (e.g., Jaafar et al., 2018; Sadegh Moghadam et al., 2016), within our sample, the scale demonstrated acceptable to good internal reliability (positive consequences $\alpha = .66$; positive control $\alpha = .89$; awareness of aging $\alpha = .68$; negative emotional representations $\alpha = .68$; negative control and consequences $\alpha = .74$).

Cognitive Battery

The MMSE assesses mental status, immediate and delayed recall, attention, calculation, language, and orientation to time and place (Folstein et al., 1975). The MMSE is a widely used dementia screen and participants scoring <24 out of a total 30 were excluded due to suspected cognitive impairment.

The California Verbal Learning Test assesses immediate, short-delay and long-delay free recall, and recognition memory (Delis et al., 1987). Four learning trials of nine shopping items are presented orally and participants must recite as many items as they can remember after each trial. Immediate memory score was calculated as the average of these four trials. Memory for items is assessed after a short delay (30 s) and then again after a long delay (10 min). Recognition memory is also assessed via a forced-choice task. Participants are read aloud 27 items and must indicate whether each item was on the original shopping list. Accuracy was calculated as number of correct hits. Scores range from 0 to 9 on all four memory measures.

The Trail Making Test part A (Trails A) and part B (Trails B) are used to assess attention, concentration, visuomotor scanning, perceptuomotor speed, working memory, and set-shifting (Reitan, 1992). Trails A involves drawing a line to connect randomly placed numbers from 1 to 25 in sequential order and Trails B involves connecting randomly placed numbers from 1 to 13 and letters from A to L in an alternating sequence, such that the line must go from 1 to A, then 2 to B and so forth. Participants are instructed to complete the task with speed and accuracy. Scores are time in seconds it takes participants to complete the task and is the only task in which a higher score denotes poorer performance (i.e., longer time to completion).

The Digit Symbol Substitution Test (DSST; Wechsler, 1981) measures the psychomotor speed and visual–perceptual integration and executive function. Participants are given a sheet with numbers 1–9, as well as associated symbols, and are asked to insert the symbols below each number in sequence without skipping any numbers. Participants are given 90 s to correctly match each symbol with each number. Scores are derived from the total number of accurate number–symbol pairs reproduced in a sequence.

The Digit Span subtest of the WAIS-R (Wechsler, 1999) is a measure of short-term memory, attention, and concentration. In the Forward Digit Span subtest, participants are read aloud up to seven series of numbers and must repeat the numbers aloud in the same order. In the Backward Digit Span subtest, the administration is identical with the exception that participants are asked to repeat the numbers aloud in reverse order.

Scores are derived from the maximum span length obtained for both forward and backward subtests and range from 0 to 9 for forward and 0–8 for backward.

Category and phonetic fluency are measures of fluent language production and executive function. Participants are given 60 s to generate as many words as possible from specific categories (animals, fruits, vegetables; Newcombe, 1969) and beginning with specific letters (F, A, S; Benton, 1968). Scores are derived from the total number of correct words generated in 60 s, averaged across each of the three trials, generating one score for category fluency and one for phonetic fluency.

Procedure

Participants entered the testing room, were seated, and provided written informed consent. They completed all tasks comprising the larger "Aging in Idaho" study. All measures including a demographics form, the B-APQ, the MMSE, and the neuropsychological battery were counterbalanced. Participants were then thanked, debriefed, and compensated for their time (approximately 2 hrs).

Data Analysis

We first conducted correlational analyses to explore the relationships between dimensions of SPA and all cognitive outcomes. We then conducted multiple regressions to examine the unique contributions of each dimension of the SPA to each cognitive outcome, adding relevant demographic covariates to the models. This allowed us to examine whether SPA was associated with cognitive aging beyond the well-established indicators of age, sex, and education (McCarrey et al., 2016). Sex was dummy coded with females = 1 and males = −1. Given both positive and negative dimensions of the B-APQ were related to cognitive outcomes in the correlational analysis, we used stepwise regression to identify the best set of predictors for each cognitive outcome separately. Using a post hoc statistical power calculation for multiple regression, it was determined that there was an observed power to find effects with power greater than 0.82 for all cognitive domains except phonetic fluency, with power equal to 0.54.

Results

Table 1 displays correlations between all variables of interest. The two positive SPA subscales were associated with several cognitive outcomes in the expected direction, such that the greater endorsement, the better cognitive performance. Negative control and consequences was significantly but weakly related to mental status ($r = -.172$, $p < .05$), long-delay memory ($r = -.173$, $p < .05$), and the DSST ($r = -.172$, $p < .05$), whereas negative emotional representations was not related to any cognitive outcome. Awareness of aging was significantly but weakly related to Trails B ($r = .176$, $p < .05$) only. Immediate memory, recognition memory, and backward digit span were not significantly related to any dimension of SPA.

