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Title :

“Not performing worse but feeling older !” The negative effect of the induction of a negative aging stereotype.

Running head

Stereotype threat and health

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1 **1. Introduction**

2 In western societies, older adults faced many negative stereotypes (e.g., frail, weak; Hummert,
3 1990) and are generally perceived as less competent than young adults (e.g., Cuddy, Fiske, & Glick,
4 2008). Contemporary research support social psychologists' idea that the physical decline observed
5 with the increase of age is not exclusively explained by an inevitable biological process. According to
6 them, aging stereotypes also have a significant impact on physical capacity of elderly (e.g., Levy,
7 2009). Two complementary frameworks have provided some evidence to this assumption: the
8 stereotype embodiment theory (Levy, 2009) and the stereotype threat theory (Steele, 1997). In the
9 present research, we only focused on the stereotype threat theory, which has been few explored when
10 considering aging stereotypes. Specifically, the aim of the study was to investigate the influence of the
11 induction of a negative aging stereotype on different objective and subjective health indicators in older
12 women.

13 The stereotype threat theory posits that when a negative stereotype toward one group is
14 induced, in a context where this stereotype can be applied, a performance decrease is expected (Steele,
15 1997). For over twenty years, many studies found and replicated this performance impairment on
16 various domains, on many populations, using different stereotypes (e.g., sex stereotypes, weight
17 stereotypes, race stereotypes; for a review, see Smith & Martiny, 2018). Concerning more precisely
18 older adults, most studies replicated this deleterious effect in the cognitive domain (for a review, see
19 Lamont, Swift, & Abrams, 2015). However, very few studies have tested the influence of aging
20 stereotypes on older adults' physical performance (Chiviawowsky, Cardozo, & Chalabaev, 2018;
21 Horton, Baker, Pearce, & Deakin, 2010; Marquet et al., 2018; Swift, Lamont, & Abrams, 2012) and
22 the classic performance decrease expected was not totally observed. Some researchers have postulated
23 that older adults, especially women, could react differently from other stereotyped populations in the
24 physical domain (e.g., Chiviawowsky et al., 2018). Therefore, more research is needed to apprehend
25 more deeply the effect of the induction of negative aging stereotypes on older adults' physical
26 performance.

27 Moreover, previous research has mostly focused on the effect of stereotype threat on health-
28 related performance indicators such as walking speed (Marquet et al., 2018), balance (Chiviawowsky et

29 al., 2018), or strength (Swift et al., 2012). Less is known however about the impact of stereotype threat
30 on the subjective experience of aging. Consequently, we examined in the current study the effect of
31 the induction of a negative aging stereotype on both objective and subjective health indicators.
32 Considering the objective parameter, we decided to investigate endurance capacity. Exploring this
33 health indicator appears important as endurance is considered as a main predictor of the frailty
34 syndrome (i.e., biological syndrome associated with age characterized by a decrease in the biological
35 functional reserve due to modifications of several physiological systems; Fried et al., 2001).
36 Moreover, a better endurance is associated to a better functional health with the increase of age (for a
37 review, see Cadore, Pinto, Bottaro, & Izquierdo, 2014). As endurance tasks induce most of the time a
38 neuromuscular fatigue, characterized by a decrease in maximal strength between before and after the
39 task, fatigue was also assessed in the present research. This measure allows to observe if, in addition
40 to influence endurance performance, the negative stereotype would impact the level of fatigue induced
41 by the task. In other words, would one group be more fatigued at the end of the protocol than the
42 other? Previous studies conducted on another stereotyped population (i.e., women) support this
43 assumption by showing that negative stereotypes can influence participants' fatigue (e.g., Deshayes,
44 Zory, Seitchik, Chalabaev, & Clément-Guillotin, 2019).

