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# Highlighting and Reducing the Impact of Negative Aging Stereotypes During Older Adults' Cognitive Testing

Marie Mazerolle, Isabelle Régner, François Rigalleau, Pascal Huguet

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1 **TITLE:**

2 **Highlighting and Reducing the Impact of Negative Aging Stereotypes During Older Adults'**  
3 **Cognitive Testing**

4  
5 **AUTHORS AND AFFILIATIONS:**

6 Marie Mazerolle<sup>1</sup>, Isabelle Régner<sup>2</sup>, François Rigalleau<sup>3</sup>, Pascal Huguet<sup>4</sup>

7  
8 <sup>1</sup>Department and Laboratory of Psychology, MSHE, University of Burgundy Franche-Comté,  
9 Besançon, France

10 <sup>2</sup>Aix-Marseille University, CNRS, LPC, Marseille, France

11 <sup>3</sup>Department of Psychology, University of Poitiers, CNRS, Poitiers, France

12 <sup>4</sup>University of Clermont Auvergne, CNRS, LAPSCO, Clermont-Ferrand, France

13  
14 Corresponding author:

15 Isabelle Régner (isabelle.regner@univ-amu.fr)

16  
17 Email addresses of co-authors:

18 Marie Mazerolle (marie.mazerolle@univ-fcomte.fr)

19 François Rigalleau (francois.rigalleau@univ-poitiers.fr)

20 Pascal Huguet (pascal.huguet@uca.fr)

21  
22 **KEYWORDS:**

23 behavior, stereotype threat, aging, memory, neuropsychological testing, dementia, social  
24 cognition

25  
26 **SUMMARY:**

27 Here, we present a protocol designed to show how negative aging stereotypes can impair  
28 memory performance of older adults during cognitive testing and how to reduce this  
29 deleterious effect. This method can help older people to perform at an optimal level during  
30 testing in both lab studies and clinical settings.

31  
32 **ABSTRACT:**

33 As life expectancy increases, aging has become a major health challenge, resulting in a huge  
34 effort to better discriminate between normal and pathological cognitive decline. It is thus  
35 essential that cognitive tests and their administration are as fair as possible. However, an  
36 important source of bias during cognitive testing comes from negative aging stereotypes that  
37 can impair the memory performance of older adults and inflate age differences on cognitive  
38 tasks. The fear of confirming negative aging stereotypes creates an extra pressure among older  
39 adults which interferes with their intellectual functioning and leads them to perform below  
40 their true abilities. Here, we present a protocol that highlights simple but efficient interventions  
41 to alleviate this age-based stereotype threat effect. The first study showed that simply  
42 informing older participants about the presence of younger participants (threat condition) led  
43 older adults to underperform on a standardized memory test compared with younger  
44 participants, and that this performance difference was eliminated when the test was presented

45 as age-fair (reduced-threat condition). The second study replicated these findings on short  
46 cognitive tests used to screen for predementia in clinical settings and showed that teaching  
47 older adults about stereotype threat inoculated them against its effects. These results provide  
48 useful recommendations about how to improve older adults' memory assessment both in lab  
49 studies and in clinical settings.

50

## 51 **INTRODUCTION:**

52 A growing field of laboratory research in social cognition conducted in the healthy population  
53 has demonstrated that members of groups whose abilities are negatively stereotyped typically  
54 underperform when the negative stereotypes are made relevant to the performance at hand, a  
55 phenomenon called stereotype threat (ST). In addition to the normal anxiety associated with  
56 taking cognitive tests, the fear of confirming negative stereotypes creates extra pressure that  
57 may interfere with cognitive functioning and lead to perform below one's abilities<sup>1,2</sup>. Many  
58 findings demonstrate that negative aging stereotypes (e.g., the culturally shared beliefs that  
59 aging inescapably causes severe cognitive decline and diseases such as Alzheimer's disease  
60 [AD]) contribute, at least in part, to the differences classically observed in the healthy  
61 population between younger and older adults in memory tasks<sup>3-5</sup>. Without denying the impact  
62 of aging on cognitive functioning, research clearly demonstrates that age-related stereotypes  
63 are powerful enough to artificially decrease older adults' performance on memory tests.

