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Age stereotypes' effects on motor learning in older adults: The impact may not be immediate, but instead delayed

Suzete Chiviacowsky[a,*], Priscila Lopes Cardozo[a], Aïna Chalabaev[b]

[a] Federal University of Pelotas, Pelotas, Brazil
[b] Univ. Grenoble Alpes, Grenoble, France

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ABSTRACT

Recent research with young adults has demonstrated that stereotype threat can impact not only immediate performance, but also the learning of motor skills. Studies examining this phenomenon on motor learning in other populations, however, are still lacking. The objective of the present study was to investigate whether stereotypes influence motor learning in older adults. Participants (all females; age range: 60–76 years) were divided into three groups. Before practice they were informed that their performance would be compared with the performance of young adults (negative condition), with performance of participants 20 years older (positive condition), or that performance on the task was not influenced by age (control condition). The results of a retention test showed worse learning for participants in the negative group relative to the other groups. The results provide the first evidence that stereotypes can impact motor learning in older adults.

1. Introduction

Social psychologists have recently challenged the assumption that the age-related cognitive and physical decline is exclusively explained by an inevitable biological process (e.g., Levy, 2009). This approach considers that age stereotypes (i.e., shared beliefs about older adults) may also account for this diminution. Although the stereotype according to which functional abilities naturally decline with age has a kernel of truth, it does not consider the important variability that exists between individuals: some experience normal or successful forms of aging while others face pathological aging. In other words, if age stereotypes may be true on average, they are inaccurate when applied to particular individuals, and may therefore potentially affect them.

In line with this idea, an important body of work has reported behavioral confirmation of age stereotypes. These effects may occur through different pathways. In the long term, stereotypes can be internalized into self-perceptions of aging: the more people adopt negative stereotypes during their life, the more they endorse negative views about their own aging when they enter old age. These self-perceptions affect in turn health-related outcomes (Levy, 2009; Sargent-Cox, Anstey, & Luszcz, 2012). For example, Sargent-Cox et al. (2012) observed that positive self-perceptions of aging were related to better physical functioning (balance and gait speed) over a 16-year period. But age stereotypes can also impact behaviors in the short term, especially in evaluative contexts, when situational cues trigger one's age category and its associated stereotypes. Once these stereotypes have been activated, people may fear confirming them, disrupting in turn their performance. The present study aimed at better understanding this phenomenon known as stereotype threat (Steele, 1997), in the motor domain.

Most studies have investigated age-based stereotype threat effects on cognitive and memory performance (e.g., Desrichard & Kopetz, 2005; Haslam et al., 2012; Hess, Auman, Colcombe, & Rahhal, 2003). For example, Hess et al. (2003) asked older adults to perform a recall task after having read scientific evidence that either reinforced or contradicted traditional views of the aging effects on memory. In line with stereotype threat theory, performance was more negatively affected for participants in the stereotype-consistent condition than for other participants. Overall, more than thirty experiments have reported age-based stereotype threat effects on cognitive performance. Meta-analyses have confirmed the existence of this phenomenon, indicating significant small-to-medium effect sizes of $d = .28$ (Lamont, Swift, & Abrams, 2015) and $d = .38$ (Horton, Baker, Pearce, & Deakin, 2008).

Despite clear evidence of age-based stereotype threat effects on cognitive performance, very little research has reported such effects on motor outcomes. To our knowledge, only three studies have been published in this domain (Horton, Baker, Pearce, & Deakin, 2010; Moriello, Cotter, Shook, Dodd-McCue, & Welleford, 2013; Swift, Lamont, & Abrams, 2012), and results are inconsistent. In Swift et al. (2012) study, older adults were assigned to a condition in which

* Corresponding author. Escola Superior de Educação Física, Universidade Federal de Pelotas, Rua Luís de Camões, 625, CEP 96055-630, Pelotas, RS, Brazil.
E-mail address: suzete@ufpel.edu.br (S. Chiviacowsky).