45 For the subjective health indicator, we focused on the effect of aging stereotypes on subjective
46 age (i.e., how young or old individuals experience themselves to be). In the gerontological literature,
47 subjective age is gaining popularity as it has been shown to be linked with some health-related
48 outcomes (e.g., Keyes & Westerhof, 2012; Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith,
49 2009; Stephan, Sutin, & Terracciano, 2015, 2016). For example, with the increase of age, feeling
50 younger than its chronological age is related to higher well-being and lower depressive symptoms
51 (Keyes & Westerhof, 2012), whereas feeling older is associated with an increase of risk of
52 hospitalization (Stephan et al., 2016) or even an increase in mortality risk (Kotter-Grühn et al., 2009).
53 Subjective age can be influenced by some psychological or psychosocial factors (e.g., Stephan,
54 Chalabaev, Kotter-Grühn, & Jaconelli, 2013). As in daily life many stimuli may implicitly induce
55 negative stereotypes, such as the vision of a wheelchair or a cane (Moriello, Cotter, Shook, Dodd-
56 McCue, & Welleford, 2013), it appeared necessary to examine if aging stereotypes may influence

57 subjective age. Very few studies have attempted to answer this question, especially in the physical
58 domain (see Marquet et al., 2018). Therefore, we explored in the present research the influence of the
59 induction of a negative aging stereotype on older women's subjective age.

60 Investigating the effects of aging stereotypes on both objective and subjective health-related
61 outcomes is also relevant as the theoretical aspects of the literature would suggest ambivalent
62 hypotheses. While an impairment is expected concerning the subjective age, based on the result of the
63 only study evaluating the effect of aging stereotypes on subjective age showing that older adults feel
64 older after stereotype induction (Marquet et al., 2018), an increase can be expected for the endurance
65 performance. Contrary to what is expected by the stereotype threat theory (Steele, 1997), the mere
66 effort account (Jamieson & Harkins, 2007) proposes that the effects of stereotypes on performance
67 depend on the quality of the prepotent response (i.e., the most likely to be produced): if this response
68 is correct, performance is improved but if it is incorrect, performance is debilitated. In the present
69 research, we used an endurance task consisting in maintaining an isometric contraction (i.e., a
70 contraction of a muscle without changing the length of the muscle, no coordination) as long as
71 possible. As endurance tasks are mostly non-technical and composed of only one component of task
72 execution (e.g., isometric tasks), we may suggest that only one response could be made. If only one
73 correct response can be realized, a performance increase could be expected in the present research.
74 Three recent studies, conducted in another stereotyped population (i.e., women) supported this
75 assumption (Deshayes, Clément-Guillotin, & Zory, 2019; Deshayes, Zory et al., 2019; Deshayes,
76 Zory, Seitchik, Chalabaev, & Clément-Guillotin, 2020). These studies found, during different
77 isometric endurance tasks, a performance increase after the induction of a negative stereotype, as
78 compared to participants in a nullified-stereotype condition.

79 Thus, the aim of the present study was to investigate the effects of the induction of a negative
80 aging stereotype on both subjective (i.e., subjective age) and objective (i.e., endurance) health-
81 indicators in older women. We predicted that older women would feel older after the induction of the
82 negative stereotype based on Marquet et al.'s (2018) first results but would increase their performance,
83 based on the mere effort predictions.

84

85 **2. Method**

86 **2.1. Participants and design.**

87 Thirty-four older women ranged in age from 66 to 85 ($M_{age} = 73.8$; $SD_{age} = 4.86$) were recruited and
88 provided informed consent. The exclusion criteria were as follows: being less than 60 years old,
89 having any bone, muscle or tendon trauma of the lower limbs (e.g., osteoarthritis). A sensitivity power
90 analysis, assuming an α of .05 and power of .70, indicated that our sample size allows us to detect
91 moderate-to-large effects of $f = .38$, which is in line with the effect sizes obtained in previous studies
92 evaluating the effect of aging stereotypes in the physical domain (Chiviawosky et al., 2018; Swift et
93 al., 2012). Participants were randomly assigned to a negative stereotype or a nullified-stereotype
94 condition for a single session (using a block randomization). Approval of the study protocol was
95 obtained (n° 2015-A01188-41).