64

65 Detrimental age-based ST effects are readily observable and fairly easy to produce with  
66 instructional manipulations<sup>6</sup>, such as simply emphasizing the memory component of the test<sup>7-9</sup>,  
67 highlighting differences in performance between young and older adults<sup>10,11</sup>, or implicitly  
68 activating negative aging stereotypes<sup>12,13</sup>. Given the results obtained in laboratory studies, it is  
69 very likely that negative aging stereotypes also permeate, at least implicitly, the standard  
70 neuropsychological testing settings during the screening for pre-dementia. Indeed, because of  
71 the lengthening of life expectancy, more and more people are concerned with the possibility of  
72 getting AD or other forms of dementia. Importantly, false-positive errors are quite frequent in  
73 the diagnosis of prodromal state of AD<sup>14</sup>, which could be explained, at least in part, by  
74 transitory impaired performances in older adults due to the age-based ST phenomenon<sup>15</sup>.

75

76 For these reasons, it is important to provide efficient methods to deactivate the influence of  
77 negative aging stereotypes and thereby help older people to perform at their maximum during  
78 memory assessment in general and during neuropsychological testing specifically. Some  
79 methods, such as de-emphasizing the memory component of the test (e.g., characterizing the  
80 task as a vocabulary test), have already proved efficient to eliminate ST effects in older adults  
81 on explicit memory tests taken in the context of lab studies<sup>7,9,16</sup>. However, such instructions are  
82 not compatible with the ecological clinical context of the neuropsychological testing, in which  
83 older adults come to have their memory abilities assessed. The goal of our articles is to present  
84 two methods likely to alleviate age-based ST effects among older adults, either in the lab or in  
85 the clinical contexts. The first one, especially suited for the lab context, consists in telling older  
86 adults that performance on the ongoing memory tests usually does not differ between younger  
87 and older adults (i.e., age-fair instructions). The second method, which can be implemented in  
88 both lab and clinical contexts, consists in explaining to older adults (or patients) the negative

89 impact of aging stereotypes, which may help them reappraise the situation, reduce evaluative  
90 pressure, and feel less threatened during the testing.

91

92 **PROTOCOL:**

93 The present research was carried out in accordance with French standards, each participant  
94 provided informed consent and procedures were consistent with the guidelines of the  
95 American Psychological Association.

96

97 **1. Highlighting and reducing age-based stereotype threat on a lab memory test**

98

99 1.1. Participants screening

100

101 1.1.1. Recruit participants in the desired age range (e.g., younger participants: 18–35 years old;  
102 older participants: 60–85 years old) for a study on general mental abilities and/or the impact of  
103 emotions on various cognitive tasks and questionnaires.

104

105 1.1.2. Ensure that participants are native speakers, have normal or corrected-to-normal vision  
106 and hearing, are free of neurological and psychiatric disorders, and have no current depression  
107 (Geriatric Depression Scale<sup>17</sup>) nor abnormal anxiety (State-Trait Anxiety Inventory<sup>18</sup>).

108

109 1.1.3. Screen older participants for cognitive impairment using the Mini-Mental State  
110 Examination (MMSE)<sup>19</sup>. Include older adults who meet or exceed a cutoff score corresponding  
111 to his/her age and educational level<sup>20</sup>, and who live at home.

112

113 1.2. Conditions and experimental design

114

115 1.2.1. Test each participant individually at home or in local community associations' premises  
116 by an experimenter trained at neuropsychological testing.

117

118 1.2.2. Run the study as a single session, but inform participants there are two separate studies.

119

120 1.2.3. Use the "first study" as a baseline measure of participants' working memory capacity. In  
121 the "first study", minimize evaluative pressure, informing participants they will perform a  
122 cognitive task currently under elaboration. Encourage participants to do their very best<sup>21</sup>.

123

124 1.2.4. Use the "second study" to evaluate the impact of stereotype threat on participants'  
125 working memory capacity. That is, inform participants that they are going to perform a fully  
126 validated and diagnostic test of memory capacity.

127

128 1.2.4.1. Randomly assign participants to one of two conditions (threat versus reduced-threat  
129 conditions).

130

131 NOTE: See **Figure 1** for a visual depiction of the procedure; full details on this research were  
132 published in Mazerolle et al.<sup>22</sup>.

133  
134 1.2.4.2. In the "threat condition", simply tell participant that both younger and older adults are  
135 participating in the study.