Table 1. Correlations Between All Variables of Interest.

	Variable (possible range)	M (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.	13.	14.	15.	16.
1.	Positive cons. (1–5)	4.03 (.56)	–															
2.	Positive cont. (1–5)[1]	4.48 (.59)	.378**	–														
3.	Awareness of aging (1–5)	2.91 (.79)	−.188*	−.011	–													
4.	Negative emotional representations (1–5)	2.37 (.77)	−.317**	−.212*	.365***	–												
5.	Negative cont. and cons. (1–5)	2.59 (.73)	−.180*	−.117	.416**	.460***	–											
6.	Mental status (0–30)	28.21 (1.45)	.211*	−.011	−.046	−.030	−.172*	–										
7.	Immediate memory (0–9)	6.91 (.94)	.122	.143	−.082	.050	−.107	.342***	–									
8.	Short-delay memory (0–9)	7.38 (1.28)	.188*	.150	−.143	−.030	−.166	.347***	.756***	–								
9.	Long-delay memory (0–9)	6.76 (1.78)	.095	.056	−.056	.068	−.173*	.276**	.644***	.823***	–							
10	Recognition memory (0–9)[1]	8.46 (.85)	−.053	−.020	−.019	.135	.019	.226**	.481***	.514***	.473***	–						
11.	Trails A (NA)	33.49 (9.99)	−.230**	−.145	.108	−.005	.017	−.169*	−.269**	−.272**	−.201*	−.246**	–					
12.	Trails B (NA)	81.18 (30.04)	−.248**	−.198*	.176*	.077	.074	−.298***	−.237**	−.178*	−.139	−.157	.550***	–				
13.	DSST (NA)	48.47 (10.72)	.165	.069	−.098	−.085	−.172*	.133	.182*	.133	.129	.060	−.536***	−.528***	–			
14.	Forward digit span (3–9)	6.77 (1.25)	.022	.177*	.094	−.019	−.008	.248**	.189*	.128	−.001	.046	−.021	−.215**	−.023	–		
15.	Backward digit span (2–9)	5.10 (1.14)	.080	.083	−.082	.063	−.067	.225**	.329***	.213*	.113	.065	−.020	−.141	−.017	.425***	–	
16.	Categorical fluency (NA)	17.05 (3.62)	.189*	.102	−.030	.031	−.112	.240**	.346***	.380***	.425***	.229**	−.255**	−.362***	.397***	.077	.150	–
17.	Phonetic fluency (NA)	13.41 (3.73)	.089	.178*	−.090	.074	−.084	.154	.291**	.223**	.065	.070	−.221**	−.335***	.310***	.149	.176	.390***

Abbreviations: NA = not applicable; DSST = digit symbol substitution test; cons. = consequences; cont. = control.
Note. Spearman's rho correlations due to non-normal distributions.
*$p < .05$; **$p < .01$; ***$p < .001$.

Multiple regressions (stepwise) were performed to examine the unique contributions of each SPA subscale to cognitive outcomes separately, controlling for demographics (age, sex, and education). A significant regression equation was found for mental status based on positive consequences and age ($F(2, 133) = 5.21$, $p < .01$, $R^2 = .07$), for short-delay memory based on positive consequences and sex ($F(2, 133) = 14.72$, $p < .001$, $R^2 = .18$), Trails A based on positive control, age, and sex ($F(3,132) = 8.35$, $p < .001$, $R^2 = .16$), Trails B based on positive consequences, age, and education ($F(3,132) = 11.11$, $p < .001$, $R^2 = .20$), and phonetic fluency based on positive control ($F(1,134) = 4.30$, $p < .05$, $R^2 = .03$). See Table 2 for detailed results.

In terms of memory and category fluency, our hypothesis was partially supported. Positive consequences predicted short-delay memory, but none of the SPA subscales were associated with category fluency. Our hypothesis that the negative subscales (specifically negative control and consequences) would have greater predictive utility than the positive scales was not supported. Contrary to expectations, the negative subscales did not contribute to performance on any cognitive domain after controlling for covariates. Instead, positive consequences uniquely contributed to mental status, short-delay memory, and Trails B scores; positive control uniquely contributed to Trails A and phonetic fluency after controlling for covariates. Age and sex were consistent predictors with lower cognitive scores linked to advanced years and male sex. Education was predictive of Trails B and DSST only, such that greater education contributed to better performance.