96 **Procedure.**

97 Upon arriving to the laboratory, participants were greeted by a male experimenter in a quiet
98 room. After giving consent, participants performed a quick warm-up consisted of 8 to 10 submaximal
99 contractions of the knee. Next, the protocol was initiated. They were asked to maintain a strength
100 corresponding to 30% of their maximal strength as long as possible (T1: baseline measurement). The
101 protocol was stopped when participants were not able to maintain the set level for 3 consecutive
102 seconds or when they stopped themselves the task due to exhaustion. Before and after the endurance
103 protocol, participants performed two maximal voluntary contractions (MVC), to define the amount of
104 fatigue induced by the task. After a recovery time of twenty minutes, participants performed a second
105 time the protocol consisting of maintaining 30% of their maximal strength as long as possible (T2).
106 They were randomly assigned to one of the two following conditions: a negative stereotype condition
107 or a nullified-stereotype condition. These two conditions are mostly used in the stereotype threat
108 literature to highlight the impact of negative stereotypes on physical performance (e.g., Chalabaev et
109 al., 2013; Deshayes, Clément-Guillotin et al., 2019). All participants were informed that we were
110 interested in examining performances of younger and older adults. For individuals in the negative
111 stereotype condition, they were told: “it is widely assumed that the decrease in physical abilities is
112 depending on age. Consequently, older adults have been shown to underperform on this test as

113 compared to younger adults”. For participants in the nullified-stereotype condition, they were said:
114 “the decrease in physical abilities is not depending on age. Consequently, older and younger adults
115 have been shown to perform the same on this task”. Before and after this second endurance protocol,
116 participants also performed two MVC. Immediately after the protocol, they responded to a
117 questionnaire comprising measure of subjective age (participants responded to this same questionnaire
118 one week prior the experimental session as a baseline measurement).

119 **2.2. Materials and measures.**

120 *2.3.1. Performance.* Performance was determined by the exhaustion time corresponding to the time
121 during which participants maintained the required strength task. This protocol was performed on an
122 isokinetic dynamometer (Biodex, Biodex Medical Systems, Inc., Shirley, NY, USA) with a 90° hip
123 angle and a 90° knee angle (with 0° corresponding to the full extension of the knee).

124 *2.3.2. Fatigue.* Fatigue was characterized by the difference between pre/post MVC (Δ MVC). The
125 difference of Δ MVC between T1 and T2 indicated the amount of fatigue induced by the task.

126 *2.3.3. Subjective age.* Based on previous research, felt age was assessed twice: at baseline, participants
127 were asked to indicate the age they feel most of the time, whereas they were asked to indicate the age
128 they feel at this moment after the stereotype manipulation (e.g., Marquet, Missotten, Dardenne, &
129 Adam, 2019; Stephan et al., 2013). The subjective age was obtained by subtracting chronological age
130 (i.e., assessed at the end of the session) to felt age. Positive values indicate the tendency to feel
131 younger and conversely.

132 **2.4. Statistics**

133 *To define the adequate statistical analyses to perform, the normality of the residuals for the*
134 *three main dependent variables was firstly checked visually with QQ-plots (see Figures 2, 3 and 4 in*
135 *the supplementary materials file). Secondly, we statistically checked for the normality of the residuals,*
136 *using the skewness index. Normality was not assumed if this index was superior to 1.5 (or inferior to -*
137 *1.5). For exhaustion time, the skewness index was 1.11, for fatigue it was -0.98, and for subjective age*
138 *it was 0.44 (see Table 2 in the supplementary materials file). Consequently, normality of the residuals*
139 *for the three main variables was obtained. Based on these analyses, the effects of the induction of a*

140 negative stereotype on performance (i.e., exhaustion time) and fatigue were evaluating using 2
141 (Condition: negative stereotype condition vs. nullified-stereotype condition) x 2 (Time of
142 measurement: T1 vs. T2) analyses of variance (i.e., ANOVAs) with repeated measures, with
143 Condition as a between-subject factor and Time of measurement as a within-subject factor. Next, an
144 analysis of covariance (ANCOVA) on subjective age at T2 between the two conditions was computed,
145 with controlling for baseline measurement (i.e., T1). Means and standard deviations for the study
146 variables are presented in Table 1.

