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Supplementary information

Evidence that ageing yields improvements as well as declines across attention and executive functions

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Supplementary Information
Veríssimo, Verhaeghen, Goldman, Weinstein, and Ullman (2021)
'Evidence that aging yields improvements as well as declines across attention and executive functions'

Supplementary Tables

Supplementary Table 1 | Linear effects of age on the three attentional networks in each of the nine sensitivity analyses

Sensitivity analysis	N	# data points	df	Results
1. Participant mean log-RT also as covariate	702	49,176	49,162	Age X Alerting: *b*=-0.0008 [-0.0012, -0.0003], *t*=-3.07, *p*=.002 Age X Orienting: *b*=0.0007 [0.0002, 0.0011], *t*=2.62, *p*=.009 Age X Executive: *b*=-0.0012 [-0.0017, -0.0007], *t*=-4.42, *p*<.001
2. Raw (unlogged) RTs as dependent measure	702	49,176	49,163	Age X Alerting: *b*=-0.49 [-0.87, -0.10], *t*=-2.46, *p*=.014 Age X Orienting: *b*=0.58 [0.20, 0.97], *t*=2.96, *p*=.003 Age X Executive: *b*=-0.44 [-0.85, -0.02], *t*=-2.06, *p*=.040
3. No covariates	702	49,176	49,166	Age X Alerting: *b*=-0.0007 [-0.0012, -0.0002], *t*=-2.92, *p*=.004 Age X Orienting: *b*=0.0007 [0.0002, 0.0012], *t*=2.80, *p*=.005 Age X Executive: *b*=-0.0012 [-0.0016, -0.0008], *t*=-5.91, *p*<.001
4. Visual acuity also as covariate	547	38,290	38,276	Age X Alerting: *b*=-0.0007 [-0.0012, -0.0001], *t*=-2.43, *p*=.015 Age X Orienting: *b*=0.0007 [0.0001, 0.0012], *t*=2.49, *p*=.013 Age X Executive: *b*=-0.0011 [-0.0017, -0.0005], *t*=-3.67, *p*<.001
5.1. Only responses faster than 1600ms	702	49,038	49,025	Age X Alerting: *b*=-0.0007 [-0.0012, -0.0002], *t*=-2.70, *p*=.007 Age X Orienting: *b*=0.0006 [0.0001, 0.0011], *t*=2.39, *p*=.017 Age X Executive: *b*=-0.0012 [-0.0017, -0.0006], *t*=-4.40, *p*<.001
5.2. Only responses faster than 1500ms	702	48,867	48,854	Age X Alerting: *b*=-0.0006 [-0.0011, -0.0001], *t*=-2.53, *p*=.012 Age X Orienting: *b*=0.0006 [0.0001, 0.0011], *t*=2.33, *p*=.020 Age X Executive: *b*=-0.0012 [-0.0017, -0.0007], *t*=-4.50, *p*<.001
6. Both central and double cues included	702	65,552	65,539	Age X Alerting: *b*=-0.0005 [-0.0009, -0.0001], *t*=-2.24, *p*=.025 Age X Executive: *b*=-0.0012 [-0.0017, -0.0007], *t*=-4.82, *p*<.001
7. Lenient participant exclusion: at least 50% accuracy	734	50,541	50,528	Age X Alerting: *b*=-0.0008 [-0.0013, -0.0003], *t*=-3.13, *p*=.002 Age X Orienting: *b*=0.0007 [0.0002, 0.0012], *t*=2.69, *p*=.007 Age X Executive: *b*=-0.0012 [-0.0017, -0.0007], *t*=-4.52, *p*<.001
8. Stringent participant exclusion: at least 90% accuracy	643	45,563	45,550	Age X Alerting: *b*=-0.0006 [-0.0011, -0.0001], *t*=-2.19, *p*=.029 Age X Orienting: *b*=0.0007 [0.0001, 0.0012], *t*=2.51, *p*=.012 Age X Executive: *b*=-0.0011 [-0.0017, -0.0006], *t*=-3.96, *p*<.001
9. Extremely old participants excluded	698	48,913	48,900	Age X Alerting: *b*=-0.0009 [-0.0014, -0.0004], *t*=-3.35, *p*=.001 Age X Orienting: *b*=0.0008 [0.0003, 0.0013], *t*=2.96, *p*=.003 Age X Executive: *b*=-0.0012 [-0.0018, -0.0007], *t*=-4.47, *p*<.001