Discussion

The aim of the present study was to investigate the relationship of dimensions of SPA with domain-specific cognitive performance in a sample of clinically normal community-dwelling older adults. The main findings were that independent of sociodemographic factors, positive elements of SPA were related to mental status (MMSE), short-delay memory, processing speed (Trails A), and measures of executive function (Trails B and phonetic fluency). These effects were small but robust. Contrary to our hypothesis, after the inclusion of sociodemographic variables, negative SPA was not related to any of the tasks in the neuropsychological battery. Thus, despite negative SPA being indicated in physical (Robertson et al., 2015) and mental (Freeman et al., 2016) health, we report that *positive* SPA may be a better predictor of cognitive health in older adults. Further, in the case of mental status, short-delay memory, and phonetic fluency, positive subscales of SPA had a stronger effect than the well-established predictors of age and education (McCarrey et al., 2016). Our findings are in keeping with previous studies that have reported positive general SPA to be associated with better memory performance (Hess et al., 2003; Levy & Langer, 1994, Levy, 1996, 2003; Meisner, 2011).

Awareness of aging was related to Trails B, and negative control and consequences were weakly related to mental status and the DSST, but these relations did not survive after controlling for sociodemographic covariates. Thus, our results suggest that an

Table 2. Multiple Regression Analyses Demonstrating the Unique Contributions of Aspects of Self-Perceptions of Aging and Demographics to Each Cognitive Domain.

Cognitive domains[a]	R^2 (adj. R^2)	Positive consequences	Positive control	Awareness of aging	Negative emotional representations	Negative control and consequences	Age	Sex	Edu.
Mental status	.07 (.06)**	.50* (.22) [.19]	–	–	–	–	−.04* (.02) [−.17]	–	–
Imm. Memory	.11 (.11)***	–	–	–	–	–	–	.32*** (.07) [.34]	–
Short-delay memory	.18 (.17)***	.38* (.18) [.16]	–	–	–	–	–	.49*** (.10) [.38]	–
Long-delay memory	.14 (.14) ***	–	–	–	–	–	–	.67*** (.14) [.38]	–
Recog. Memory	.07 (.06)**	–	–	–	–	–	−.03* (.01) [−.21]	.17* (.07) [.20]	–
Trails A	.16 (.14)***	–	−3.51* (1.37) [−.21]	–	–	–	.44** (.14) [.25]	−2.41** (.82) [−.24]	–
Trails B	.20 (.18)***	−11.11** (4.21) [−.21]	–	–	–	–	1.80*** (.41) [.34]	–	−2.10** (.79) [−.21]
DSST	.17 (.15)***	–	–	–	–	–	−.57*** (.15) [−.31]	2.91** (.87) [.27]	.77** (.29) [.22]
Categorical fluency	.13 (.12)***	–	–	–	–	–	−.18** (.05) [−.28]	1.02** (.30) [.28]	–
Phonetic fuency	.03 (.02) *	–	1.11* (.54) [.18]	–	–	–	–	–	–

Abbreviation: DSST = digit symbol substitution test.
Unstandardized regression coefficients, standard errors in parenthesis, and standardized coefficients in square brackets.
*p < .05; **p < .01; ***p < .001.
[a]There were no significant predictors for either forward or backward digit span, and therefore no model was generated.

awareness of growing older (on its own) is not enough to associate with cognitive aging. Furthermore, awareness of aging has previously been classified as negative (Lachman et al., 2011), and this is a position that we support given the strong positive correlations observed with the other negative subscales. Negative control and consequences were expected to possess predictive utility (Windsor & Anstey, 2008), but did not. One potential reason may be that some items on this subscale are capturing physical and functional losses such as becoming less independent and being able to take part in fewer activities, which may not be adequately measuring perceptions of aging per se. It may be the case, then, that this negative subscale is more likely to be associated with activities of daily living, and future research should investigate this premise.

Of interest, even with zero-order correlations, negative emotional representations did not correlate with any cognitive domain. To our knowledge, there is only one study that has previously captured cognitive aging with multifaceted dimensions of SPA using the B-APQ, and as with the present study, negative emotional representations did not predict any cognitive domain (Robertson et al., 2016). This B-APQ subscale captures "the emotional response generated by aging" (Barker et al., 2007, p. 3), and items inquire about depression, anger, and worry. It is not surprising then that negative emotional responses to aging have been linked to late-life maladaptive coping and poorer psychological function (Gomez & Madey, 2001; Smith & Freund, 2002) as well as drinking and smoking behaviors (Villiers-Tuthill et al., 2016). Thus, negative emotional representations may be a better predictor of mood or mental health in old age as opposed to cognition. Indeed, in another study from the Irish Longitudinal Study on Aging that used the B-APQ, Robertson and Kenny (2016a) demonstrated that cross-sectionally, this negative subscale was predictive of community involvement, leisure pursuits, and social contact, but not cognitive stimulation. Taken together, we suggest that the negative subscales of the B-APQ may be capturing aging perceptions linked to physical, social, and mental health in old age as opposed to cognitive health.

