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Motivation Moderates the Impact of Aging Stereotypes on Effort Expenditure

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Abstract

The impact of aging stereotypes on task engagement was examined. Older adults (*N* = 144, ages 65 – 85) were exposed to primes designed to activate positive or negative stereotypes about aging, with half of the individuals in each stereotype group also assigned to a high accountability condition in order to enhance motivation. Participants performed a memory-scan task comprising two levels of demands (memory sets of 4 or 7 items), with two 5-min blocks at each level. Systolic blood pressure recorded throughout the task were used to monitor engagement levels. High accountability was associated with greater engagement at the highest level of task demands. Negative stereotype activation also resulted in elevated engagement levels, but only during the initial trial blocks in the high-accountability condition. Lowest levels of engagement were associated with low accountability, with no difference between stereotype conditions. An analogous differential analysis on these same data using need for cognition and attitudes toward aging as measures of motivation and stereotypes revealed similar trends. Specifically, negative aging attitudes were associated with elevated levels of engagement only in individuals who were high in intrinsic motivation, with the effects greatest at the highest levels of task demands. The results provide a more nuanced perspective on the impact of negative aging stereotypes than suggested in previous research, with the impact on behavior moderated by situational and personal factors associated with motivation. Although potentially negative in the long run, elevated cardiovascular responses indicative of task engagement may represent an adaptive response to support performance.

Keywords

Aging; motivation; engagement; aging attitudes; stereotypes

Engagement in cognitively demanding activities is beneficial in promoting cognitive health and well-being in later life (see Hertzog, Kramer, Wilson, & Lindenberger, 2008). As such, it is important to identify the factors that influence older adults' willingness to engage in such activities. One set of such factors involves the interplay between the costs associated with cognitive resource expenditure, perceptions of task demands, and the meaningfulness of the activity. As proposed by Selective Engagement Theory (SET; Hess, 2014), normative

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increases in costs (e.g., the effort required for successful performance) decrease intrinsic motivation to engage in cognitively demanding activities that are potentially beneficial for cognitive health. Specifically, the increased demands associated with cognitive activity in later life make older adults more selective in terms of their willingness to participate in activities that place demands on these resources.

Support for this position has been demonstrated using both cross-sectional (Hess, 2002; Hess, Growney, O'Brien, Neupert, & Sherwood, 2018; Queen & Hess, 2018) and longitudinal (Growney & Hess, 2018; Hess, Emery, & Neupert, 2012) data, whereby individual differences in intrinsic motivation have been shown to mediate the relationship between factors reflecting costs (e.g., health, sensory functioning) and engagement in demanding everyday activities. Casting these relationships in terms of benefits and costs, the increased costs of cognitive engagement in later life also result in benefits (e.g., the congruence of the activity with personal goals) playing a disproportionate role in determining older adults' engagement, as demonstrated in a number of different studies using a variety of tasks and measures (e.g., Germain & Hess, 2007; Hess, Germain, Swaim, & Osowski, 2009; Smith & Hess, 2015; Zhang, Fung, Stanley, Isaacowitz, & Ho, 2013). Given their hypothesized and demonstrated importance in determining activity participation in later life, there is a need to better understand the factors that define and determine costs, and ultimately engagement.

One way in which these relationships have been studied in the laboratory is through the examination of cardiovascular response—in particular, systolic blood pressure (SBP)—as a measure of engagement in relation to task demands during performance of a cognitively challenging activity. SBP is influenced by ß-adrenergic sympathetic nervous-system responses associated with active coping (Obrist, 1981), and research with young adults has shown it to be sensitive to task demands (e.g., systematic increase with cognitive load) when performance is viewed as worthwhile and within the capabilities of the individual (e.g., Richter, Friedrich, & Gendolla, 2008). Recent work by Hess and colleagues (e.g., Ennis, Hess, & Smith, 2013; Hess & Ennis, 2012; Smith & Hess, 2015) has demonstrated that SBP is similarly responsive to task demands in older adults, and it has been proposed (Hess & Ennis, 2014) that the observed age differences are valid reflections of age-related differences in effort expenditure. Thus, consistent with much prior work (for reviews, see Richter, Gendolla, & Wright, 2016; Wright & Kirby, 2001), we focused on SBP to examine patterns of engagement in response to task and situational factors that could potentially impact perceptions of benefits and costs.

Factors Affecting Engagement

A major assumption in much work using SBP to assess effort or engagement is that the effort expended—or the SBP response—is calibrated to the difficulty of the task, with individuals exerting effort proportional to the level of experienced task demand. This assumption is derived from Motivation Intensity Theory (Brehm & Self, 1989), and is an integral component of Wright's (1996) integration of Obrist's (1981) Active Coping Model with this theory. Research has demonstrated, however, that this assumption may not always be valid. For example, Richter (2015) found that, although energy expenditure increased with task demands, the amount of effort exerted exceeded that necessary for successful performance (see also Stanek & Richter, 2016). This raises the interesting possibility that factors other than objective task demands and individual differences in cognitive costs may influence engagement, even when the individual perceives there to be benefits associated with engagement. For example, research with younger adults has found that SBP responses to task demands are influenced by personality variables (e.g., Need for Closure; Richter, Baeriswyl, & Roets, 2012), mood states (e.g., De Burgo & Gendolla, 2009), and social context (e.g., Gendolla & Richter, 2006a). Similarly, individuals have been shown to adjust effort expenditure in response to affective primes in a manner that reflects beliefs or perceptions of costs associated with specific emotional states (e.g., happiness is related to greater ease of coping than sadness) as opposed to objective task demands (Gendolla & Silvestrini, 2011). Given that performance in these studies was typically unaffected by these same factors, these findings indicate that effort mobilization can reflect perceptions of task demands and associated changes in motivational processes that are based in task-extraneous factors.

These findings have important implications for aging. Specifically, if older adults expend levels of effort beyond that necessary to achieve successful performance—or believe that they need to do so—they may subsequently exaggerate the costs associated with engagement in potentially beneficial activities, reducing the probability of participation. Some evidence that these effects may disproportionately impact older adults can be seen in findings that perceptions of task difficulty (Hess, Smith, & Sharifian, 2016) and control (Ennis et al., 2013) influence effort expenditure above-and-beyond objective task demands in older, but not younger adults. One age-related factor that may have an effect on effort expenditure relates to aging stereotypes. Studies of implicit priming (e.g., Hess, Hinson, & Statham, 2004; Levy, 1996) and stereotype threat (e.g., Barber, Mather, & Gatz, 2015; Eich, Murayama, Castel, & Knowlton, 2014; Hess, Auman, Colcombe, & Rahhal, 2003) have shown that activation of negative aging stereotypes results in degraded cognitive performance by older adults. One possible interpretation of these findings is that, under such conditions, older adults disengage from the task due to activated stereotypes coloring beliefs regarding their capability to perform, and thus the effort required to be successful.