147 **3. Results**

148 **3.1. Performance.**

149 Concerning exhaustion time, results showed only a Time of measurement effect ($F(1, 31) =$
150 $7.1, p = .01, \eta^2 = .19$) revealing that exhaustion time was longer at T1 ($M = 143.30; SD = 64.29$) than
151 at T2 ($M = 127.83; SD = 63.80$). There was no Condition main effect ($F(1, 31) = 1.0, p = .32, \eta^2 =$
152 $.03$), as well as no Condition x Time of measurement interaction effect ($F(1, 31) = 2.6, p = .12, \eta^2 =$
153 $.08$).

154 **3.2. Fatigue**

155 For fatigue, analyses revealed no significant Condition main effect ($F(1, 31) = 1.01, p = .32,$
156 $\eta^2 = .03$), Time of measurement effect ($F(1, 31) < 0.1, p = .98, \eta^2 < .01$), as well as no Condition x
157 Time of measurement interaction effect ($F(1, 31) = 0.02, p = .88, \eta^2 < .01$).

158 **3.3. Subjective age**

159 Results showed a condition main effect ($F(1, 31) = 4.9, p = .03, \eta^2 = .14$), revealing that the
160 difference between chronological age and felt age was shorter for participants assigned to the negative
161 stereotype condition ($M = 4.12; SD = 4.72$) than for participants in the nullified-stereotype condition
162 ($M = 9.13; SD = 8.85$). In other words, older women in the negative stereotype condition felt older
163 than older women in the nullified-stereotype condition (see Figure 1). This large effect is in line with
164 the effect size detectable, given the sample size.

165 **4. Discussion**

166 The aim of this study was to examine in older women the effect of the induction of a negative
167 stereotype toward older adults on subjective and objective health-related indicators, precisely on
168 subjective age and endurance performance. Contrary to expectations, no significant difference
169 concerning the endurance performance was observed between the two experimental groups.
170 Nevertheless, the negative stereotype negatively impacted subjective age.

171 In the physical domain, previous studies focused on the effect of aging stereotypes on health-
172 related performance indicators such as walking speed (Marquet et al., 2018), balance (Chiviawowsky et
173 al., 2018), or maximal strength (e.g., Swift et al., 2012). In the present research, we focused on
174 endurance capacity, less investigated in the literature, while it is a main predictor of older adult's
175 health (e.g., Fried et al., 2001). The absence of results is in line with three of the four studies
176 investigating aging stereotypes on older adults' performance, showing that older adults' performance
177 was not modified immediately after the induction of the negative stereotype (Chiviawowsky et al.,
178 2018; Horton et al., 2010; Marquet et al., 2018). However, this non-effect of the induction of the
179 negative aging stereotype may be quite surprising. As the endurance task was non-technical (i.e.,
180 maintaining an isometric contraction), only one response can be realized (i.e., contracting the
181 quadriceps). Usually, when the response is immediately correct, a performance increase is observed
182 for threatened participants (see the mere effort account, Jamieson & Harkins, 2007; see also Deshayes,
183 Zory et al., 2019; Deshayes et al., 2020; Huber, Brown, & Sternad, 2016). To our knowledge, no
184 studies investigated the applicability of the mere effort account in older adults. Through our results,
185 we may suggest that the mere effort account would not be applicable to the physical domain when
186 investigating older women. These results also confirm that older adults, especially older women,
187 would react differently from other stereotyped groups during physical tasks (for a review, see Smith &
188 Martiny, 2018). Indeed, three recent studies found that threatened female students performed better
189 than non-threatened female students during different tasks, closed to that one used in the present
190 research (Deshayes, Clément-Guillot et al., 2019; Deshayes, Zory et al., 2019; Deshayes et al.,
191 2020).

192 An explanation has been suggested to understand why no effect could be observed in the
193 physical domain when investigating aging stereotypes, especially in older women, with a delayed

194 effect of the negative stereotype outlined by Chiviawosky et al. (2018). Under threat, older adults
195 would adopt a prevention-focus approach (i.e., focus on avoiding failure; Popham & Hess, 2015).
196 Adopting this approach can annihilate the stereotype threat effect in a short term due to resources
197 involvement, but not in a long term due to cognitive exhaustion (Ståhl, Van Laar, & Ellemers, 2012).
198 Supporting this assumption, Chiviawosky et al. (2018) observed no effect on older women's physical
199 performance after the induction of a negative stereotype, but a negative effect the day after. It could be
200 interesting to assess physical performance the day after the stereotype manipulation to validate this
201 hypothesis, and potentially many days after the stereotype induction to explore how long the
202 stereotype may impact physical performance.