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comparison with younger people was induced, or to a no comparison condition. Results showed a stereotype threat effect, the social comparison condition causing significantly worse performance on handgrip strength and persistence than the control condition. However, the studies of Horton et al. (2010) and Moriello et al. (2013) did not report such effects on the performance of activities as walking speed, grip strength, standing balance, and a timed test of the ability to rise from a chair five times. In addition, no experiments have yet tested the effects of age-based stereotypes, if any, on the learning of motor skills. Therefore, more research is needed to determine whether older adults' motor behavior may be affected by stereotype threat effects. This is an important question because of the consequences that impaired motor abilities may have on health. For example, handgrip strength is associated with functional, psychological and social health in older adults (Gale, Martyn, Cooper, & Sayer, 2007), and balance performance is a predictor of risk of falling in this population (Maki, Holliday, & Topper, 1994; Shumway-Cook, Brauer, & Woollacott, 2000).

The low evidence of age-based stereotype threat effects in the motor domain is intriguing given that other stereotypes affect performance and learning in this area. Gender-based stereotype threat effects have notably been observed on a variety of motor tasks, including soccer (Chalabaev, Sarrazin, Stone, & Cury, 2008; Heidrich & Chiviacowsky, 2015; Hermann & Vollmeyer, 2016), basketball (Krendl, Gainsburg, & Ambady, 2012), golf putting (Beilock, Jellison, Rydell, McConnell, & Carr, 2006), tennis (Hively & El-Alayli, 2014), a rhythmic ball bouncing task (Huber, Seitchik, Brown, Sternad, & Harkins, 2015), and a simple strength task (Chalabaev et al., 2013). Weight-based stereotypes have also been shown to affect performance and learning of overweight people on a balance task (Cardozo & Chiviacowsky, 2015).

The current study investigated age-based stereotype threat on a balance task immediately after the stereotype induction, and after a delay of 24 h, based on a motor learning paradigm (e.g., Heidrich & Chiviacowsky, 2015). A balance task was chosen because it has already been proven to be affected by learning motivational factors, such as autonomy support (Chiviacowsky, Wulf, Lewthwaite, & Campos, 2012) and enhanced expectancies for performance (Wulf, Chiviacowsky, & Lewthwaite, 2012) in older adults, and stereotypes (e.g., Cardozo & Chiviacowsky, 2015; Chalabaev, Stone, Sarrazin, & Croizet, 2008) in other populations. More particularly, and similarly to past research (Haslam et al., 2012), participants were told that they would be compared to younger adults (negative stereotype condition), or to adults older than them (positive stereotype condition), before performing a novel balance task on a stabilometer. In addition, we added a control group in which no social comparison was induced. They then performed ten trials during the practice phase, and five trials during the delayed retention test, 24 h later. We hypothesized that participants receiving the stereotype induction would demonstrate disadvantages in motor performance and learning relative to control and positively stereotyped individuals.

2. Method

2.1. Participants

Thirty-nine healthy older adults (all females; age range: 60–76 years; average age: 66.1 years, SD: 4.78) were recruited from a female physical activity group as part of the university's extension program. Previous stereotype threat studies in sport psychology have usually been conducted with similar small samples (e.g., Heidrich & Chiviacowsky, 2015; Huber, Brown, & Sternad, 2016). All participants were volunteers and had no prior experience with the task. The study was approved by the university's institutional review board, and the participants gave their informed consent before being involved in the study.

2.2. Apparatus and task

The task required participants to balance on a stabilometer consisting of a wooden platform, 130 cm long x 140 cm wide, with a maximum deviation of 18° to the left or right side. A safety harness that was suspended from the ceiling above the stabilometer was used to prevent participants from falling if they lost their balance. The participant's task was to try to keep the platform as close to horizontal as possible during each 30-s trial, and a millisecond timer was used to measure time in balance (i.e., platform angle within ± 4°).