A recent study by Zafeiriou and Gendolla (2017) provides evidence supportive of these ideas. Specifically, they exposed young adults to implicit primes designed to activate stereotypes of young or older adults, and then examined effort expenditure during a difficult memory task. The expectation was that exposure to primes designed to activate aging stereotypes would also activate beliefs regarding reduced ability, resulting in greater perceptions of both task demands and the effort required for successful performance. Consistent with expectations, effort expenditure was greatest following exposure to aging stereotypes under high incentive conditions designed to maximize benefits for performance. That is, when the task was viewed as worthwhile, participants exerted more effort following exposure to old age primes than to young primes even though performance was unaffected. Thus, participants appeared to adjust engagement levels to support performance when perceived task demands were increased through activation of the aging stereotype. In contrast, when motivational inducements were low—a situation common to most laboratory studies of stereotype threat—stereotype activation resulted in a response pattern more consistent with disengagement. Although some research has also shown that older adults adjust their approach (e.g., shift strategies) to a task following stereotype activation (e.g., Lemaire, Brun, & Regner, in press; Popham & Hess, 2015), to our knowledge, there have been no studies of the impact of aging-related beliefs on effort expenditure.

The Present Study

We attempted to fill this void in the present study, with two sets of goals guiding our efforts. Our primary goal was to examine the impact of aging stereotypes on effort expenditure in older adults. To this end, we examined older adults' engagement in a cognitively demanding task following the activation of positive or negative views of old age. We also manipulated motivation using a procedure designed to affect personal accountability. Accountability "refers to the implicit or explicit expectation that one may be called on to justify one's beliefs, feelings, and actions to others" (Lerner & Tetlock, 1999. p. 255), and performance evaluation is considered a major component of accountability (Ferris, Munyon, Basik, & Buckley, 2008). High accountability has been shown to increase the degree and quality of task engagement, and similar procedures have been used effectively in past studies with older adults (e.g., Hess, Germain, Swaim, & Osowski, 2009; Smith & Hess, 2015).

In line with previous research and with SET, we hypothesized that engagement would be significantly reduced under low versus high accountability conditions, with this effect being particularly evident at higher levels of task demands (e.g, increased time on task or memory load; H1). This would be consistent with the idea that benefits (e.g., self-presentation concerns) would be perceived to be greater under high accountability conditions, effectively increasing the ratio of benefits to costs, along with the probability of engagement. We also hypothesized that activation of negative relative to positive aging stereotypes would increase perceptions of experienced task difficulty. In SET terms, this can be viewed as an increase in the perceived costs associated with the task. When motivation (i.e., perceived benefit) is high, this should result in increased levels of effort expenditure in response to the elevation in perceived costs (i.e., experienced task difficulty). In contrast, relatively little impact of age stereotypes might be expected when motivation to engage is already low, since negative age stereotypes and the consequent increased perception of costs would simply bias the already low ratio of benefits to costs even more, discouraging high levels of engagement. Thus, we hypothesized that accountability would moderate the impact of stereotypes on engagement, with their effect being most evident under task conditions designed to maximize motivation (H2). Specifically, we not only expected engagement to be generally greater under high accountability conditions, but that the effect of accountability would be exacerbated for those exposed to the negative aging stereotypes due to the hypothesized greater expectations of task difficulty (e.g., Zafeiriou & Gendolla, 2017). We also examined perceptions of task difficulty to determine if the hypothesized effects of aging stereotypes on effort expenditure would be based in subjective evaluations of task performance (H3).

A secondary goal of our study was to conduct a differential examination of the effects of motivation and aging stereotypes on effort expenditure. Although our study was initially designed to examine these factors experimentally, we also collected individual measures of both attitudes about aging (Expectations Regarding Aging; Sarkisian, Steers, Hays, &

Mangione, 2005) and intrinsic motivation to engage in cognitively demanding tasks (Need for Cognition; Cacioppo & Petty, 1982) from participants prior to coming to the lab. Although these measures do not fully overlap conceptually with our experimental conditions, they do share important components associated with both motivation to engage cognitive resources and beliefs about aging. We therefore decided to examine the impact of aging attitudes and motivation using these *a priori* measures of individual differences in analyses similar to those used with our experimental manipulations. In doing so, we tested the same hypotheses with similar expectations about results (e.g., the impact of aging attitudes on engagement would be greatest in those individuals with the highest levels of intrinsic motivation).

Methods

Participants

Participants were community-based volunteers recruited via newspaper and online advertisements from the Raleigh, North Carolina, area. The Short Blessed Orientation–Memory–Concentration Test (Katzman et al., 1983) was used as a cognitive screening measure. Following conventional guidelines (Lezak, Howieson, & Loring, 2004), individuals receiving a score over 6 were excluded from participation ($N = 5$). Individuals were also excluded if they had medical conditions that could potentially affect cardiovascular responses (e.g., diabetes, congestive heart failure, coronary heart disease), if they self-reported uncontrolled hypertension, or if their systolic blood pressure (SBP) met or exceeded 160 or diastolic blood pressure (DBP) met or exceeded 100 ($N = 19$). The final sample included 144 older adults (79 female) 65–85 years of age.[1] Further information about participants is presented in Table 1. Each participant was paid $30 for participating in the study. The procedures used in the project were reviewed and approved by the Institutional Review Board at North Carolina State University.

Measures and Equipment

Cardiovascular responses.

Systolic blood pressure, diastolic blood pressure, and heart rate were collected using a CNAP monitor (CNSystems Medizintechnik AG, Graz, Austria) in conjunction with a BIOPAC MP150 system (BIOPAC Systems, Inc., Goleta, CA). This system uses two finger cuffs to measure finger arterial pressure, which is then converted into predictions of brachial arm pressure. This system also employs an arm cuff for calibration purposes.

Stereotype activation.

Materials used to activate positive and negative aging stereotypes were similar to those used successfully in Kotter-Grühn and Hess (2012). There were two sets of six pictures, one

[1]A sample size of 36 participants in each Accountability × Stereotype group was determined using the G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007) with power = .80, $\alpha = .05$, and an effect size of f = .25 for a design that included four independent groups and four observations within each group. (Given that most of our analyses used multilevel modeling, this is a conservative approach for determining sample size.) Thus, our sample size provided reasonable power to test for medium effect sizes for all main and interaction effects in our analyses.

consisting of older adults with happy faces for the positive condition and the other consisting of older adults with sad or grumpy faces for the negative condition. Images were taken from The Center for Vital Longevity Face Database (Minear & Park, 2004), with each set containing pictures of three men and three women from the same range (65 – 85 years) as our study sample. Each face was accompanied by a brief vignette about the individual, with pictures in the positive condition described mostly in positive terms and those in the negative condition described mostly in negative terms. Sample positive and negative vignettes are:

> *Robert is 67 years old. He is relatively healthy and can still perform all necessary tasks in and around his house. His family describes him as always having a positive outlook and being full of life. He enjoys his retirement and is currently planning a trip to France together with his younger brother. To learn some French for the trip, he participates in an evening class.* (Positive)

> *Robert is 67 years old. After his recent retirement, he has struggled to keep himself occupied throughout the day. His wife is still employed as a school teacher, and he feels lonely after she leaves for work each morning. He wishes he could get together with his friends who meet up to play tennis each week, but he fears he doesn't have the energy to play like he used to.* (Negative)

Cognitive task.

A computer-based memory-scan task was used as the focal point for assessing engagement. On each trial, an asterisk was presented in the middle of the screen for 500 ms. This was then replaced by a memory set of randomly ordered consonants, with the full set displayed for 1500 ms. After a 500 ms pause, an individual consonant (target) was presented for 1500 ms. Participants were instructed to respond yes or no as to whether the target was contained in the immediately preceding memory set using labeled buttons on a response box. Two sets of stimuli were constructed that included memory sets with either four consonants (low demand) or seven consonants (high demand).

Subjective ratings.