Higher endorsement of positive control SPA was linked to faster processing speed (Trails A) and higher phonetic fluency scores, which aligns with the well-established link in the literature between control beliefs and cognitive functioning (Neupert & Allaire, 2012; Soederberg Miller & Lachman, 2000). As posited by stereotype embodiment theory, it may be the case that greater endorsement of this aspect of SPA acts self-fulfilling prophecies (Levy, 2009; Levy et al., 2002a). To illustrate, older adults who believe they have elements of control in how they age are more likely to behave in ways that embrace greater health and wellness, such as exercising, eating well, and maintaining cognitively stimulating challenges in retirement (Lachman et al., 2011). Alternatively, those who strongly associate aging with chronic illness and debilitation demonstrate greater perceived symptoms, less health maintenance behaviors, and increased risk of mortality (Stewart et al., 2012). Our results further this line of research by highlighting that perceived positive control in SPA is linked to cognitive function in older adulthood and may be due, in part, to the cognitively stimulating behaviors (such as active participation in clubs or events) that people with more positive SPA are likely to engage in (Levy & Myers, 2004).

That positive, but not negative, subscales of SPA predict cognitive performance in old age is in contrast to the Robertson et al. (2016) study, which reported both positive and negative subscales of perceptions of aging to be predictive of memory and category fluency cross-sectionally. It is possible that variations in measures used explain this discrepancy in findings. Whereas our memory measures teased apart immediate, short-delay, and long-delay recall and recognition memory, the prior study used a composite score that combined measures of immediate and short-delay recall. Additionally, our measures of verbal fluency consisted of three types of category fluency (animals, fruits, vegetables) and three types of phonetic fluency (letters F, A, S) instead of animal-naming only. Alternatively, it may be variability in sample characteristics. Whereas the Irish Longitudinal Study on Aging tested a nationally representative sample of Irish individuals ($n = 5602$) aged ≥50 years, the current study sampled highly educated older individuals ($n = 136$) aged ≥60 years living in Idaho. It is possible that negative SPA effects exist but are so small as to be found only with research designs that include very large sample sizes (e.g., $n > 5000$). Additionally, perceptions of aging may be discernibly different at 50 compared with 60 years of age, in which participants project more years left in their lifespan, and in mostly highly educated individuals who are likely experiencing better health and financial circumstances. Lastly, the two studies controlled for different covariates; notably, the prior study additionally controlled for physical and mental health which the current study did not. Nonetheless, the discrepancies in these findings raise questions regarding the relationship between SPA (as measured by the B-APQ) and cognition.

Robertson et al. (2016) also reported that both positive and negative subscales of the B-APQ were predictive of category fluency 2 years later. It is possible that holding negative SPA results in a negative self-fulfilling prophecy and contributes to decreased cognition over time due to the age-related expectation that cognitive function will decrease. Alternatively, it may be the case that negative aspects of SPA are better used as moderators in the relationships between physical and cognitive function in older adults. Previous work has shown that older individuals identified as frail or prefrail demonstrate lower cognitive ability but only in the presence of negative SPA (Robertson & Kenny, 2016b). However, this study did not test for any positive components of SPA. Taken together, more research is needed to further illuminate whether positive and/or negative aspects of SPA uniquely contribute to cognitive functioning directly, both concurrently and at future time points, or indirectly via mediation.

One of the most notable strengths of the present study is the comprehensive neuropsychological battery used in relation to SPA. This, coupled with a multifaceted measure of SPA, affords a more thorough examination of the relationship between SPA and cognition than has previously been possible. However, the current findings must be considered within several important limitations. The sample consisted of predominately white, highly educated older individuals, which reduces the ability to generalize findings to older adults with diverse ethnic and racial backgrounds and with education levels closer to the general population (64.1% of participants in our sample had 16 years of education, as compared with the United States national average of 28% for adults aged 65 years and older (United States Census Bureau, 2018). We also had reduced power to find any effect of SPA dimensions on phonetic fluency and generally had a smaller sample size than some prior studies (e.g., Robertson et al., 2016). Finally, due to the correlational nature of the present study, it is not possible to discern whether positive SPA in older adulthood serves to buffer the effects of cognitive aging, or whether those who have a positive outlook on their aging process do so precisely because they enjoy high levels of cognitive functioning.