136  
137 1.2.4.3. In the "reduced threat condition", tell participants that both younger and older adults  
138 are participating in the study but add that younger and older adults usually obtain the same  
139 performances on the ongoing test.

140  
141 1.3. Memory tests and procedure

142  
143 1.3.1. Use a validated memory test that is typically used in cognitive lab studies. Because ST  
144 effects typically occur on difficult tasks, use a difficult test, such as the reading span test<sup>23</sup>.

145  
146 1.3.2. Use two alternative versions of the reading span test (one for the "first study" and the  
147 other one for the "second" study), with different sentences but match them in number of  
148 words and in length, frequency, and number of syllables of the last word.

149  
150 1.3.3. Use a reading span test that contains 42 sentences: 12 series of two to five sentences  
151 with 3 series per length.

152  
153 1.3.4. Present one sentence at a time and instruct participant to read it, at his/her own pace,  
154 while memorizing the last word of the sentence.

155  
156 1.3.5. Ask participant not to interrupt his reading and not to pause between two sentences.

157  
158 1.3.6. Have participant to recall the words immediately after he/she finished reading the last  
159 sentence of the block considered.

160  
161 1.3.7. Do not require participants' recall being serial but constrain them not to start by recalling  
162 the final word of the last sentence read. Do not limit the recall time and invite participants to  
163 find as many words as possible.

164  
165 1.3.8. Do not inform participants of their errors, and do not give them a second chance to  
166 answer.

167  
168 1.3.9. Compute the final score of each participant using the mean proportion of correctly  
169 recalled words across the 12 series.

170  
171 **2. Highlighting and reducing age-based stereotype threat on short cognitive tests used to**  
172 **screen for predementia in clinical settings**

173  
174 2.1. Participants screening

175

176 2.1.1. Recruit older participants aged 60 to 85 for a study on general mental abilities and/or the  
177 impact of emotions on various cognitive tasks and questionnaires.

178  
179 2.1.2. Ensure that participants live at home, have no history of significant trauma nor chronic  
180 illness, have normal or corrected-to-normal vision and hearing, have no current depression  
181 (Geriatric Depression Scale<sup>17</sup>) nor abnormal anxiety (State-Trait Anxiety Inventory<sup>18</sup>).

182  
183 2.2. Conditions and experimental design

184  
185 2.2.1. Test each participant individually at home or in local community associations' premises  
186 by an experimenter trained at neuropsychological testing.

187  
188 2.2.2. Have participants taking two short cognitive tests used to screen for predementia (or  
189 mild cognitive impairment [MCI]): the MMSE<sup>19</sup> and the Montreal Cognitive Assessment  
190 (MoCA<sup>24</sup>) in a counterbalanced order.

191  
192 2.2.3. Randomly assign participants to one of the two order (MMSE then MoCA or MoCA then  
193 MMSE).

194  
195 2.2.4. Before taking the first test, randomly assign participants to one of two threat conditions  
196 (threat versus reduced-threat conditions).

197  
198 2.2.5. In the "threat condition", inform participants that both younger and older adults are  
199 taking part in the study about memory capacity.

200  
201 2.2.6. In the "reduced threat condition", inform participants that both younger and older adults  
202 are taking part in the study about memory capacity but add that younger and older adults  
203 typically obtain the same performances on the ongoing tests.

204  
205 2.2.7. Before taking the second test, use an educational intervention to debrief all participants  
206 (regardless of the threat condition they were previously assigned) about age-based stereotype  
207 threat. Tell participants that "Numerous studies demonstrated that negative age-related  
208 beliefs, especially about memory capacity decline, trigger anxiety, which in turn prevents older  
209 adults from performing optimally. Actually, it is well-known that performance on memory tests  
210 may not accurately reflect people's true abilities, because performance can be affected by the  
211 testing context. In other words, people's negative reputation in an ability domain may impair  
212 their performance on tests that assess this stereotyped ability, for example when older adults  
213 complete a memory test. Therefore, if you feel anxious during the subsequent memory test,  
214 this does not mean that you are unable to complete the tests. It rather probably means that  
215 your feelings are affected by the general negative reputation of older adults regarding  
216 memory."

217  
218 NOTE: See **Figure 2** for a visual depiction of the educational intervention; full details on this  
219 research were published in Mazerolle et al.<sup>25</sup>.