A computerized version of the NASA-Task Load Index scale (NASA-TLX; Hart & Staveland, 1988) was used to measure subjective task difficulty. The six subscales (mental demands, physical demands, temporal demand, performance, effort, and frustration) were each presented on the computer screen individually, and participants used a slider scale from very low to very high (or perfect to failure for the performance subscale) to indicate their responses. These responses were later converted to scores of 1 to 100. A computerized version of the 30-item intrinsic motivation inventory (IMI; McAuley, Duncan, & Tammen, 1989) was used to assess task-specific motivation.

Cognitive ability.

Several cognitive tests were given in order to characterize the sample. These included the Digit-Symbol Substitution and Letter-Number Sequencing subtests of the Wechsler Adults Intelligence Scale III (Wechsler, 1997), which were used to assess perceptual speed and working memory, respectively, and Vocabulary Test V-2 from the Kit of Factor-Referenced Cognitive Tests (Ekstrom, French, Harman, & Derman, 1976) for assessing verbal ability.

Intrinsic motivation.

The 18-item Need for Cognition scale (NFC; Cacioppo & Petty, 1982) was used to assess the intrinsic motivation to engage in cognitively challenging activities (sample item: "I would prefer complex to simple problems"; Cronbach's α = .89).

Aging attitudes.

The 12-item Expectations Regarding Aging survey (ERA; Sarkisian et al., 2005) was used to assess individual differences in attitudes about aging (sample item: "Forgetfulness is a natural occurrence just from growing old"; Cronbach's α = .91).

Procedure

Several days prior to coming into the lab, participants completed the ERA and NFC scales on-line in their homes along with the Geriatric Depression Scale (Sheikh & Yesavage, 1986) and several measures unrelated to the present study. Once participants arrived at the lab, blood pressure was screened using the HEM-780 automatic blood pressure monitor (Omron Health care, Inc., Kyoto, Japan). If their blood pressure exceeded the previously described limits, they were given a chance to relax for about 5 min after which a second assessment was taken. If readings still exceeded the prescribed limits, they were compensated but excluded from participation ($n = 2$). For qualifying participants, the CNAP monitor was then attached to the participant's index and middle fingers of their non-dominant hand and the calibrating arm cuff was placed on their arm.

Prior to turning on the CNAP monitor, participants completed the stereotype activation task. This was characterized as an impression-formation task and was described as one of a series of unrelated activities that the participant would be performing during the session. Participants were assigned to either the positive or negative stereotype condition, and they then viewed the set of pictures associated with that condition. Each picture and associated vignette was displayed on the computer screen individually, with participants asked to form an impression of each depicted individual based on the displayed information. When they were ready, they then responded to four questions (using a 5-point scale) based on their impression of the target person: (a) How mentally fit is this person? (b) How healthy is this person? (c) How active is this person? and (d) How happy is this person?

After participants had viewed and rated all the pictures in the stereotype activation task, the CNAP monitor was adjusted and turned on. Participants were instructed to relax silently for 10 min while the CNAP calibrated and collected baseline blood pressure. No materials were provided during this relaxation period, and the computer screen only displayed the words "Relax" or "Please continue to relax" to ensure participants attention was not diverted by other tasks. The last 5 min of this period were used as a baseline assessment. At the end of this baseline period, we attempted to reactivate the previously primed stereotype. This was done by telling participants that we had "forgotten" to administer the last part of the impression-formation task, and then having them think back to the pictures they had viewed and respond to the same four questions for the group instead of for each individual. They were provided with a reference sheet containing the six pictures that they saw to refresh their memories, and then completed this task on paper.

The memory scan task was given next. Participants were presented with a series of 75 trials in each of four 5-min blocks. For the first two blocks, the memory sets included four items, whereas for the final two sets, the memory sets included seven items. On each trial, participants indicated whether or not the target item had appeared in the just-presented memory set. After each 5-min trial block was completed, participants provided their subjective impressions of task difficulty during that block using the TLX. Prior to beginning the memory scan task, half of the participants in each stereotype condition were provided with instructions designed to enhance motivation to engage using an accountability manipulation similar to those successfully employed in previous studies (e.g., Smith & Hess, 2015). Specifically, they were told that engagement in cognitively complex activities can be beneficial and that a summary of their performance on the task would be displayed on the screen, which the experimenter would review with them. Our manipulation is consistent with both the previously described definition of accountability and other uses in the literature (Lerner & Tetlock, 1999). Participants in the low accountability condition received standard directions about the task, with no reference to a subsequent performance review. After all four trial blocks were presented, participants completed the IMI in relation to their feelings about the memory-scan task as a whole. In addition, those in the high accountability condition were shown results of their performance (i.e., total number of correct responses). Participants were then disconnected from the CNAP monitoring system.

Following this, participants completed the Digit-Symbol Substitution, Letter-Number Sequencing, and vocabulary tests. They also completed a brief demographics survey, the SF-36 health survey (Ware, 1993), and a chronic conditions checklist. They were then debriefed and compensated for their participation.

Data Preparation and Analytic Plan

Cardiovascular responses were recorded during baseline and throughout the cognitive task. Acqknowledge software (BIOPAC Systems, Inc.) was used to record and clean the data, allowing us to eliminate artifacts in the data caused by movement and other factors. Means were then calculated for baseline and each of the four trial blocks using these cleaned data. SBP-responsivity (SBP-R) was used to measure effortful engagement and was calculated by subtracting baseline SBP from the mean of each trial block.

Given the constant temporal sequence in which participants experienced the different levels of task demands—which could influence the effects of task demands and of trial blocks within each level of demand—we decided to examine our primary dependent variables using multilevel modeling (MLM), which controls for sequential dependencies in the data. Since MLM also allows for missing data, this analytic approach permitted us to maximize the power of our analyses by not excluding participants who may have been missing data in one of the task conditions. In all analyses, task demands (i.e., memory sets of 4 vs. 7 items) and trial block (first vs. second within each level of demands) were treated as Level 1 predictors and accountability condition (low accountability = referent) and stereotype condition (negative stereotype = referent) were treated as level 2 predictors. In our differential analysis, grand-mean-centered NFC and ERA scores were substituted for accountability and stereotypes, respectively. All models also included all within- and cross-level interactions. In order to control for Type I error, significance levels were set at $p \leq .01$ for all follow-up tests.

Although it would also be interesting to examine the interactions between our experimental conditions and our two individual differences variables, the study was not designed to do so and thus is statistically underpowered to examine such complex effects. Thus, we chose to focus on these two analogous sets of analyses, and also tested to see if controlling for the untested effects (e.g., NFC and ERA in the experimental analysis) affected the results.

Results

Prior to proceeding with our analyses, we performed 2 × 2 (Stereotype Condition × Accountability Condition) analyses of variance (ANOVA) on the measures displayed in Table 1 to identify any inadvertent biases introduced by assignment to experimental conditions. Only two effects were obtained. A significant interaction was observed for SF36 mental health scores, $F(1,140) = 4.29$, $p = .04$, $\eta^2_{partial} = .03$, reflecting relatively minor variations across conditions. We also found that NFC scores[2] were significantly greater in the high than in the low accountability condition (*M*s = 4.6 vs. 4.3, respectively), $F(1,139) = 5.59$, $p = .02$, $\eta^2_{partial} = .04$. As we note later, controlling for these differences did not impact the results.