Although no causation can be inferred, our findings speak to the utility of positive psychology as a potential pathway for cognitive health in older adulthood. In contrast to the view that psychological science focuses exclusively on pathology or improving a disease model of human functioning, positive psychology examines the roles that subjective belief-sets and traits play in optimizing personal health and well-being (Seligman & Csikszentmihalyi, 2000). Our findings that only positive SPA predict cognition speak to Fredrickson's (1998) broaden-and-build theory that provides a pathway by which positive emotions can carry durable and adaptive long-term benefits for health as well as cognition. Indeed, rather than operating as passive recipients of societal narrative around growing older, and in spite of physical limitations brought about with an aging body, "positive aging" charges older adults to play a central role, and be active agents in the quality of their own aging process and interactions with their communities (Cody-Rydzewski, 2007; Ranzijn, 2002). Taken together, rather than amelioration of negative aging perceptions, it is possible that promoting a message of positive aging within older communities may have a marginally greater impact on cognitive aging.

Our findings provide fertile ground for positive SPA interventions that may support improved cognitive functioning in older adulthood. Prior experiments have revealed that immediate one-time priming of either positive or negative age-related stereotypes in older adults affected memory performance (Hess et al., 2003; Levy, 1996). However, whether the specific domains of SPA can be manipulated is a subject for future research. Given that self-perceptions of one's own aging process is a deeply individual and personal belief, likely constructed over several years or even decades, it may be the case that interventions targeting an increase in positive SPA would need to be administered over time. Prior research from the growth mindset literature, a construct which also involves personal beliefs constructed over one's lifetime (Dweck et al., 1993), suggests that while simple one-time manipulations can influence mindset temporarily (Dweck, 2012), interventions involving multiple sessions over a series of weeks or months are much more successful at changing individual mindset beliefs in the long-term (Blackwell et al., 2007; Cutts et al., 2010; Dweck, 2012). Thus, future research seeking to induce a positive change in specific domains of SPA may want to consider long-term, targeted intervention approaches. Furthermore, healthcare providers could benefit from positive SPA interventions that describe the potential impact of informing patients that their health declines are due entirely to their increasing age. This change in language on the part of the healthcare provider could reduce the negative expectations associated with aging, and thus, reduce negative SPA in older adults.

Other fruitful avenues for future studies include examining potential interactions between the B-APQ domains and other well-established predictors of cognitive function, such as diet or exercise behaviors (Chodzko-Zajko et al., 2009; Christensen et al., 1996; Lee et al., 2010; Samieri et al., 2008). Given that prior research indicates that negative general SPA relates to lower amounts of exercise (Levy & Myers, 2004; Sarkisian et al., 2005), and more recently, that positive general SPA promotes healthy eating (Klusmann et al., 2019), the strength of this type of design would be the ability to examine any possible moderating effects of diet or exercise behaviors on the relationship between SPA and cognitive function. For example, it may be the case that a poor diet attenuates the beneficial effects of positive SPA on cognition.

In conclusion, we identify that positive, but not negative, SPA predicts cognitive performance in older adulthood and may be a useful target for intervention, either through priming or long-term training. Whereas decreasing negative aging perceptions may help with mood and activities of daily living in old age, our tfindings suggest that increasing positive perceptions may be one pathway in combating age-related deficits in cognitive function. As the average global population age rises, so will rates of Alzheimer's and dementia. Therefore, isolating psychological predictors of cognition has never been more important, and the present results help to increase such an understanding.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

Kellie E. Brown https://orcid.org/0000-0002-6206-3264
Erika Fulton https://orcid.org/0000-0002-1322-5933

References

Alzheimer's Disease International. (2015). *Dementia Statistics*.

Barker, M., O'Hanlon, A., McGee, H. M., Hickey, A., & Conroy, R. M. (2007). Cross-sectional validation of the aging perceptions questionnaire: A multidimensional instrument for assessing self-perceptions of aging. *BMC Geriatrics*, *7*(1), 9. https://doi.org/10.1186/1471-2318-7-9

Benton, A. L. (1968). Differential behavioral effects in frontal lobe disease. *Neuropsychologia*, *6*(1), 53–60.