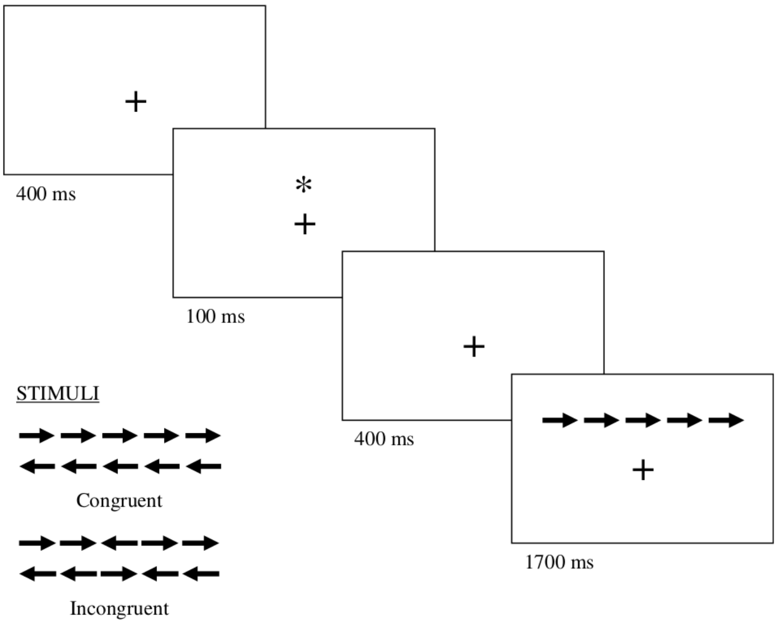
Degrees of freedom (df) in each *t*-test were computed as the number of data points minus the number of fixed effect estimates (Baayen et al., 2008). In sensitivity analysis 3 (no covariates), the mixed-effects model included a random by-participant intercept but no random slope for flanker type, because models with random slopes did not converge. In sensitivity analysis 6 (both central and double cues included), the effect of age on orienting cannot be estimated, since the orienting effect can only be computed as the difference between spatial and central cues. N: number of participants; #: number.

Supplementary Table 2 | Nonlinear effects of age on the three attentional networks in each of the nine sensitivity analyses