203 Even if the negative stereotype did not influence the health-related performance indicator, it
204 had a negative impact on subjective age. Specifically, older women assigned to the negative stereotype
205 condition felt older than older women in the nullified-stereotype condition. This result appears to be
206 consistent with the only study examining the effects of aging stereotypes on subjective age in the
207 physical domain (Marquet et al., 2018), confirming that subjective age can be influenced by the
208 induction of a negative stereotype in the physical domain. Therefore, the present research highlights
209 that investigating performance is not enough to have a complete vision of how negative stereotypes
210 operate. The use of other indicators such as self-reported and non-phenomenological measures are
211 encouraged to understand in more detail the impact of negative aging stereotypes in older women.

212 In daily life, many stimuli may implicitly induce negative stereotypes (e.g., vision of a
213 wheelchair or a cane; Moriello et al., 2013). Consequently, a permanent exposition to these
214 stereotypes may induce a permanent older subjective age, accompanied by all the detrimental effects
215 on health (e.g., increase of risk of hospitalization, increase in mortality risk; Stephan et al., 2015,
216 2016). It seems therefore necessary to develop some strategies to reduce this subjective age. In this
217 respect, giving a positive feedback regarding older adults' performance led to a decrease in subjective
218 age with an increase in immediate physical performance (Stephan et al., 2013). In addition to short
219 term effects, positive feedbacks have also been shown to improve motor performance in more long-
220 term period (e.g., Wulf, Chiviawosky, & Lewthwaite, 2012). It could consequently be essential to
221 examine if positive feedbacks could annihilate the effects of negative stereotypes in short and mostly

222 long-term. Finally, it could be interesting to provide evidence to older people that their performance
223 may be identical, as well as better than those of younger adults in some physical tasks. For example,
224 Bilodeau, Erb, Nichols, Joiner, and Weeks (2000) found that older adults were able to maintain a
225 muscular endurance task longer than younger participants. These strategies could reduce negative
226 stereotypes toward older people and consequently, their older subjective age.

227 Despite interesting results, the current study presents some limitations. Firstly, the sample size
228 allowed us to detect moderate-to-large effects. Despite the fact that this is consistent with the effects
229 size observed in previous studies investigating aging stereotypes in the physical domain
230 (Chiviacosky et al., 2018; Swift et al., 2012), it is mandatory to recruit more participants in future
231 studies in order to detect smaller effects, to ensure that the study is not underpowered and to have a
232 better view of how negative stereotypes operate. Secondly, only older women participated in the
233 present research. In the physical domain, there is a salient sex stereotype suggesting that women have
234 less athletic ability as compared to men (Clément-Guillotin & Fontayne, 2011). The task we used
235 being physical, older women may have activated this sex stereotype, in addition to aging stereotypes.
236 It has been shown that this sex stereotype can drastically impact women's physical performance (for a
237 meta-analysis, see Gentile, Boca, & Giammusso, 2018). Thus, it could be plausible that older women
238 would be more impacted than older men after the induction of a negative stereotype during a physical
239 task. It is therefore important to explore the effects of negative aging stereotypes with a gender-
240 balanced sample to highlight the possible different effects of negative aging stereotypes on older men
241 and older women, which is currently undefined.

242 Thirdly, experimenter in the present research was a 25-year-old male. In the literature, it has
243 been shown that when the experimenter is part of the group that is non-targeted by the negative
244 stereotype, the effect could be accentuated (Marx & Goff, 2005; Stone & McWhinnie, 2008). To
245 reduce this possible influence, certain precautions were taken: the experimenter learned the stereotype
246 manipulation by heart, and the different conditions were induced using the same tone in a quiet room.
247 However, it could be wise to conduct again this research with a female experimenter, as in Marquet et
248 al.'s (2018) study or with an older experimenter to observe if the effect would be different.