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, *78*(1), 246–263. https://doi.org/10.1111/j.1467-8624.2007.00995.x

Chodzko-Zajko, W. J., Proctor, D. N., Fiatarone Singh, M. A., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). Exercise and physical activity for older adults. *Medicine & Science in Sports & Exercise*, *41*(7), 1510–1530. https://doi.org/10.1249/MSS.0b013e3181a0c95c

Christensen, H., Korten, A., Jorm, A. F., Henderson, A. S., Scott, R., & Mackinnon, A. J. (1996). Activity levels and cognitive functioning in an elderly community sample. *Age and Ageing*, *25*(1), 72–80. https://doi.org/10.1093/ageing/25.1.72

Cody-Rydzewski, S. (2007). Reviewed work: Positive aging: A guide for mental health professionals and consumers. *International Social Science Review*, *82*, 97–99.

Cutts, Q., Cutts, E., Draper, S., O'Donnell, P., & Saffrey, P. (2010). *Manipulating Mindset to Positively Influence Introductory Programming Performance*. *Paper presented at the Proceedings of the 41st ACM technical symposium on Computer science education.*

Delis, D., Kramer, J., Kaplan, E., & Ober, B. (1987). *California verbal learning test*. The Psychological Corporation.

Dweck, C. S. (2012). Mindsets and human nature: Promoting change in the Middle East, the schoolyard, the racial divide, and willpower. *American Psychologist*, *67*(8), 614–622. https://doi.org/10.1037/a0029783

Dweck, C. S., Hong, Y. Y., & Chiu, C. Y. (1993). Implicit theories individual differences in the likelihood and meaning of dispositional inference. *Personality and Social Psychology Bulletin*, *19*(5), 644–656. https://doi.org/10.1177/0146167293195015

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). “Mini-mental state”. *Journal of Psychiatric Research*, *12*(3), 189–198.

Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology*, *2*(3), 300–319. https://doi.org/10.1037/1089-2680.2.3.300

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, *56*(3), 218–226. https://doi.org/10.1037/0003-066X.56.3.218

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

Giles, H., & Reid, S. A. (2005). Ageism across the lifespan: Towards a self-categorization model of ageing. *Journal of Social Issues*, *61*(2), 389–404. https://doi.org/10.1111/j.1540-4560.2005.00412.x

Gomez, R. G., & Madey, S. F. (2001). Coping-with-hearing-loss model for older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *56*(4), P223–P225. https://doi.org/10.1093/geronb/56.4.P223

Haslam, C., Morton, T. A., Haslam, S. A., Varnes, L., Graham, R., & Gamaz, L. (2012). "When the age is in, the wit is out": Age-related self-categorization and deficit expectations reduce performance on clinical tests used in dementia assessment. *Psychology and Aging*, *27*(3), 778–784. https://doi.org/10.1037/a0027754

Hess, T. M., Auman, C., Colcombe, S. J., & Rahhal, T. A. (2003). The impact of stereotype threat on age differences in memory performance. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *58*(1), P3–P11. https://doi.org/10.1093/geronb/58.1.P3

Isaacs, L. W., & Bearison, D. J. (1986). The development of children's prejudice against the aged. *The International Journal of Aging & Human Development*, *23*(3), 175–194. https://doi.org/10.2190/8GVR-XJQY-LFTH-E0A1

Jaafar, M. H., Villiers-Tuthill, A., Sim, S. H., Lim, M. A., & Morgan, K. (2018). Validation of the brief ageing perceptions questionnaire (B-APQ) in Malaysia. *Aging & Mental Health*, 1–7. https://doi.org/10.1080/13607863.2018.1550631

Klusmann, V., Sproesser, G., Wolff, J. K., & Renner, B. (2019). Positive self-perceptions of aging promote healthy eating behavior across the life span via social-cognitive processes. *Journals of Gerontology: Series B*, *74*(5), 735–744. https://doi.org/10.1093/geronb/gbx139

Lachman, M. E., Neupert, S. D., & Agrigoroaei, S. (2011). The relevance of control beliefs for health and aging. In *Handbook of the Psychology of Aging* (pp. 175–190). Elsevier.