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### 2.3. Short cognitive neuropsychological tests and procedure

2.3.1. Administrate the 8 subtests of the MMSE<sup>19</sup> (orientation, registration, attention and calculation, recall, language, copying) to evaluate memory, orientation to time and place, attention and executive functioning, language and visuospatial abilities. Follow Folstein, Folstein and McHugh's administration guidelines<sup>19</sup> and compute the final score adding the scores of every subtest. Obtain a final score rated on 30-point scale.

2.3.2. Administrate the 8 subtests of the MoCA<sup>24</sup> (visuospatial/executive, naming, memory, attention, language, abstraction, delayed recall, orientation) to evaluate memory, orientation to time and place, attention and executive functioning, language and visuospatial abilities. Follow administration guidelines available at [www.mocatest.org](http://www.mocatest.org) and compute the final score adding the scores of every subtest. Obtain a final score rated on 30-point scale.

#### **REPRESENTATIVE RESULTS:**

We addressed the hypothesis that stereotype threat impairs the working memory performance of older adults and that this effect can be reduced or eliminated by a simple instruction. The expected interaction between age group and threat instructions was significant,  $F(1, 214) = 4.85, p < 0.03, \eta_p^2 = 0.02$ , and is depicted in **Figure 3**. In the threat condition, older participants underperformed (mean [ $M$ ] = 0.73, standard error [ $SE$ ] = 0.01) relative to younger participants ( $M = 0.78, SE = 0.01$ ),  $F(1, 214) = 12.87, p < 0.001, \eta_p^2 = 0.06$ , whereas the two age groups performed equally well in the reduced-threat condition ( $F < 1$ ). Moreover, older participants in the reduced-threat condition obtained a better working memory score ( $M = 0.77, SE = 0.01$ ) relative to those in the threat condition ( $M = 0.73, SE = 0.01$ ),  $F(1, 214) = 9.42, p < 0.002, \eta_p^2 = 0.04$ . The performance of younger participants did not differ across the two conditions (threat condition:  $M = 0.78, SE = 0.01$ ; reduced-threat condition:  $M = 0.78, SE = 0.01$ ;  $F < 1$ ). More details about this research can be found in Mazerolle et al.<sup>22</sup>. These findings highlight the deleterious impact of very subtle cues in the environment (e.g., mentioning the presence of younger adults in a study about memory) on older adults' performance on a laboratory test. Because stereotype threat seems to be powerful enough to create significant differences between younger and older adults, we went further and tested its impact on brief cognitive tests classically used by primary care clinicians for the diagnosis of predementia.

We tested the impact of stereotype threat on older adults' performance on two brief cognitive tests used to screen for predementia states: the MoCA and the MMSE. As shown in **Figure 4** (left panel), during test 1 (before debriefing), participants' performance was higher in the reduced-threat condition ( $M = 28.50; SE = 0.47$ ) than in the threat condition ( $M = 26.40; SE = 0.43$ ) on the MMSE,  $F(1, 76) = 12.506, p = 0.001, \eta_p^2 = 0.141$ . The same pattern occurred on MoCA, with participants underperforming in the threat condition ( $M = 24.80; SE = 0.53$ ) as compared to the reduced-threat condition ( $M = 27.45; SE = 0.53$ ),  $F(1, 76) = 10.153, p = 0.002, \eta_p^2 = 0.118$ . These results show that the performances of older adults on short cognitive tests are susceptible to stereotype threat effects.

264 Because these tests are used to screen for predementia state, we also examined the proportion  
265 of participants meeting the clinical criteria of MCI on MoCA and MMSE (using a cutoff at 26 for  
266 both tests). During test 1, stereotype threat was powerful enough on the MoCA to result in 50%  
267 of our sample performing under the cutoff score of 26/30 in the threat condition, versus 15% in  
268 the reduced-threat condition ( $p = 0.041$ , Fischer's exact test). The same pattern occurred on  
269 MMSE, with 30% of the participants scoring below 26 in the threat condition, against 5% in  
270 reduced-threat condition ( $p = 0.038$ , Fisher's exact test). More information about this study can  
271 be found in Mazerolle et al.<sup>25</sup>.