Manipulation Checks

We next checked to see that our manipulations of stereotypes and motivation worked as intended. With respect to stereotypes, we examined the mean response to the four impression-formation questions (Cronbach's $\alpha = .96$) administered just prior to the memory scan task. A 2 × 2 (Stereotype × Accountability) ANOVA revealed a strong effect due to stereotype condition in the expected direction, $F(1,140) = 662.54$, $p < .001$, $\eta^2_{partial} = .83$, with more positive scores provided by participants who viewed positive images ($M = 4.4$, $SD = 0.6$) than for those who viewed negative images ($M = 2.1$, $SD = 0.5$). Importantly, there were no significant differences across accountability conditions regarding the impact of the stereotype manipulation (*p*s > .14).

With respect to the motivation manipulation, we examined the two IMI subscale scores—enjoyment and effort—which are typically used to assess task-specific intrinsic motivation. A multivariate ANOVA performed on these scores did not result in any significant effects due to either accountability or stereotype condition (*p*s > .47). A potential complication with respect to this measure is that it was given at completion of the memory-scan task instead of following the manipulation at instructions or after each trial block, perhaps decreasing sensitivity. As will be seen later in our examination of engagement, however, our accountability manipulation did have a clear impact.

[2]A score was missing for 1 participant.

Engagement

Our main dependent variable of interest was SBP-R, which we used as a measure of engagement (i.e., effort expenditure). A null model performed on this measure revealed that 76.1% of the variability was at the between-persons level whereas 23.9% was within persons, both of which were significant ($p < .0001$). Prior to our main analyses involving this factor, we examined whether baseline SBP was related to our experimental or individual difference measures of motivation and stereotypes. An Accountability × Stereotype Condition analysis of variance revealed only a significant interaction effect, $F(1,138) = 4.03$, $p = .047$. As seen in Table 1, this was due to baseline levels in the low-accountability, negative-stereotype group being lower than those in the other three groups. A similar analysis examining effects associated with NFC and ERA revealed no significant effects (ps > .06). Given the observed variability across conditions, and the possibility of differences in SBP-R as function of starting point, we included grand-mean-centered baseline SBP as a covariate in our analyses of SBP-R. We also controlled for grand-mean-centered accuracy to assess effort expenditure at a set level of performance across levels of objective task demands. (Eliminating this covariate reduced the strength of some effects somewhat, but the overall pattern of significant effects remained the same.)

Experimental analysis.

Our full model accounted for 16.2% of the between-person variance and 53.9% of the within-person variance, with the results of this analysis presented in Table 2. Significant Accountability × Trial Block and Accountability × Task Demands × Trial Block interactions were obtained. Contrasts revealed that the latter interaction was primarily due to a significant accountability effect in trial block 2 under high demands, $b = 4.78$, $t(132) = 2.22$, $p = .03$, which we assume reflects the combined effects of these conditions placing greatest demands on cognitive resources (i.e., difficult task performed over an extended period of time).[3] The steeper decline with an increase in task demands in the low accountability condition is consistent with a pattern of disengagement as capabilities are challenged and cognitive fatigue sets in (Ennis et al., 2013). The less severe impact of demands and time on task in the high accountability condition is suggestive of the positive impact of motivation on maintenance of engagement under challenging circumstances. Thus, in partial support of H1, those in the high accountability condition had generally higher levels of engagement than those in the low accountability condition, with the difference between conditions being primarily evident at high levels of task difficulty. That is, although engagement levels declined for all participants with an increase in demands and time on task (i.e., over trial blocks)—potentially reflective of disengagement—this decline was exacerbated for those in the low accountability condition (Figure 1).

Relevant to H2, the hypothesized interaction between Accountability and Stereotype was not significant. However, significant Accountability × Stereotype × Block and Accountability × Stereotype × Demands × Block interactions were observed (see Table 2).[4] Model-derived

[3]An alternative interpretation is in terms of fatigue effects due to engagement over an extended period of time in a relatively demanding task, similar to those observed in Smith and Hess (2015). Regardless of the source of the effect, however, the implications are the same: motivation influences are strongest at highest levels of task demands or, alternatively, under depleted resources.

estimates of engagement depicting the latter interaction are presented in Figure 2. Decomposition of the interactions using analyses focused within accountability conditions revealed no significant effects due to stereotype condition under low accountability conditions. In contrast, a significant Stereotype × Block interaction, $b = 3.37$, $p = .01$, for the high accountability condition was obtained. The difference in SBP-R between the negative and positive stereotype conditions was greater for trial block 1 (13.2 vs. 11.3) than for block 2 (10.7 vs. 10.7), with the negative effect of trial block being significant in the negative stereotype condition ($b = -4.45$, $p < .0001$), but not in the positive stereotype condition ($b = -1.08$, $p = .25$). Thus, whereas stereotype activation had a stronger effect at high than at low levels of motivation, the impact of negative stereotypes was primarily evident in the first trial block at each level of task difficulty.

Taken together, the results provide qualified support of both H1 and H2. Specifically, high accountability was associated with greater levels of engagement, primarily at higher levels of task demands. In addition, activation of negative stereotypes was evident at high levels of accountability, but its impact was restricted to the initial trials encountered at both the low and high demand conditions of the task. Notably, participants in the positive stereotype/high accountability condition maintained relatively consistent levels of engagement across both trial blocks and levels of task demands.

Differential analysis.

We next estimated the model examining the impact of aging stereotypes and motivation from an individual differences perspective, which accounted for 16.7% of the between-person and 53.9% of the within-person variance. Results of this analysis are presented in Table 3. Inconsistent with both H1 and H2, the main effect of NFC and the NFC × ERA interaction were not significant. However, a significant ERA × NFC × Demands × Block interaction was obtained, with the pattern of results providing qualified support for both hypotheses. (Controlling for membership in the two experimental conditions did not change the results appreciably.) Estimates of SBP-R calculated at 1 *SD* above and below the mean for both ERA and NFC are presented in Figure 3. Visual inspection of these data reveals a pattern not dissimilar to that observed with the experimental analysis. Specifically, aging attitudes appear to have their primary impact at high levels intrinsic motivation.

Using a procedure similar to that in the experimental analysis to interpret the 4-way interaction, we provided more focused tests by examining responses at 1 *SD* above and below the mean for NFC (i.e., high versus low motivation). These analyses verified our observations. At low levels of NFC, there were no significant effects due to ERA (*p*s > .25). At high levels of NFC, significant effects were observed for demands ($b = -3.31$, $p = 001$) and trials ($b = -2.11$, $p = .003$), with both interacting with ERA ($b = -.14$, $p = .004$). As can be seen in Figure 3 (top), those with relatively negative attitudes had numerically higher levels of SBP-R than those with positive attitudes at all levels of task demands across both trial blocks. The 3-way interaction reflected the fact that the impact of ERA was greatest at

[4]We ran an additional model that included scores relating to attitudes on aging (i.e., ERA) and intrinsic motivation (i.e., NFC) as covariates in order to control for pre-existing differences in the factors being manipulated in the present study. Inclusion of these covariates did not affect the results.

the highest level of task demands (i.e., trial block 2 with memory sets of 7), where a significant effect due to attitudes was observed ($b = -.26$, $p = .002$); this same effect was only marginal at the other three levels of Demands × Trial blocks (*b*s = −.12 to −.14, *p*s = .05 – .09). In sum, these results also lend qualified support to H2 and generally congruent with results of the experimental analysis demonstrating that stereotype influences are strongest at high levels of motivation.

Other Cardiovascular Measures.