2.3. Procedure

Participants were assigned randomly to one of three groups, a negative stereotype group, a positive stereotype group, and a control group. They were told that the task was to keep the platform in the horizontal position for as long as possible during each 30-s trial, with 90 s of interval between trials. They were also told that, after each trial, they would be informed of their time in balance (± 4°). In addition, after a one-trial pre-test, participants in the negative stereotype task frame condition were informed that we were interested in examining differences in balance ability between different age groups, and that their performance would be compared with performance of young adults. Participants in the positive stereotype task frame condition were also informed that we were interested in examining differences in balance ability between different age groups, but that their performance would be compared with performance of participants 20 years older. In the control group, participants were informed that performance on this balance task was not influenced by age. The practice phase consisted of 10 trials with 90-s breaks. The delayed retention test, used to assess the relatively permanent, or learning, effects of our stereotype manipulation, was conducted one day later, without feedback regarding the time used to complete each trial, and consisted of 5 trials. Participants were instructed to step on the platform approximately 15 s before the beginning of each trial, and once a start signal was given, the participant began to move the platform and data collection began. After the end of the retention test on Day 2, participants were debriefed.

2.4. Data analysis

Time in balance on each trial was analyzed in a 3 (groups: negative stereotype, positive stereotype, control) x 10 (trials) analyses of variance (ANOVA) with repeated measures on the last factor. Retention data were analyzed in a 3 (groups: negative stereotype, positive stereotype, control) x 5 (trials) repeated-measures ANOVA. For significant results, partial eta-squared values were used to indicate effect sizes. Alpha level for significance was set at .05 for all analyses.

3. Results

3.1. Pre-test

There was no significant difference between groups on the pre-test, $F\ (2, 36) < 1$.

3.2. Practice

The groups increased their time in balance across practice trials (see Fig. 1, left). The main effect of trial was significant, $F\ (9, 324) = 13.92$, $p < .001$, $\eta p^2 = .28$. The main effect of group was not significant, $F\ (2, 36) = 2.06$, $p = .142$, indicating that performance during practice did not significantly differ across groups. The interaction of group and trial was also not significant, $F\ (18, 324) = 1.12$, $p = .333$.

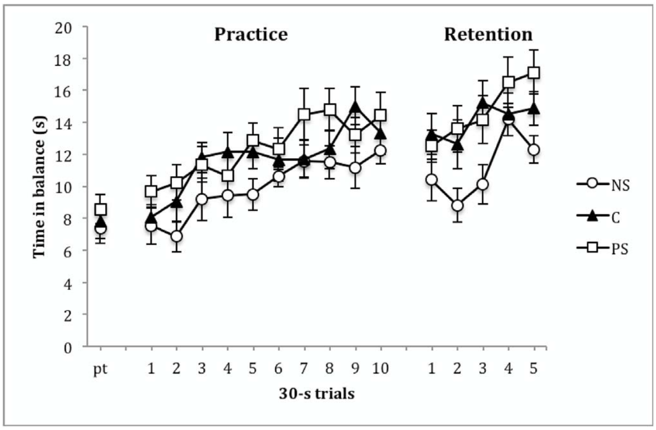

Fig. 1. Balance performance (time in balance) of the negative stereotype (NS), positive stereotype (PS) and control (C) groups during pre-test, practice and retention. Error bars indicate standard errors.

3.3. Retention

The main effect of group was significant, $F(2, 36) = 3.77$, $p = .032$, $\eta p^2 = .17$. Specifically, follow-up simple comparisons confirmed that the negative stereotype group had shorter time in balance than the control group, $p = .042$, and than the positive stereotype group, $p = .014$. The main effect of trial was also significant, $F(4, 144) = 8.53$, $p = .0001$, $\eta p^2 = .19$, indicating that the three groups increased their time in balance across trials (see Fig. 1, right). Finally, the interaction of group and trial was not significant, $F(8, 144) = 1.45$, $p = .181$.