272  
273 We also hypothesized that an educational intervention (debriefing) consisting in informing  
274 older adults about the stereotype threat phenomenon and alleviating the evaluative pressure  
275 of the test, would reduce the impact of negative aging stereotypes on their performance. As  
276 shown in **Figure 4** (right panel), after the educational intervention (debriefing), older adults  
277 performed equally well on test 2 (be it MoCA or MMSE), regardless of the administration  
278 condition of their previous test 1, threat or reduced-threat. In other words, lower performance  
279 of participants at test 1 due to threat instructions was restored at test 2 thanks to the  
280 educational intervention. More details about these findings can be found in Mazerolle et al.<sup>25</sup>.

281  
282 **FIGURE LEGENDS:**

283  
284 **Figure 1: Visual depiction of the procedure to test age-based stereotype threat on a lab**  
285 **memory test.**

286  
287 **Figure 2: Visual depiction of the educational intervention to reduce age-based stereotype**  
288 **threat effects.**

289  
290 **Figure 3: Reading span score (adjusted for covariates) as a function of instructions condition**  
291 **and age group.** Error bars indicate standard errors of the mean. This figure has been modified  
292 from Mazerolle et al.<sup>22</sup>.

293  
294 **Figure 4: MMSE and MoCA scores as a function of threat conditions before debriefing and**  
295 **after debriefing participants about the impact of stereotype threat.** Error bars represent  
296 standard errors of the mean. This figure has been modified from Mazerolle et al.<sup>25</sup>.

297  
298 **DISCUSSION:**

299 The present studies show that stereotype threat, a neglected source of stress in many testing  
300 situations, can lead older adults to perform below their true abilities on memory tests. The  
301 method presented here highlights the crucial importance of the instructions given to  
302 participants and patients before testing memory. Simply mentioning that younger adults are  
303 taking part in the study (without mentioning any expected age-related differences in  
304 performance) is sufficient to inflate by 40% (MMSE and MoCA averaged) the number of older  
305 adults meeting clinical criteria for predementia on short cognitive tests. The present findings  
306 also showed that presenting the memory tests as age fair or explaining to older adults the  
307 negative impact of aging stereotypes on their performances are two efficient strategies to help



308 them resist to age-based stereotype threat. Taken together, these results highlight the critical  
309 importance of taking into account stereotype threat effects when assessing older adults'  
310 memory using short cognitive tests, especially given the current pressure on general  
311 practitioners to participate in the screening for predementia<sup>26,27</sup>. It is also important for  
312 experimental studies about cognitive aging because short cognitive tests are used to exclude  
313 participants who are suspected to show predementia symptoms only because they scored  
314 below a cutoff.

315  
316 Some of the critical aspects of the method deserve particular attention. A typical mistake when  
317 one discovers stereotype threat research<sup>28</sup> consists in assuming that a stereotype threat  
318 condition requires the implementation of an extra pressure that does not exist in conventional  
319 real-life testing, and that standard real-life testing instructions can be used to operationalize a  
320 no-stereotype threat control condition. Actually, it is quite the contrary: The standard real-life  
321 testing settings are likely to induce stereotype threat, either implicitly or explicitly, because of  
322 the words used to present the tests and/or any environmental cues that are related to negative  
323 aging stereotypes (e.g., the presence of flyers or posters on Alzheimer's disease or other  
324 dementia). It is much more difficult to find a way to eliminate stereotype threat in a testing  
325 situation. Therefore, any modification to the instructions that have been found efficient to  
326 reduce stereotype threat should be carefully considered to avoid the belief that one is  
327 comparing a threat and a reduced-threat condition while, in fact, one is comparing two  
328 stereotype threat conditions.

329  
330 Although the present findings were obtained on lab memory tests and short cognitive tests,  
331 they raise the question of whether age-based stereotype threat effects can also affect older  
332 patients' performances on complete neuropsychological batteries used in memory clinics for  
333 the diagnosis of MCI, the prodromal stage of AD. In our view, it seems very likely that age-based  
334 stereotype threat effects contribute, at least in part, to the 53% of false positive errors  
335 observed in the diagnosis of MCI. Without denying that aging may be associated with cognitive  
336 decline and neurodegenerative diseases such as MCI or AD for many people, our findings  
337 suggest paying special attention to the influence of negative aging stereotypes that have been  
338 largely overlooked in the context of neuropsychological testing.