249 Fourthly, participants filled out subjective age measurement one week before the experimental

250 session to avoid to answer the same measure, composed of only one item, in the same session (i.e., 20
251 minutes between the two experimental times), and easily remembered their answer. Consequently, we
252 adapted the item at baseline by asking them the age they feel most of the time whereas they were
253 requested to indicate the age they feel at this moment after the stereotype manipulation. This
254 adaptation at baseline, already used in previous research (Marquet et al., 2019; Stephan et al., 2013),
255 was made to have a relatively stable measure over-time (e.g., Kleinspehm-Ammerlahn, Kotter-Grünn,
256 & Smith, 2008). Indeed, the item “the age they feel at this moment” is more dynamic and often used to
257 explore daily variations or the effect of multiple contextual variables on subjective age (e.g., Marquet
258 et al., 2019; Stephan et al., 2013). However, it could be interesting to explore in future research the
259 influence of aging stereotypes on subjective age within the same session and with the same both items,
260 and taking precautions like increasing the amount of time between the two measurements.

261 In conclusion, the present research showed that inducing a negative aging stereotype did not
262 impact older women’s endurance. This finding is contrary to the stereotype threat theory but also to
263 the mere effort account predictions and may suggest that, in the physical domain, the effects of aging
264 stereotypes on older women are different, as compared to other stereotyped groups such as women.
265 However, even if no performance modification was observed, older women in the negative stereotype
266 condition felt older after this stereotype was induced. As an older subjective age has been shown to
267 influence health outcomes, it seems necessary to develop some strategies to counter this stereotype
268 threat effect on subjective age.

269

270

References

- 271 1. Bilodeau, M., Erb, M. D., Nichols, J. M., Joiner K. L., & Weeks, J. B. (2001). Fatigue of elbow
272 flexor muscles in younger and older adults. *Muscle & Nerve*, 24, 98-106. doi: 10.1002/1097-
273 4598(200101)24:1<98::AID-MUS11>3.0.CO;2-D
- 274 2. Cadore, E. L., Pinto, R. S., Bottaro, M., & Izquierdo, M. (2014). Strength and endurance training
275 prescription in healthy and frail elderly. *Aging and Disease*, 5, 183-195. doi:
276 10.14336/AD.2014.0500183

- 277 3. Chalabaev, A., Brisswalter, J., Radel, R., Coombes, S. A., Easthope, C., & Clément-Guillotin, C.
278 (2013). Can stereotype threat affect motor performance in the absence of explicit monitoring
279 processes? Evidence using a strength task. *Journal of Sport & Exercise Psychology*, *35*, 211-215.
280 doi: 10.1123/jsep.35.2.211
- 281 4. Chiviacowsky, S., Cardozo, P. L., & Chalabaev, A. (2018). Age stereotypes' effect on motor
282 learning in older adults: the impact may not be immediate, but instead delayed. *Psychology of Sport
283 & Exercise*, *36*, 209-212. doi: 10.1016/j.psychsport.2018.02.012
- 284 5. Clément-Guillotin, C., & Fontayne, P. (2011). Situational malleability of gender schema: The case
285 of the competitive sport context. *Sex Roles*, *64*, 426-439.
- 286 6. Cuddy, A. J. C., Fiske, S. T., & Glick, P. (2008). Warmth and competence as universal dimensions
287 of social perception: The stereotype content model and the BIAS map. In M. P. Zanna (Vol. Ed.),
288 *Advances in experimental social psychology: Vol. 40*, (pp. 61– 149). New York, NY: Academic
289 Press.
- 290 7. Deshayes, M., Clément-Guillotin, C., & Zory, R. (2019). “Men are better than women!”: the
291 positive effect of a negative stereotype toward women. *Journal of Sport and Exercise Psychology*,
292 *41*, 242-250. doi: 10.1123/jsep.2018-0213
- 293 8. Deshayes, M., Zory, R., Seitchik, A. E., Chalabaev, A., & Clément-Guillotin, C. (2019). Can
294 stereotype threat increase women's performance? The case of a fatiguing task. *Sport, Exercise, and
295 Performance Psychology*, *91*, 354-360. doi: 10.1037/spy0000190
- 296 9. Deshayes, M., Zory, R., Seitchik, A. E., Chalabaev, A., & Clément-Guillotin, C. (2020). Can the
297 stereotype threat and lift phenomenon be applicable to a muscular endurance task? *Research
298 Quarterly for Exercise and Sport*, *91*, 354-360. doi : 10.1080/02701367.2019.1668518
- 299 10. Fried, L. P., Tangen, C. M., Walston, J., Newman, A. B., Hirsch, C., Gottdiener, J., ... McBurnie,
300 M., -A. (2001). Frailty in older adults: Evidence for a phenotype. *The Journals of Gerontology:
301 Series A*, *56*, 146-157. doi : 10.1093/gerona/56.3.M146
- 302 11. Gentile, A., Boca, S., & Giammusso, I. (2018). ‘You play like a woman!’ Effects of gender
303 stereotype threat on women's performance in physical and sport activities: A meta-analysis.
304 *Psychology of Sport and Exercise*, *39*, 95–103. doi : 10.1016/j.psychsport.2018.07.013

