Supplementary Material

Effect of baseline correction

In order to test whether the results of the current manuscript could be due to the choice of baseline period used, a series of control analyses with different baseline periods were conducted. Similar to the manuscript, the ERN/CRN was re-analyzed using a GLM, with mean amplitude as the DV, accuracy (ERN, CRN) and electrode location as within-subjects factors, and age as a continuous between-subjects factor. Critically, this analysis was conducted six times, using each of the following baselines: 1) -500 to -400 ms 2) -400 to -300 ms 3) -300 to -200 ms 4) -200 to -100 ms 5) -100 to 0 ms 6) no baseline correction. Significance values, as a function of the baseline used, for the three-way interaction between accuracy, electrode and age are reported in table S1 below. Additionally, Pearson correlation coefficients and significance values for the relation between the delta-ERN and age at each electrode site, as a function of the baseline used, are also reported in table S. Where appropriate, degrees of freedom were adjusted using the Hyund-Feldt correction for violations of sphericity. As can be observed in table S1, none of the effects of interest changed qualitatively as a function of the baseline used.

Table S1

	-500 to -400	-400 to -300	-300 to -200	-200 to -100	-100 to 0	No baseline
3-way interaction	(<.001)	(<.001)	(<.001)	(.008)	(<.001)	(.005)
delta-ERN and age correlation at E11 (Fz)	.277 (.073)	.242 (.119)	.285 (.064)	.163 (.296)	.225 (.147)	.147 (.347)
E6 (FCz)	-.016 (.919)	-.027 (.862)	.038 (.810)	-.032 (.840)	-.008 (.960)	-.082 (.601)
E5 (CPz)	-.452 (.002)	-.501 (.001)	-.496 (.001)	-.391 (.009)	-.456 (.002)	-.420 (.005)
E62 (POz)	-.582 (<.001)	-.631 (<.001)	-.566 (<.001)	-.461 (.002)	-.508 (.001)	-.470 (.001)

Effect of controlling for trial counts

In order to test whether the ERP results of the current manuscript could be due to differences in the number of error and correct trials, either within or between subjects, a control analysis was conducted, in which each participants' number of artifact-free error and correct trials were controlled for. Similar to the manuscript, the ERN/CRN was re-analyzed using a GLM, with mean amplitude as the DV, accuracy (ERN, CRN) and electrode location as within-subjects factors, and age as a continuous between-subjects factor; the number of artifact-free error and correct trials were also added into the model as covariates. Where appropriate, degrees of freedom were adjusted using the Hyund-Feldt correction for violations of sphericity.

Similar to the results reported in the manuscript, analysis of the ERP data during the time range of the ERN revealed an interaction between electrode and accuracy [F (3,

117) = 17.67, $p < .001$)]. The interaction between electrode and accuracy was such that, regardless of age, participants demonstrated a maximal difference between error and correct incongruent responses over frontocental (11/Fz and 6/FCz) electrode locations. However, the accuracy by electrode interaction was qualified by a three-way interaction between electrode, accuracy and age [F (3, 117 = 4.14, $p = .019$)]. Post-hoc correlations between delta-ERN (error minus correct) activity and age at each of the four electrode locations (while controlling for trial counts) revealed that the error minus correct effect only correlated with age at the centroparietal electrodes, 5/CPz ($r = -.484$, $p = .001$) and 62/POz ($r = -.393$, $p = .011$). Thus, all participants demonstrated a classic frontocentral ERN effect, but the topography of the ERN effect differed with age; increasing age was associated with more posterior electrodes also demonstrating this effect. This pattern of results is qualitatively similar to that of the results presented in the main text, providing evidence that the number of artifact-free error trials included in the analysis does not substantially influence the results obtained.