4. Discussion

The present study was designed to further examine the effects of stereotype threat on motor learning. While previous studies have demonstrated that gender (Heidrich & Chiviacowsky, 2015) and weight (Cardozo & Chiviacowsky, 2015) stereotypes have the potential to affect motor learning, no research has yet tested the effects of age stereotypes on the acquisition of motor skills. Our results showed that older adults receiving a negative age stereotype showed reduced performance on a balance task in the retention test, relative to participants receiving a positive age stereotype and control participants. The findings are in accordance with previous studies testing age-based stereotype threat effects on cognitive (Desrichard & Kopetz, 2005; Haslam et al., 2012; Hess et al., 2003) as well as motor (Swift et al., 2012) performance, and provide the first evidence that stereotypes can affect the learning of motor skills in older adults.

It is noteworthy that the negative stereotype induction affected performance only during the retention test, when the more permanent (learning) effects are typically observed, but not during the practice phase. This suggests that stereotype threat impact may not always be immediate, but instead delayed. Although this result differs from previous findings with young adults, where immediate effects on performance were observed (Beilock et al., 2006; Cardozo & Chiviacowsky, 2015; Chalabaev et al, 2008a,b, 2013; Heidrich & Chiviacowsky, 2015; Hermann & Vollmeyer, 2016; Hively & El-Alayli, 2014; Huber et al., 2015; Krendl et al., 2012), this delayed stereotype threat effect may lead to a better understanding of the mixed results observed among older adults in the motor domain (Horton et al., 2010; Moriello et al., 2013; Swift et al., 2012). It suggests that it is not sufficient to assess stereotype threat effects immediately after the stereotype induction, as these effects may appear after a delay.

How can this delayed effect be explained? One possibility is that older adults respond differently than younger ones to stereotype threat situations. While anxiety regulation has been shown to mediate stereotype threat effects in young adults (Schmader, Johns, & Forbes, 2008), this is not the case in older ones, because they present better emotion regulation abilities. Instead, they are more likely to use a defensive self-regulatory strategy than younger adults, and more specifically a prevention focus (i.e., focus on avoiding a potential failure) (Popham & Hess, 2015). Relevant here, adopting a prevention focus under stereotype threat has been shown to be beneficial for performance in the short term, immediately after the stereotype induction, but not in the long term, because managing and suppressing stereotype-relevant thoughts and feelings may lead to cognitive exhaustion (Ståhl, Van Laar, & Ellemers, 2012). This could explain why older adults' immediate performance during the practice phase was not impaired under stereotype threat.

Another possible mechanism of the observed stereotype threat effects on learning relates to decreased performance expectancies (self-efficacy), which have been shown to emerge during practice under negative stereotypical conditions (Cardozo & Chiviacowsky, 2015; Heidrich & Chiviacowsky, 2015). Diminished confidence of the threaten participants may have decreased task-relevant attentional control during practice (Themanson & Rosen, 2015), whereby degrading learning. Given that performance expectancies are strongly connected to motor performance (Moritz, Feltz, Fahrbach, & Mack, 2000) and motor learning (Chiviacowsky, 2014; Chiviacowsky, Wulf & Lewthwaite, 2012; Stevens, Anderson, O'Dwyer, & Williams, 2012; Wulf & Lewthwaite, 2016; Wulf, Chiviacowsky, & Cardozo, 2014), this could explain the learning decrease observed in the negative stereotype condition.

In conclusion, the present results allow us to infer that age stereotypes can affect balance motor learning in older adults. Theoretically, they add to a growing literature highlighting the role of motivational influences on motor learning (for a review see Lewthwaite & Wulf, 2012). The findings have also important implications for intervention programs for older adults, considering that the age stereotype threat can directly interfere with the learning of motor skills in this population. For example, reducing age stereotypes may positively increase older adults perceived competence for balance tasks, possibly reducing risks of fall, in this way helping maintenance of health. Future studies should be conducted to investigate, with further depth, the underlying mechanisms of age stereotype threat on learning. It would also be fruitful to investigate if the results can be generalized to other kinds of tasks and practice contexts.

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