- 305 12. Horton, S., Baker, J., Pearce, W., & Deakin, J. M. (2010). Immunity to popular stereotypes of
306 ageing? Seniors and stereotype threat. *Educational Gerontology*, *36*, 353-371. doi:
307 10.1080/03601270903323976
- 308 13. Huber, M. E., Brown, A. J., & Sternad, D. (2016). Girls can play ball: Stereotype threat reduces
309 variability in a motor skill. *Acta Psychologica*, *169*, 79-87. doi: 10.1016/j.actpsy.2016.05.010
- 310 14. Hummert, M. L. (1990). Multiple stereotypes of elderly and young adults: A comparison of
311 structure and evaluations. *Psychology and Aging*, *5*, 182-193. doi: 10.1037/0882-7974.5.2.182
- 312 15. Jamieson, J. P., & Harkins, S. G. (2007). Mere effort and stereotype threat performance effects.
313 *Journal of Personality and Social Psychology*, *93*, 544-564. doi: 10.1037/0022-3514.93.4.544
- 314 16. Keyes, C. L. M., & Westerhof, G. J. (2012) Chronological and subjective age differences in
315 flourishing mental health and major depressive episode. *Aging and Mental Health*, *16*, 67-74. doi:
316 10.1080/13607863.2011.596811
- 317 17. Kleinspehn-Ammerlahn, A., Kotter-Grühn, D., & Smith, J. (2008). Self-perceptions of aging: Do
318 subjective age and satisfaction with aging change during old age? *The Journals of Gerontology*,
319 *Series B: Psychological Sciences and Social Sciences*, *63*, 377-385. doi :
320 10.1093/geronb/63.6.P377
- 321 18. Kotter-Grühn, D., Kleinspehn-Ammerlahn, A., Gerstorf, D., & Smith, J. (2009). Self-perceptions
322 of aging predict mortality and change with approaching death: 16-year longitudinal results from the
323 Berlin Aging Study. *Psychology and Aging*, *24*, 654-667. doi: 10.1037/a0016510
- 324 19. Lamont, R. A., Swift, H. J., & Abrams, D. (2015). A review and meta-analysis of age-based
325 stereotype threat: Negative stereotypes, not facts, do the damage. *Psychology and Aging*, *30*, 180-
326 193. doi: 10.1037/a0038586
- 327 20. Levy, B. R. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current Directions*
328 *in Psychological Science*, *18*, 332-336. doi: 10.1111/j.1467-8721.2009.01662.x
- 329 21. Marquet, M., Boutaayamou, M., Schwartz, C., Locquet, M., Bruyère, O., Croisier, J.-L., & Adam,
330 S. (2018). Does negative information about aging influence older adults' physical performance and
331 subjective age? *Archives of Gerontology and Geriatrics*, *78*, 181-189. doi:
332 10.1016/j.archger.2018.06.013