Lee, Y., Back, J. H., Kim, J., Kim, S. -H., Na, D. L., Cheong, H. -K., Hong, C. H., & Kim, Y. G. (2010). Systematic review of health behavioral risks and cognitive health in older adults. *International Psychogeriatrics*, *22*(2), 174–187. https://doi.org/10.1017/S1041610209991189

Levy, B. R. (1996). Improving memory in old age through implicit self-stereotyping. *Journal of Personality and Social Psychology*, *71*(6), 1092–1107. https://doi.org/10.1037/0022-3514.71.6.1092

Levy, B. R. (2003). Mind matters: Cognitive and physical effects of aging self-stereotypes. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *58*(4), P203–P211. https://doi.org/10.1093/geronb/58.4.P203

Levy, B. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current Directions in Psychological Science*, *18*(6), 332–336. https://doi.org/10.1111/j.1467-8721.2009.01662.x

Levy, B. R., Ferrucci, L., Zonderman, A. B., Slade, M. D., Troncoso, J., & Resnick, S. M. (2016). A culture–brain link: Negative age stereotypes predict Alzheimer's disease biomarkers. *Psychology and Aging*, *31*(1), 82–88. https://doi.org/10.1037/pag0000062

Levy, B. R., & Langer, E. (1994). Aging free from negative stereotypes: Successful memory in China among the American deaf. *Journal of Personality and Social Psychology*, *66*(6), 989–997. https://doi.org/10.1037/0022-3514.66.6.989

Levy, B. R., & Myers, L. M. (2004). Preventive health behaviors influenced by self-perceptions of aging. *Preventive Medicine*, *39*(3), 625–629. https://doi.org/10.1016/j.ypmed.2004.02.029

Levy, B. R., Slade, M. D., & Kasl, S. V. (2002a). Longitudinal benefit of positive self-perceptions of aging on functional health. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *57*(5), P409–P417. https://doi.org/10.1093/geronb/57.5.P409

Levy, B. R., Slade, M. D., Kunkel, S. R., & Kasl, S. V. (2002b). Longevity increased by positive self-perceptions of aging. *Journal of Personality and Social Psychology*, *83*(2), 261–270. https://doi.org/10.1037/0022-3514.83.2.261

Levy, B. R., Slade, M. D., Pietrzak, R. H., & Ferrucci, L. (2018). Positive age beliefs protect against dementia even among elders with high-risk gene. *PloS One*, *13*(2), e0191004. https://doi.org/10.1371/journal.pone.0191004

Levy, B. R., Zonderman, A. B., Slade, M. D., & Ferrucci, L. (2011). Memory shaped by age stereotypes over time. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *67*(4), 432–436. https://doi.org/10.1093/geronb/gbr120

McCarrey, A. C., An, Y., Kitner-Triolo, M. H., Ferrucci, L., & Resnick, S. M. (2016). Sex differences in cognitive trajectories in clinically normal older adults. *Psychology and Aging*, *31*(2), 166–175. https://doi.org/10.1037/pag0000070

McCarrey, A. C., & Resnick, S. M. (2015). Postmenopausal hormone therapy and cognition. *Hormones and Behavior*, *74*, 167–172. https://doi.org/10.1016/j.yhbeh.2015.04.018

Meisner, B. A. (2011). A meta-analysis of positive and negative age stereotype priming effects on behavior among older adults. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *67*(1), 13–17. https://doi.org/10.1093/geronb/gbr062

Moser, C., Spagnoli, J., & Santos-Eggimann, B. (2011). Self-perception of aging and vulnerability to adverse outcomes at the age of 65-70 years. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *66*(6), 675–680.

Neupert, S. D., & Allaire, J. C. (2012). I think I can, I think I can: Examining the within-person coupling of control beliefs and cognition in older adults. *Psychology and Aging*, *27*(3), 742–749. https://doi.org/10.1037/a0026447

Newcombe, F. (1969). *Missile wounds of the brain: A study of psychological deficits*. Oxford University Press.

Pacheco, J., Goh, J. O., Kraut, M. A., Ferrucci, L., & Resnick, S. M. (2015). Greater cortical thinning in normal older adults predicts later cognitive impairment. *Neurobiology of Aging*, *36*(2), 903–908. https://doi.org/10.1016/j.neurobiolaging.2014.08.031

Ranzijn, R. (2002). The potential of older adults to enhance community quality of life: Links between positive psychology and productive aging. *Ageing International*, *27*(2), 30–55. https://doi.org/10.1007/s12126-002-1001-5

Reitan, R. M. (1992). *Trail making test: Manual for administration and scoring*. Reitan Neuropsychology Laboratory.