339  
340 Several individual factors can make older adults more or less vulnerable to age-based  
341 stereotype threat effects. As indicated by a recent review<sup>5</sup>, these moderators include older  
342 adults' level of education, physical and psychological health, subjective age, stigma  
343 consciousness, domain identification (i.e., importance attached to memory), and memory self-  
344 efficacy. Future research, especially those conducted within the clinical setting where a  
345 diagnosis is requested, should thus consider some of these factors to provide fairer evaluation  
346 of patients' memory abilities.

347  
348 Our experimental design offers new recommendations to healthcare professionals to improve  
349 the accuracy of predementia diagnosis. Characterizing the memory tests as age fair or  
350 informing older adults about the age-based stereotype threat phenomenon are two simple and  
351 easily implementable instructions likely to help older people to perform at an optimal level

352 during neuropsychological testing. These recommendations may help medical staff to deliver  
353 more accurate and potentially less threatening information to the patients and/or their family  
354 (thereby significantly improving their well-being and quality of life). It should be noted,  
355 however, that these recommendations may need to be adapted to consider other types of  
356 threat that could be simultaneously triggered by the clinical context (e.g., the specific threat of  
357 AD as a dramatic disease<sup>29</sup>, the threat of being at hospital<sup>30</sup>, and the threat of the white coat<sup>31</sup>).

358

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363

#### 364 **DISCLOSURES:**

365 The authors have nothing to disclose.

366

#### 367 **REFERENCES:**

- 368 1. Steele, C. M., Aronson, J. Stereotype threat and the intellectual test performance of African  
369 Americans. *Journal of Personality and Social Psychology*. **69** (5), 797–811 (1995).
- 370 2. Steele, C. M. A threat in the air: How stereotypes shape intellectual identity and  
371 performance. *American Psychologist*. **52**, 613–629 (1997).
- 372 3. Barber, S. J. An examination of age-based stereotype threat about cognitive decline:  
373 Implications for stereotype-threat research and theory development. *Perspectives on*  
374 *Psychological Science*. **12** (1), 62–90 (2017).
- 375 4. Chasteen, A. L., Kang, S. K., Remedios, J. D. Aging and stereotype threat: Development,  
376 process, and interventions. In *Stereotype threat: Theory, process, and application*. Edited by  
377 Inzlicht M., Schmader T., 202–216, Oxford University Press. New York, NY (2012).
- 378 5. Lamont, R. A, Swift, H. J., Abrams, D. A. Review and Meta-Analysis of Age-Based Stereotype  
379 Threat: Negative Stereotypes, Not Facts, Do the Damage. *Psychology and Aging*. **30** (1),  
380 180–193 (2015).
- 381 6. Haslam, C. et al. "When the age is in, the wit is out": Age related self-categorization and  
382 deficit expectations reduce performance on clinical tests used in dementia assessment.  
383 *Psychology and Aging*. **27**, 778–784 (2012).
- 384 7. Desrichard, O., Köpetz, C. A threat in the elder: The impact of task-instructions, self-efficacy  
385 and performance expectations on memory performance in the elderly. *European Journal of*  
386 *Social Psychology*. **35**, 537–552 (2005).
- 387 8. Kang, S. K., Chasteen, A. L. The moderating role of age-group identification and perceived  
388 threat on stereotype threat among older adults. *The International Journal of Aging and Human*  
389 *Development*. **69**, 201–220 (2009).
- 390 9. Rahhal, T. A., Hasher, L., Colcombe, S. J. Instructional manipulations and age differences in  
391 memory: Now you see them, now you don't. *Psychology and Aging*. **16**, 697–706 (2001).
- 392 10. Hess, T. M., Auman, C., Colcombe, S. J., Rahhal, T. A. The Impact of Stereotype Threat on  
393 Age Differences in Memory Performance. *The Journals of Gerontology Series B: Psychological*  
394 *Sciences and Social Sciences*. **58** (1), P3–P11 (2003).