- 333 22. Marquet, M., Missotten, P., Dardenne, B., Adam, S. (2019). Interactions between stereotype threat,
334 subjective aging, and memory in older adults. *Neuropsychology, Development, and Cognition*, 26,
335 121-143. doi: 10.1080/13825585.2017.1413166
- 336 23. Marx, D. M., & Goff, P. A. (2005). Clearing the air : The effect of experimenter race on target's
337 test performance and subjective experience. *British Journal of Social Psychology*, 44, 645-657.
338 doi : 10.1348/014466604X17948
- 339 24. Moriello, G., Cotter, J. J., Shook, N., Dodd-McCue, D., & Welleford, E. A. (2013). The effect of
340 implicit stereotypes on the physical performance of older adults. *Educational Gerontology*, 39,
341 599-612. doi: 10.1080/03601277.2012.704241
- 342 25. Popham, L. E., & Hess, T. M. (2015). Age differences in the underlying mechanisms of stereotype
343 threat effects. *Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 70,
344 225–234. doi: 10.1093/geronb/gbt093
- 345 26. Smith, D. M., & Martiny, S. E. (2018). Stereotype threat in sport: Recommendations for Applied
346 Practice and Research. *The Sport Psychologist*, 32, 311-320. doi: 10.1123/tsp.2017-0134
- 347 27. Ståhl, T., Van Laar, C., & Ellemers, N. (2012). The role of prevention focus under stereotype
348 threat: Initial cognitive mobilization is followed by depletion. *Journal of Personality and Social
349 Psychology*, 102, 1239-1251. doi: 10.1037/a0027678
- 350 28. Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and
351 performance. *The American Psychologist*, 52, 613–629. doi: 10.1037/0003-066X.52.6.613
- 352 29. Stephan, Y., Chalabaev, A., Kotter-Grühn, D., & Jaconelli, A. (2013). “Feeling younger, being
353 stronger”: An experimental study of subjective age and physical functioning among older adults.
354 *Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 68, 1-7. doi:
355 10.1093/geronb/gbs037
- 356 30. Stephan, Y., Sutin, A. R., & Terracciano, A. (2016). Feeling older and risk of hospitalization:
357 evidence from three longitudinal cohorts. *Health Psychology*, 35, 634–637. doi:
358 10.1037/hea0000335
- 359 31. Stephan, Y., Sutin, A. R., & Terracciano, A. (2015). “Feeling younger, walking faster”:
360 Subjective age and walking speed in older adults. *Age*, 37: 86. doi: 10.1007/s11357-015-9830-9

361 32. Stone, J., & McWhinnie, C. (2008). Evidence that blatant versus subtle stereotype threat cues
 362 impact performance through dual processes. *Journal of Experimental Social Psychology*, *44*, 445-
 363 452. doi: 10.1016/j.jesp.2007.02.006

364 33. Swift, H. J., Lamont, R. A., & Abrams, D. (2012). Are they half as strong as they used to be? An
 365 experiment testing whether age-related social comparisons impair older people's hand grip strength
 366 and persistence. *BMJ Open*, *2*, e001064. doi: 10.1136/bmjopen-2012-001064

367 34. Wulf, G., Chiviacowsky, S., & Lewthwaite, R. (2012). Normative feedback effects on learning a
 368 timing task. *Research Quarterly for Exercise and Sport*, *81*, 425-431.
 369 doi:10.1080/02701367.2010.10599703

370 **Table**

371 Table 1. Means (\pm standard deviations) for the dependent variables

Variables	Conditions			
	Negative stereotype condition		Nullified-stereotype condition	
	T1	T2	T1	T2
Exhaustion time (s)	128.25 \pm 40.30	122.05 \pm 55.12#	159.30 \pm 81.0	133.96 \pm 73.24#
Fatigue (%)	18.93 \pm 19.96	18.18 \pm 8.47	21.50 \pm 8.20	22.03 \pm 21.41
Subjective age (Chronological - Felt age)	7.11 \pm 5.73	4.12 \pm 4.72*	8.56 \pm 7.62	9.13 \pm 8.85

372
 373 * $p < .05$ for test of difference for subjective age between the negative stereotype condition and the
 374 nullified-stereotype condition.

375 # $p < .05$ for test of difference for exhaustion time between T1 and T2

376
 377
 378
 379

Figure caption

380 Figure 1. Difference of subjective age between the negative stereotype condition and the nullified-
 381 stereotype condition. Data are expressed in year

Subjective age
(chronological age – Felt age)

20
18
16
14
12
10
8
6
4
2

Negative stereotype
condition

Nullified-stereotype
condition

*