For comparison purposes, we repeated the above experimental and differential analyses on DBP and heartrate responsivity, respectively. Consistent with expectations that active coping responses associated with our task variables would be most evident for SBP (e.g., Obrist, 1981), the only significant effect obtained was due to a decrease across trial blocks for heartrate responsivity in the differential analysis, b = −.82, t(397) = −2.03, $p = .04$.

Subjective Perceptions of Task Demands

In the next set of analyses, we tested H3 by examining the impact of stereotypes and motivation—from both an experimental and differential approach—on subjective perceptions of task difficulty using models similar to those used in the preceding analyses. Examination of the impact of our experimental manipulations on each of the six TLX subscales revealed that the only significant effect due to stereotype or motivation conditions was associated with ratings of frustration. Specifically, a significant Stereotype × Accountability × Demands interaction was obtained, $b = 13.8$, $t(419) = 2.03$, $p = .04$.[5] As with engagement, stereotype condition only influenced ratings in the high accountability condition, where a marginal Stereotype × Trial Block interaction was obtained ($b = -7.0$, $p = .06$).

With respect to the differential analysis, significant main effects relating to motivation (i.e., NFC) were obtained for the mental demands ($b = -6.0$, $p = .004$), temporal demands ($b = -6.6$, $p = 001$), performance ($b = -5.09$, $p = .02$), and frustration (b = −7.4, p = .005) scales. In addition, a significant NFC × Trial Block interaction was observed for ratings of physical demands, with the effect of NFC being significant for high task demands ($b = -9.4$, $p = .0003$), but not for low demands ($b = -2.9$, $p = .25$). In all of these cases, individuals with lower levels of intrinsic motivation perceived task demands to be greater than did those with higher levels—a result consistent with H3. The only effects involving aging attitudes were obtained for ratings of physical demands, where two significant interactions were obtained: ERA × Trial Block, $b = 0.24$, $p = .001$, and ERA × Task Demands × Trial Block, $b = -0.34$, $p = .001$. Subsequent analyses revealed that the ERA × Trial interaction was only significant at low task demands, with the block effect being significant for those with more positive attitudes ($b = 8.82$, $p < .0001$), but not for those with more negative attitudes ($b = 0.11$, $p = .95$).

[5]For each of the six subscales, significant effects were also observed for task demands and/or trial block in the expected direction (i.e., increase in perceived difficulty with an increase in demands and time on task) in both this and the individual differences analyses. These effects would naturally be expected, but are only discussed to the extent that they are moderated by stereotypes/attitudes or motivation.

In sum, motivation had some impact on perceptions of task difficulty, particularly when assessed at the individual level through Need for Cognition. There was little evidence, however, that subjective impressions of difficulty were affected by beliefs about aging, either at the group or individual level, thereby providing little support for hypothesis that negative stereotype activation or negative aging attitudes would elevate subjective perceptions of task demands.

Performance

Although our primary interest was in patterns of engagement, we also examined performance on the memory scan task to ensure that participants were responding as expected. Mean performance was calculated across all problems completed within each block of trials at each level of task demands. With respect to accuracy, a null model performed on proportion correct revealed significant ($p < .0001$) variability both between (27.9%) and within persons (72.1%), with the full model accounting for 31.5% of the between-person and 66.1% of the within-person variance. Within our main model, accuracy declined with an increase in task demands, $b = -0.17$, $t(420) = -9.27$, $p < .0001$. The following two interactions were also significant: Accountability × Stereotype × Block, $b = -0.08$, $t(420) = -2.45$, $p = .015$, and Accountability × Stereotype × Demands × Block, $b = 0.10$, $t(420) = 2.28$, $p = .02$. Further examination of these effects using the high accountability condition as the referent revealed that both demands ($b = -0.14$) and block ($b = 0.05$) were significant (ps < .001) predictors of performance in this condition. However, effects associated with stereotype failed to achieve significance (ps > .02). In addition, the comparable effects of demands ($b = -0.17$) and block ($b = 0.01$) in the low accountability were similar in magnitude to those in the high accountability condition. Together, these findings suggest that our manipulations of stereotype and accountability had minimal influence on performance.

A null model performed on mean response times on correct trials within each block also revealed significant ($p < .0001$) variability both between (76.1%) and within (23.9%) persons. The subsequent full model accounted for 1.8% of the between-person and 51.8% of the within-person variance, and revealed that response times decreased across trial blocks, $b = -54.0$, $t(420) = -6.17$, $p < .0001$. The only other significant effect was an interaction between task demands and trial block, $b = 35.79$, $t(420) = 2.89$, $p = .004$, due to the decrease in response times over blocks being greater with low demands (936 ms vs. 883 ms) than with high demands (951 ms vs. 928 ms).

In sum, participants were performing as expected on the task, with accuracy declining and response time increasing with task demands. Somewhat surprisingly, the manipulation of accountability and aging stereotypes had minimal impact on performance.

Discussion

The primary goal of the present study was to examine the impact of aging stereotypes on task engagement. We anticipated that the activation of negative aging stereotypes and associated beliefs about the effects of aging on cognitive capabilities would alter perceptions of the effort required to perform successfully, resulting in increased levels of engagement when motivation was high. We found that experimental manipulations of stereotype activation and motivation levels resulted in patterns of engagement consistent with expectations. Specifically, engagement levels were elevated when accountability was high—particularly when task demands were greatest—with this elevation of effort being particularly evident in those individuals exposed to negative aging primes. Previous research had demonstrated that activation of negative aging stereotypes resulted in elevated levels of cardiovascular reactivity (Levy, Hausdorff, Hencke, & Wei, 2000), with the interpretation being that this elevated reactivity reflected general responses to a stressor. The present results, however, expand upon these findings by demonstrating that stereotypes have their primary effect when participants are motivated to perform, in the present case through a manipulation of accountability. In other words, simple activation of a negative stereotype does not necessarily lead to increased reactivity, but rather is dependent upon other situational factors. Our findings also indicate that, contrary to previous research (e.g., Levy et al., 2000; Weiss, in press), the activation of negative stereotypes and associated changes in cardiovascular response do not necessarily lead to a degradation in performance in older adults. Rather, the effects appear to be primarily on levels of effort mobilization.

The present study also expanded upon our current knowledge of the effects of stereotypes about old age on functioning by examining the impact of personally held beliefs about aging on engagement. Independent of situationally activated stereotypes, we observed that levels of effort expenditure were highest in those individuals who held relatively negative expectations about the impact of aging on functioning *and* who also had relatively high levels of intrinsic motivation to engage in cognitively challenging tasks (i.e., need for cognition). Once again, there was little difference between individuals with more positive versus more negative attitudes when motivation levels were low, arguing against a general pattern of cardiovascular reactivity in response to negative beliefs or attitudes about aging. These effects are consistent with those from another recent study demonstrating that, under high levels of extrinsic motivation, aging attitudes were negatively associated with engagement levels (Hess et al., in press).