Sensitivity analysis	N	# data points	df	Results
1. Participant mean log-RT also as covariate	702	49,176	49,158	Age X Alerting X Age>76: *b*=0.0009 [-0.0014, 0.0032], *t*=0.76, *p*=.448 Age X Orienting X Age>76: *b*=-0.0014 [-0.0037, 0.0009], *t*=-1.23, *p*=.221 Age X Executive X Age>76: *b*=0.0039 [0.0014, 0.0063], *t*=3.08, *p*=.002
2. Raw (unlogged) RTs as dependent measure	702	49,176	49,159	Age X Alerting X Age>76: *b*=-0.07 [-1.88, 1.74], *t*=-0.08, *p*=.939 Age X Orienting X Age>76: *b*=-1.25 [-3.06, 0.56], *t*=-1.35, *p*=.176 Age X Executive X Age>76: *b*=2.29 [0.36, 4.22], *t*=2.32, *p*=.020
3. No covariates	702	49,176	49,162	Age X Alerting X Age>76: *b*=0.0006 [-0.0018, 0.0029], *t*=0.48, *p*=.632 Age X Orienting X Age>76: *b*=-0.0012 [-0.0035, 0.0011], *t*=-0.99, *p*=.321 Age X Executive X Age>76: *b*=0.0037 [0.0013, 0.0062], *t*=2.98, *p*=.003
4. Visual acuity also as covariate	547	38,290	38,272	Age X Alerting X Age>76: *b*=-0.0006 [-0.0031, 0.0019], *t*=-0.45, *p*=.653 Age X Orienting X Age>76: *b*=-0.0011 [-0.0036, 0.0014], *t*=-0.86, *p*=.391 Age X Executive X Age>76: *b*=0.0042 [0.0015, 0.0070], *t*=2.99, *p*=.003
5.1. Only responses faster than 1600ms	702	49,038	49,021	Age X Alerting X Age>76: *b*=0.0014 [-0.0008, 0.0037], *t*=1.23, *p*=.217 Age X Orienting X Age>76: *b*=-0.0018 [-0.0041, 0.0005], *t*=-1.55, *p*=.121 Age X Executive X Age>76: *b*=0.0036 [0.0017, 0.0055], *t*=3.77, *p*<.001
5.2. Only responses faster than 1500ms	702	48,867	48,850	Age X Alerting X Age>76: *b*=0.0018 [-0.0005, 0.0040], *t*=1.55, *p*=.121 Age X Orienting X Age>76: *b*=-0.0017 [-0.0040, 0.0005], *t*=-1.50, *p*=.134 Age X Executive X Age>76: *b*=0.0038 [0.0014, 0.0061], *t*=3.09, *p*=.002
6. Both central and double cues included	702	65,552	65,535	Age X Alerting X Age>76: *b*=0.0014 [-0.0006, 0.0033], *t*=1.36, *p*=.175 Age X Executive X Age>76: *b*=0.0034 [0.0010, 0.0057], *t*=2.82, *p*=.005
7. Lenient participant exclusion: at least 50% accuracy	734	50,541	50,524	Age X Alerting X Age>76: *b*=0.0006 [-0.0017, 0.0028], *t*=0.51, *p*=.612 Age X Orienting X Age>76: *b*=-0.0004 [-0.0027, 0.0018], *t*=-0.38, *p*=.706 Age X Executive X Age>76: *b*=0.0033 [0.0009, 0.0058], *t*=2.71, *p*=.007
8. Stringent participant exclusion: at least 90% accuracy	643	45,563	45,546	Age X Alerting X Age>76: *b*=0.0012 [-0.0013, 0.0037], *t*=0.97, *p*=.333 Age X Orienting X Age>76: *b*=-0.0004 [-0.0029, 0.0021], *t*=-0.30, *p*=.765 Age X Executive X Age>76: *b*=0.0037 [0.0010, 0.0064], *t*=2.73, *p*=.006
9. Extremely old participants excluded	698	48,913	48,896	Age X Alerting X Age>76: *b*=0.0002 [-0.0023, 0.0027], *t*=0.13, *p*=.895 Age X Orienting X Age>76: *b*=-0.0006 [-0.0031, 0.0019], *t*=-0.47, *p*=.636 Age X Executive X Age>76: *b*=0.0044 [0.0017, 0.0071], *t*=3.21, *p*=.001

This Table presents nonlinear breakpoint results for each sensitivity analysis. The result on each row represents the difference between linear age effects before vs. after the breakpoint (that is, between the age effect from age 58 to 76 and the age effect from 76 to 98), for a given attentional network. This difference between the two slopes is estimated as a three-way interaction between age as a continuous variable; the corresponding attentional network effect; and a numeric variable coding whether or not age is greater than 76. Degrees of freedom (df) in each *t*-test were computed as the number of data points minus the number of fixed effect estimates (Baayen et al., 2008). In sensitivity analysis 5.1 (only responses faster than 1600ms), the mixed-effects model included a random by-participant intercept but no random slope for flanker type, because models with random slopes did not converge. In sensitivity analysis 6 (both central and double cues included), the effect of age on orienting cannot be estimated, since the orienting effect can only be computed as the difference between spatial and central cues. N: number of participants; #: number.

Supplementary Figures



Supplementary Fig. 1 | ANT stimuli and trial structure. Example shows a spatial cue followed by a target row of arrows. Figure adapted from Costa et al. (2008).

References for Supplementary Information

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59*, 390–412.

Costa, A., Hernández, M., & Sebastián-Gallés, N. (2008). Bilingualism aids conflict resolution: Evidence from the ANT task. *Cognition*, *106*, 59–86.