- 395 11. Hess, T. M., Hinson, J. T. Age-related variation in the influences of aging stereotypes on  
396 memory in adulthood. *Psychology and Aging*. **21** (3), 621–625 (2006).
- 397 12. Levy, B. Improving memory in old age through implicit self-stereotyping. *Journal of*  
398 *Personality and Social Psychology*. **71**, 1092–1107 (1996).
- 399 13. Stein, R., Blanchard-Fields, F., Hertzog, C. The effects of age-stereotype priming on the  
400 memory performance of older adults. *Experimental Aging Research*. **28** (2), 169–181 (2002).
- 401 14. Sachdev, P. S. et al.; Sydney Memory, Ageing Study Team. Factors predicting reversion from  
402 mild cognitive impairment to normal cognitive functioning: a population-based study. *PLoS One*.  
403 **8**, e59649 (2013).
- 404 15. Régner, I. et al. Aging stereotypes must be taken into account for the diagnosis of  
405 prodromal and early Alzheimer's disease. *Alzheimer Disease & Associated Disorders - An*  
406 *International Journal*. **30** (1), 77–79 (2016).
- 407 16. Chasteen, A. L., Bhattacharyya, S., Horhota, M., Tam, R., Hasher, L. How feelings of  
408 stereotype threat influence older adults' memory performance. *Experimental Aging Research*.  
409 **31** (3), 235–260 (2005).
- 410 17. Yesavage, J. A. et al. Development and validation of a geriatric depression screening scale: a  
411 preliminary report. *Journal of Psychiatric Research*. **17** (1), 37–49 (1982).
- 412 18. Spielberger, C. D. *Test Anxiety Inventory*. The Corsini Encyclopedia of Psychology. John Wiley  
413 & Sons, Inc. Hoboken, NJ (2010).
- 414 19. Folstein, M. F., Folstein, S. E., McHugh, P. R. "Mini-mental state." *Journal of Psychiatric*  
415 *Research*. **12** (3), 189–198 (1975).
- 416 20. Crum, R. M., Anthony, J. C., Bassett, S. S., Folstein, M. F. Population-based norms for the  
417 Mini-Mental State Examination by age and educational level. *The Journal of the American*  
418 *Medical Association*. **269** (18), 2386–2391 (1993).
- 419 21. Gimmig, D., Huguet, P., Caverni, J.-P., Cury, F. Choking under pressure and working-memory  
420 capacity: When performance pressure reduces fluid intelligence. *Psychonomic Bulletin &*  
421 *Review*. **13**, 1005–1010 (2006).
- 422 22. Mazerolle, M., Régner, I., Morisset, P., Rigalleau, F., Huguet, P. Stereotype Threat  
423 Strengthens Automatic Recall and Undermines Controlled Processes in the Elderly.  
424 *Psychological Science*. **23**, 723–727 (2012).
- 425 23. Daneman, M., Carpenter, P. A. Individual differences in working memory and reading.  
426 *Journal of Verbal Learning and Verbal Behavior*. **19**, 450–466 (1980).
- 427 24. Nasreddine, Z. S. et al. The Montreal Cognitive Assessment, MoCA: A brief screening tool for  
428 mild cognitive impairment. *Journal of the American Geriatrics Society*. **53**, 695–699 (2005).
- 429 25. Mazerolle, M. et al. Negative Aging Stereotypes Impair Performance on Brief Cognitive Tests  
430 Used to Screen for Predementia. *Journals of Gerontology, Series B: Psychological Sciences and*  
431 *Social Sciences*. **72** (6), 932–936 (2017).
- 432 26. Brown, J. The use and misuse of short cognitive tests in the diagnosis of dementia. *Journal*  
433 *of Neurology, Neurosurgery, and Psychiatry*. **86**, 680–685 (2015).
- 434 27. Le Couteur, D. G., Doust, J., Creasey, H., Brayne, C. Political drive to screen for pre-  
435 dementia: not evidence based and ignores the harms of diagnosis. *BMJ*. **347**, f5125 (2013).
- 436 28. Steele, C.M., Davies, P.G. Stereotype Threat and Employment Testing: A Commentary.  
437 *Human Performance*. **16** (3), 311–326 (2003).

- 438 29. Scholl, J. M., Sabat, S. R. Stereotypes, stereotype threat and ageing: implications for the  
439 understanding and treatment of people with Alzheimer's disease. *Ageing & Society*. **28** (1),  
440 103–130 (2008).
- 441 30. Suhr, J. A., Gunstad, J. "Diagnosis threat": The effect of negative expectations on cognitive  
442 performance in head injury. *Journal of Clinical and Experimental Neuropsychology*. **24** (4),  
443 448–457 (2002).
- 444 31. Schlemmer, M., Desrichard, O. Is Medical Environment Detrimental to Memory? A Test of A  
445 White Coat Effect on Older People's Memory Performance. *Clinical Gerontologist*. **41** (1), 77–81  
446 (2018).