Of further interest in the present study, we also found that the effects associated with stereotypes and motivation were specific to SBP; DBP and heartrate did not exhibit similar responses. This is notable since SBP has been argued to be a purer indicator of sympathetic (β-adrenergic) influence on the myocardium during active coping than either of these other measures (e.g., Richter, Friedrich, & Gendolla, 2008). Specifically, SBP assesses peak arterial pressure during myocardial contraction, and is influenced by sympathetically induced elevation of myocardial contractile force (Guyton, 1991; Vick, 1984). In contrast, heart rate—a measure of the frequency of cardiac contractions per minute—also increases under sympathetic influence, but parasympathetic dominance makes it a less sensitive indicator of β-adrenergic influence (Berntson, Quigley, & Lozano, 2007). Similarly, because DBP is a measure of arterial pressure during diastole—the period of cardiac relaxation in the cardiac cycle—it is less influenced by myocardial contraction than SBP. DBP is determined primarily by peripheral vascular resistance, which may increase or decrease during a sympathetic response due to degree of vasoconstriction or vasodilation (Guyton, 1991; Piepoli et al., 1993; Wright & Kirby, 2001). Thus, consistent with the conclusion that SBP provides a valid means for assessing effort or the mobilization of energy resources to meet situational demands (e.g., Richter, 2015), we argue that these effects are reflective of variations in effort mobilization in response to task demands. Replicating past research (e.g., _S1_Reference12Gendolla & Richter, 2006b; Smith & Hess, 2015), effort expenditure was also related to motivation levels, which can be viewed, in part, as relating to the importance assigned to the task. The interaction of aging stereotypes with motivation, however, suggests that salient beliefs about aging were influencing perceptions or experience of task demands.

An important question relates to the mechanisms associated with the influence of stereotypes on engagement. One possibility is that stereotypes impact beliefs about capabilities to perform, in essence increasing the perceived demands of the task. As long as success is still viewed as possible and performance was viewed as meaningful, this should result in elevated levels of effort expenditure. Relevant to this perspective is a recent study by Weiss (in press), who examined the interaction between endorsement of essentialist beliefs about aging and stereotype activation. Older adults primed with negative stereotypes and who endorsed beliefs consistent with the inevitability of cognitive decline (i.e., high essentialism) exhibited significantly elevated SBP reactivity in response to a cognitive challenge when compared with those individuals who either had low essentialist beliefs or were high in essentialist beliefs but exposed to neutral primes. One interpretation of this is that the negative stereotype activated the essentialist beliefs systems, which influenced perceptions of the capability to perform or the effort required to succeed. This, in turn, may have increased reactivity, reflecting elevated levels of engagement. Unfortunately, SBP reactivity was only assessed in that study after completion of the cognitive task, and thus it is unclear how SBP was affected during performance. However, given previously observed positive associations between task engagement and subsequent fatigue (e.g., Hess & Ennis, 2012), it might be inferred that the elevated post-task levels of SBP—reflective of fatigue—represent greater levels of engagement during the task.

In the present study, we tested whether stereotypes would affect perceptions of task difficulty using NASA TLX scores. However, little relationship was found between stereotypes—either experimentally induced or personally held—and subjective evaluations of workload. It should be noted, however, that in those cases where stereotype effects were obtained, they were consistent with expectations (e.g., greater levels of frustration following activation of a negative vs. positive stereotype in the high motivation condition). A similar absence of impact of aging stereotypes on subjective task ratings was observed by Zafeiriou and Gendolla (2017) in their study with young adults. There are several possibilities for the observed null associations. First, it may suggest the effects of stereotypes on effort expenditure are relatively subtle, perhaps operating at an implicit level with little impact on more conscious assessments of task demands. A second possibility is that our method of assessing difficulty may not have been optimal. For example, assessments were made following each trial block, with reports being necessarily retrospective and subject to potential memory issues; moment-to-moment ratings during the actual task may have provided more sensitive assessments of difficulty. A third possibility is that the impact of task manipulations on subjective ratings of task demands may be more evident in within-subject than in between-subject comparisons. Given the relatively subjective nature of stereotype effects, we might not expect a systematic translation of stereotype influences on subjective workload at the group level. Such effects may be more evident at the individual level as individuals contrast their subjective experiences under different task conditions.

Of course, alternative explanations are possible for the observed effects (e.g., Maddox & Markman, 2010). For example, highly motivated older adults exposed to negative aging stereotypes may engage more resources not due to perceptions of difficulty, but due to increased incentive to avoid a negative outcome (e.g., confirming an aging stereotype). Alternatively, the results might also be interpreted with respect to perspectives on regulatory focus and fit (e.g., Higgins, 2012). For example, negative stereotypes may induce feelings of loss, potentially activating a prevention focus, and high motivation may enhance vigilance. This combination of prevention and vigilance represents good regulatory fit, which is hypothesized to be associated with engagement and positive goal attainment. Future work should focus on distinguishing between these alternatives.

The present results present a more nuanced view of the impact of aging stereotypes on functioning and potential implications for cognitive and physical health than suggested by previous research. Specifically, negative aging stereotypes—both situationally activated and personally held—do not necessarily lead to elevated cardiovascular responses or degradation of performance in cognitively challenging situations. When motivational levels are low either due to situational manipulations of the importance of successful task performance or to chronically low levels of intrinsic enjoyment of cognitively challenging activities, the impact of negative aging stereotypes on responses is not meaningfully different than the impact of positive stereotypes. When motivation levels are high, negative stereotypes do result in elevated levels of cardiovascular response. However, rather than having a disruptive impact on performance, these elevated responses appear to represent mobilization of the sympathetic nervous system in support of performance. That is, participants appear to increase their mobilization of effort in order to accommodate greater experiences of task difficulty associated with negative stereotypes of aging. This is not to say that exposure or adherence to these negative stereotypes will not have detrimental effects on health due to their impact on cardiovascular responses. Rather, it suggests that the effect may be more selective, with some individuals being more susceptible based upon the importance they assign to a situation in which negative stereotypes might be prevalent or the degree to which they enjoy and value cognitive challenge.

The present results also have implications for SET (Hess, 2014). Consistent with expectations, older adults modulated their effort expenditure based upon motivational levels. Although the study did not include younger or middle-aged adults, thereby not permitting a test of expectations regarding the hypothesized disproportionate impact of task benefits on older adults' engagement, clear differences in engagement patterns similar to those observed previously (Smith & Hess, 2015) were obtained in response to our accountability manipulation.

Our findings with respect to the impact of stereotypes on engagement also have implications for understanding the cost-benefit analyses that underlie the patterns of age-based selective engagement associated with the theory. SET assumes that the primary basis for general declines in activity participation and increased selectivity related to perceived benefits in older adults is based in an age-related increase in costs associated with cognitive engagement. It further assumes that the increased costs are a reflection of normative changes in the effort required to achieve successful performance, with the increase in effort assumed to be based in normative declines in resources supporting effort (Hess et al., 2011; Queen & Hess, 2018). The elevated levels of engagement associated with negative stereotypes under high levels of motivation suggest, however, that calculation of costs may also be based in beliefs that modify the experience of task difficulty and impact effort expenditure. That is, costs associated with aging may be based in both objective (e.g., changes in physiology) and subjective (e.g., beliefs about aging) factors. This perspective is supported by other recent research (Hess et al., 2018) demonstrating that greater levels of costs are tied to negative aging attitudes, which negatively affect intrinsic motivation and the subsequent engagement in cognitively demanding, but potentially beneficial everyday activities.