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

Robertson, D. A., & Kenny, R. A. (2016b). Negative perceptions of aging modify the association between frailty and cognitive function in older adults. *Personality and Individual Differences*, *100*, 120–125. https://doi.org/10.1016/j.paid.2015.12.010

Robertson, D. A., King-Kallimanis, B. L., & Kenny, R. A. (2016). Negative perceptions of aging predict longitudinal decline in cognitive function. *Psychology and Aging*, *31*(1), 71–81. https://doi.org/10.1037/pag0000061

Robertson, D. A., Savva, G. M., King-Kallimanis, B. L., & Kenny, R. A. (2015). Negative perceptions of aging and decline in walking speed: A self-fulfilling prophecy. *PloS One*, *10*(4), e0123260. https://doi.org/10.1371/journal.pone.0123260

Sadegh Moghadam, L., Foroughan, M., Mohammadi Shahboulaghi, F., Ahmadi, F., Sajjadi, M., & Farhadi, A. (2016). Validity and reliability of the Persian version of the brief aging perceptions questionnaire in Iranian older adults. *Clinical Interventions in Aging*, *11*, 507–511. https://doi.org/10.2147/CIA.S101620

Samieri, C., Jutand, M. -A., Féart, C., Capuron, L., Letenneur, L., & Barberger-Gateau, P. (2008). Dietary patterns derived by hybrid clustering method in older people: Association with cognition, mood, and self-rated health. *Journal of the American Dietetic Association*, *108*(9), 1461–1471. https://doi.org/10.1016/j.jada.2008.06.437

Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2013). Longitudinal change of self-perceptions of aging and mortality. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *69*(2), 168–173. https://doi.org/10.1093/geronb/gbt005

Sarkisian, C. A., Prohaska, T. R., Wong, M. D., Hirsch, S., & Mangione, C. M. (2005). The relationship between expectations for aging and physical activity among older adults. *Journal of General Internal Medicine*, *20*(10), 911–915. https://doi.org/10.1111/j.1525-1497.2005.0204.x

Seidler, A. L., & Wolff, J. K. (2017). Bidirectional associations between self-perceptions of aging and processing speed across 3 years. *GeroPsych: The Journal of Gerontopsychology and Geriatric Psychiatry*, *30*(2), 49–59. https://doi.org/10.1024/1662-9647/a000165

Seligman, M. E., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, *55*(1), 5–14. https://doi.org/10.1037/0003-066X.55.1.5

Sexton, E., King-Kallimanis, B. L., Morgan, K., & McGee, H. (2014). Development of the brief ageing perceptions questionnaire (B-APQ): A confirmatory factor analysis approach to item reduction. *BMC Geriatrics*, *14*(1), 44. https://doi.org/10.1186/1471-2318-14-44

Smith, J., & Freund, A. M. (2002). The dynamics of possible selves in old age. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *57*(6), P492–P500. https://doi.org/10.1093/geronb/57.6.P492

Soederberg Miller, L. M., & Lachman, M. E. (2000). Cognitive performance and the role of control beliefs in midlife. *Aging, Neuropsychology, and Cognition*, *7*(2), 69–85. https://doi.org/10.1076/1382-5585(200006)7:2;1-U;FT069

Stewart, T. L., Chipperfield, J. G., Perry, R. P., & Weiner, B. (2012). Attributing illness to 'old age': Consequences of a self-directed stereotype for health and mortality. *Psychology & Health*, *27*(8), 881–897. https://doi.org/10.1080/08870446.2011.630735

United States Census Bureau. (2018). Current Population Survey, 2018. Annual Social and Economic Supplement from Census Bureau..

Villiers-Tuthill, A., Copley, A., McGee, H., & Morgan, K. (2016). The relationship of tobacco and alcohol use with ageing self-perceptions in older people in Ireland. *BMC Public Health*, *16*(1), 627. https://doi.org/10.1186/s12889-016-3158-y

Wechsler, D. (1981). *Wais-R manual: Wechsler adult intelligence Scale-Revised*. Psychological Corporation.

Wechsler, D. (1999). *Manual for the Wechsler abbreviated intelligence scale*. The Psychological Corporation.

Windsor, T. D., & Anstey, K. J. (2008). A longitudinal investigation of perceived control and cognitive performance in young, midlife and older adults. *Aging, Neuropsychology, and Cognition*, *15*(6), 744–763. https://doi.org/10.1080/13825580802348570

Zissimopoulos, J., Crimmins, E., & Clair, P. S. (2015). *The value of delaying Alzheimer's disease onset. Paper presented at the Forum for Health Economics and Policy.*

Author Biographies

Kellie E. Brown, MS, is a doctoral student in the Experimental Psychology program at Idaho State University.

Jeehoon Kim is the BSW Program of Social Work at Idaho State University.

Tara Stewart is a Health Services researcher at the Winnipeg Regional Health Authority and an assistant professor at the University of Manitoba.

Erika Fulton is an assistant professor of Experimental Psychology at Idaho State University.

Anna C. McCarrey is an assistant professor of Experimental Psychology at Idaho State University.