Several caveats need to be considered in interpreting the present results. First, we did not include a neutral stereotype condition, and thus we cannot definitively conclude that the observed effects were due to activation of positive or negative stereotypes. Second, the stereotypic information presented about older adults covaried with affective information (e,g,, positive or negative facial expressions), which previous research has found to also influence engagement levels (e.g., Gendolla & Silvestrini, 2011). We suggest, however, that the responses by participants to the stimuli in our stereotype manipulation, and the consistency in patterns of engagement associated with stereotype manipulation and personally held attitudes supports our arguments that the observed experimental effects reflect activation of positive versus negative stereotypes. An additional caveat relates to the finding that stereotypes and motivation did not appear to have the same effect on performance in the memory scan task as they did on levels of engagement. For example, one might reasonably expect that higher levels of effort mobilization would be associated with higher levels of performance. However, as previously noted, effort expenditure is influenced by a number of task-unrelated factors, complicating the direct translation of effort into performance. Indeed, Zafeiriou and Gendolla (2017) also found minimal associations between effort and performance in their study which involved similar manipulations to ours. Significantly, the absence of effects on performance can be viewed as consistent with our perspective that the variations in engagement levels are based in perceptions of difficulty, as opposed to objective task demands.

In conclusion, the present study demonstrates that negative aging stereotypes have an impact on the engagement of older adults in cognitively demanding activities. However, contrary to implications from prior work, this impact is not uniformly negative. Instead, it depends on other factors surrounding the individual and situation. Even in situations where we demonstrated the greatest effect of negative stereotypes on engagement, the impact might not necessarily be perceived as negative, but rather as an adaptive response to the perceived demands of the situation and the effort required to support performance. This is not to say that the impact of negative stereotypes on engagement might not ultimately prove to be consequential with respect to future health and functioning in later life. It does suggest, however, that the effects of stereotypes may be more nuanced than previous research suggests.

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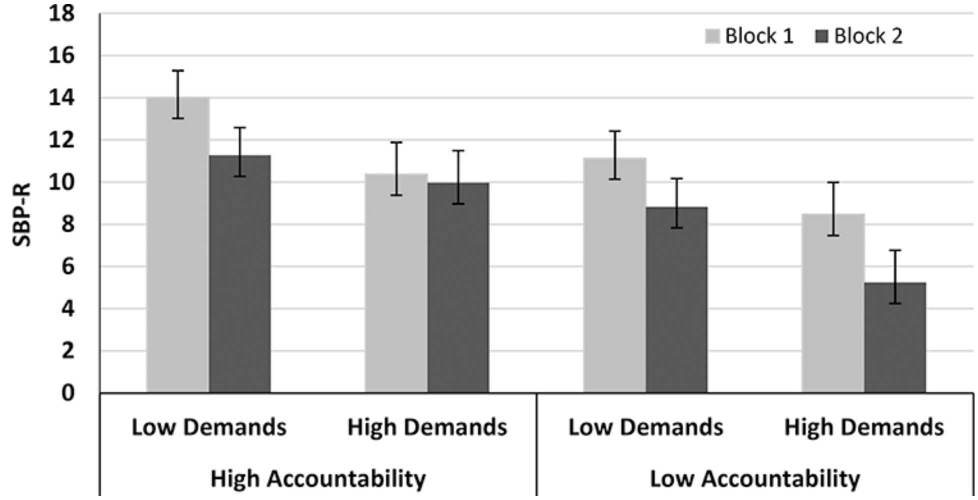

Figure 1.
Engagement levels (SBP-R model-based estimates with SE bars) as a function of accountability, task demands (memory sets of 4 vs. 7 items), and trial block.

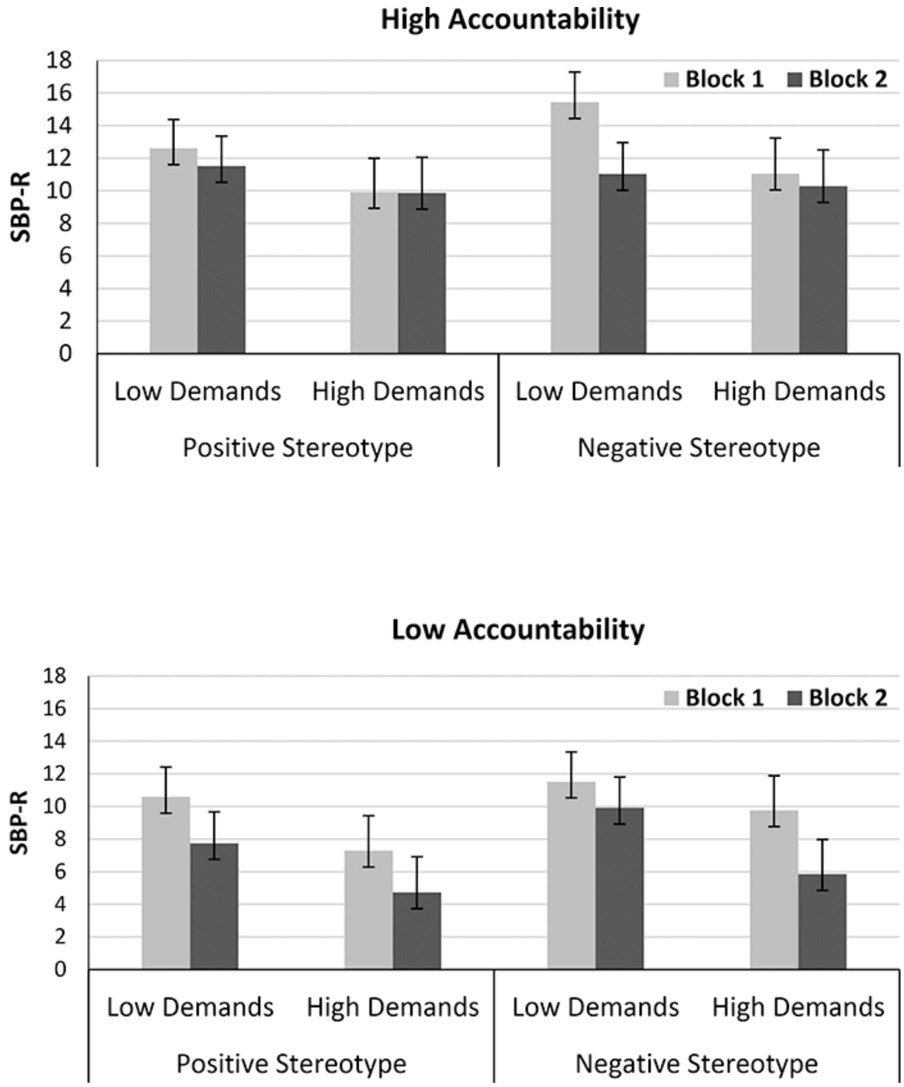

Figure 2.

Engagement levels (SBP-R model-based estimates with *SE* bars) within motivation conditions (high versus low accountability) as a function of stereotype condition, task demands (memory sets of 4 vs. 7 items), and trial block.

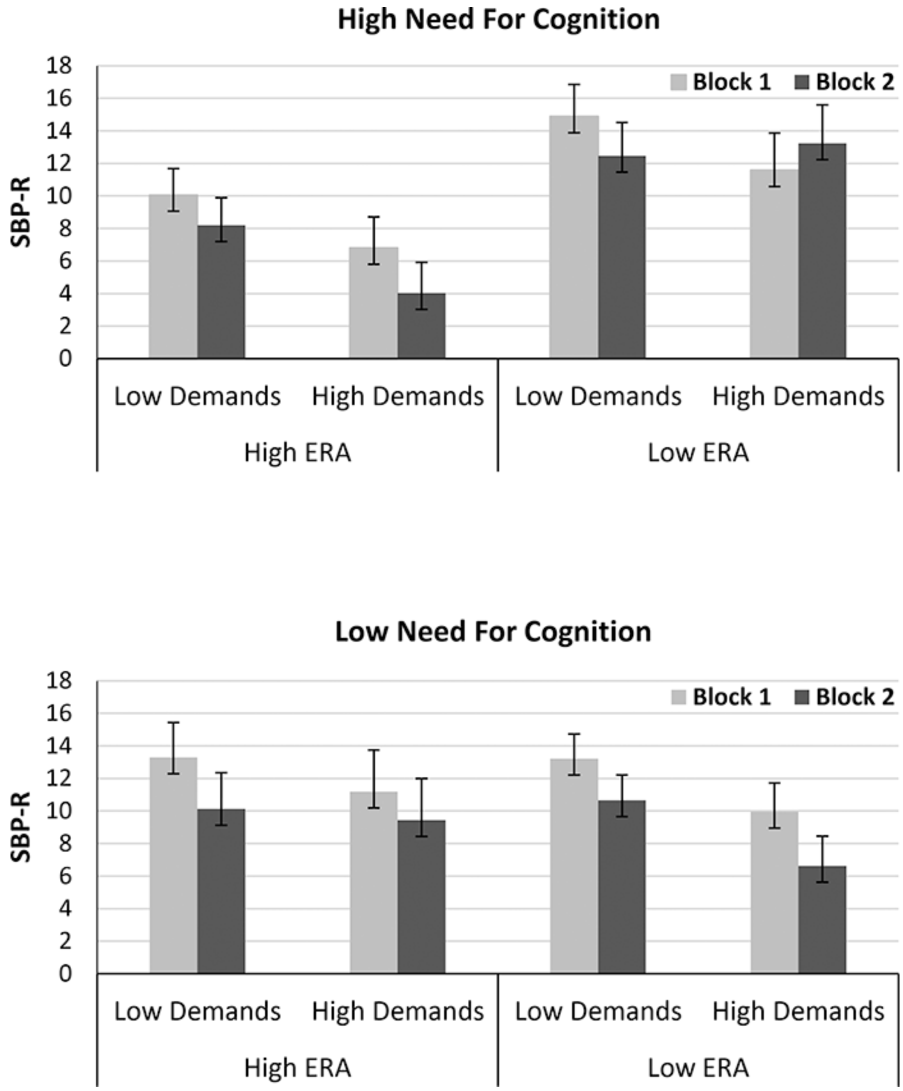

Figure 3.

Engagement levels (SBP-R model-based estimates with *SE* bars) as a function of individual differences in intrinsic motivation (Need for Cognition) and attitudes about aging (Expectations Regarding Aging [ERA]). Scores estimated at 1 *SD* above and below the mean for each measure. Higher ERA scores indicate more positive attitudes.

Table 1

Participant Characteristics

Measure	Positive Stereotype				Negative Stereotype			
	High Accountability (*n* =38)		Low Accountability (*n* = 35)		High Accountability (*n* = 35)		Low Accountability (*n* = 36)	
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Age	73.7	6.6	71.1	4.4	72.4	6.3	71.4	5.4
Education	17.2	2.4	17.2	3.0	17.3	2.4	17.4	2.3
SF36 Physical Hlth.	45.2	2.7	45.4	3.1	45.3	2.9	45.4	3.3
SF36 Mental Hlth.[1]	44.8	3.7	46.0	4.3	45.6	4.0	44.0	4.7
Geriatric Depression Scale	1.3	2.2	1.1	1.9	1.1	1.5	1.2	1.6
Letter-Number Sequencing	10.0	2.6	9.7	2.4	10.3	2.2	10.8	2.9
Digit-Symbol Substitution	63.4	14.2	60.4	11.1	63.91	12.0	64.3	10.6
Vocabulary	27.1	4.5	27.8	4.0	26.2	7.5	27.6	4.0
Need for Cognition[2]	4.6	0.7	4.3	0.9	4.5	0.8	4.2	0.6
Expectations Regarding Aging	56.9	13.4	57.9	21.6	56.7	17.5	58.6	18.0
Baseline Systolic Blood Pressure[3]	131.4	19.7	134.1	19.7	134.8	20.2	124.6	16.4

[1] Significant Stereotype × Motivation interaction ($p = .04$).

[2] Significant motivation effect ($p = .02$), with scores in high motivation condition ($M = 4.6$) being greater than those in the low motivation condition ($M = 4.3$).

[3] Significant Stereotype × Motivation interaction ($p = .047$).

Table 2

Results of Multilevel Model Examining the Effects of Accountability, Stereotype Activation, Task Demands, and Trial Block on Systolic Blood Pressure Response

Effect	Estimate	*SE*	df	*t*	*p*
Intercept	11.52	1.82	137	6.33	<.0001
Trial Block	−1.54	0.95	392	−1.62	0.1057
Task Demands	−1.67	1.338	392	−1.25	0.2102
Accountability Condition	3.91	2.60	137	1.50	0.1354
Stereotype Condition	−0.93	2.57	137	−0.36	0.7186
Accountability × Stereotype	−1.89	3.64	137	−0.52	0.6041
Block × Accountability	−2.91	1.37	392	−2.12	0.0344
Block × Stereotype	−1.31	1.37	392	−0.96	0.3376
Block × Accountability × Stereotype	4.68	1.94	392	2.42	0.0161
Block × Demands	−2.33	1.24	392	−1.88	0.0603
Demands × Accountability	−2.925	1.80	392	−1.62	0.1050
Demands × Stereotype	−1.79	1.77	392	−1.01	0.3120
Demands × Accountability × Stereotype	3.55	2.52	392	1.41	0.1604
Block × Demands × Accountability	5.87	1.82	392	3.23	0.0013
Block × Demands × Stereotype	2.61	1.79	392	1.46	0.1452
Block × Demands × Accountability × Stereotype	−5.26	2.58	392	−2.04	0.0423
Baseline SBP	−0.00	0.05	392	−0.01	0.9938
Accuracy	5.91	2.96	392	2.00	0.0462

Table 3

Results of Multilevel Model Examining the Effects of Need for Cognition, Expectations Regarding Aging, Task Demands, and Trial Block on Systolic Blood Pressure Response

Effect	Estimate	SE	df	t	p
Intercept	12.86	0.95	136	13.56	<.0001
Trial Block	−2.50	0.51	389	−4.92	<.0001
Task Demands	−3.06	0.79	389	−3.86	0.0001
Need for Cognition (NFC)	−0.52	1.28	136	−0.41	0.6856
Expectations Regarding Aging (ERA)	−0.07	0.05	136	−1.26	0.2109
NFC × ERA	−0.09	0.06	136	−1.55	0.1226
Block × NFC	0.51	0.69	389	0.75	0.4559
Block × ERA	0.00	0.03	389	0.02	0.9847
Block × NFC × ERA	0.02	0.03	389	0.66	0.5084
Block × Demands	0.89	0.67	389	1.34	0.1807
Demands × NFC	−0.33	0.92	389	−0.36	0.7200
Demands × ERA	0.02	0.04	389	0.59	0.5573
Demands × NFC × ERA	−0.03	0.04	389	−0.62	0.5384
Block × Demands × NFC	0.83	0.95	389	0.88	0.3808
Block × Demands × ERA	−0.04	0.04	389	−1.08	0.2823
Block × Demands × NFC × ERA	−0.14	0.05	389	−2.97	0.0032
SBP Baseline	−0.00	0.05	389	−0.02	0.9871
Accuracy	5.46	2.94	389	1.86	0.0643