Analysis of the positivity preceding the ERN and CRN

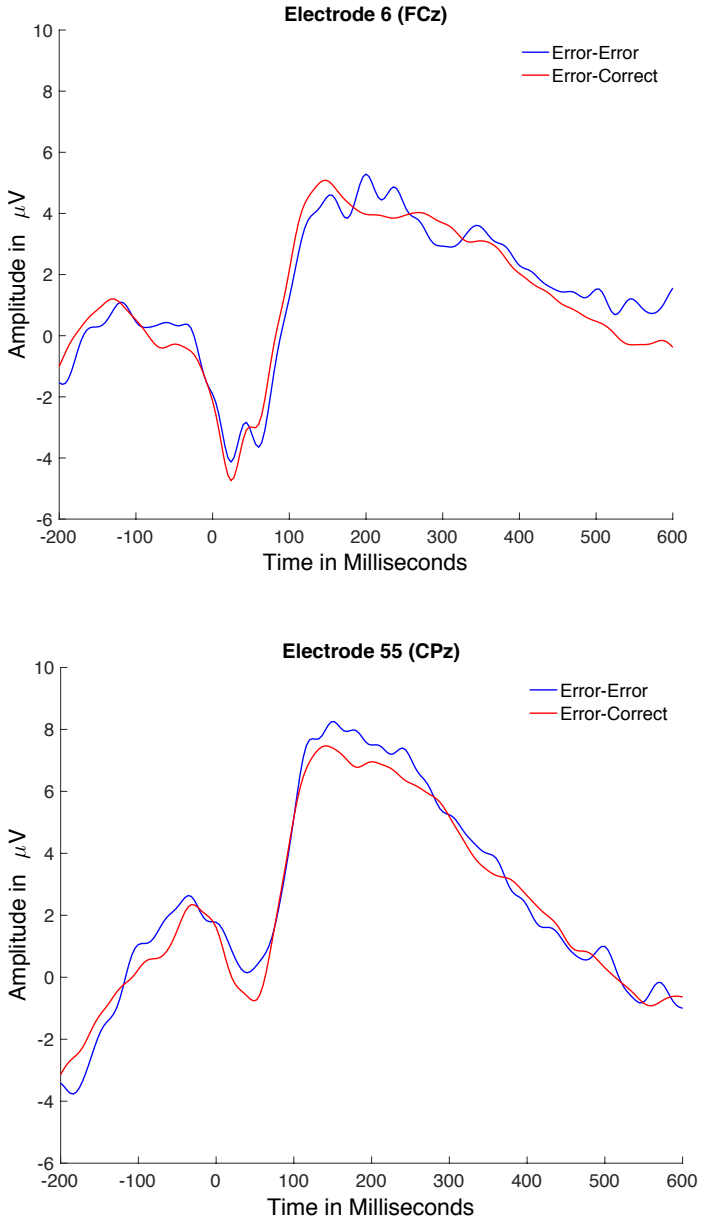
In order to rule out the possibility that re-baselining the ERN and CRN to the immediately preceding positivity confounds the ERN with another possible component (i.e. the stimulus-locked P3), we analyzed this positivity itself. To this end, the preceding positivity was analyzed using a GLM, with mean amplitude as the DV, accuracy and electrode location as within-subjects factors, and age as a continuous between-subjects factor. Where appropriate, degrees of freedom were adjusted using the Hyund-Feldt correction for violations of sphericity. Critically, there was no main effect of accuracy ($p = .540$), no interaction between accuracy and electrode ($p = .340$), no interaction between accuracy and age ($p = .812$), and no three-way interaction between accuracy, electrode and age ($p = .283$). Thus, it does not appear that the ERP effects, nor the associated source analyses, can be explained by a confound of the positivity preceding the ERN and CRN.

Within-subject analysis of the relation between the ERN and PEA

Significant relations between source activity and PEA were reported in the manuscript. Additionally, although the delta-ERN did not significantly correlate with PEA on a between-subjects level, the relation between the delta-ERN and PEA was in the expected direction, but not significant at either electrode 11/FZ ($r = -.241$, $p = .120$) or 6/FCz ($r = -.175$, $p = .261$). Given this pattern of results, we also performed an additional analysis in which we binned the ERN based on whether the subsequent trial was correct or not (i.e. a within-subject analysis of the relation between the ERN and PEA). To this end, the contextual effects of the ERN were analyzed using a GLM, with mean amplitude as the DV, and next-trial accuracy and electrode location as within-subjects factors. Critically, a main effect of next-trial accuracy was found, such that the ERN was more negative for error trials that were followed by a correct response, compared to error trials that were followed by another error, $F(1, 28) = 4.45$, $p = .044$. It should be noted that this within-subject analysis was only possible for a subset of participants (n = 29) that had at

least two double-error trials. Plots of the ERN, as a function of next-trial accuracy are depicted for electrodes 6/FCz and 55/CPz in figure S1.

Figure S1



Effect of controlling for RT

In order to test whether the ERP results of the current manuscript could be due to differences in RT across subjects, a control analysis was conducted, in which each participant's correct and error mean RT were controlled for. Similar to the manuscript, the ERN/CRN was re-analyzed using a GLM, with mean amplitude as the DV, accuracy

(ERN, CRN) and electrode location as within-subjects factors, and age as a continuous between-subjects factor; the mean RT for correct and error trials were also added into the model as covariates. Where appropriate, degrees of freedom were adjusted using the Hyund-Feldt correction for violations of sphericity.

Similar to the results reported in the manuscript, the three-way interaction between electrode, accuracy and age was significant [F (3, 117 = 4.54, p = .012)]. Post-hoc correlations between delta-ERN (error minus correct) activity and age at each of the four electrode locations (while controlling for RT) revealed that the error minus correct effect only correlated with age at the centroparietal electrodes, 5/CPz (r = -.378, p = .015) and 62/POz (r =- .420, p = .006). This pattern of results is qualitatively similar to that of the results presented in the main text, providing evidence that the differences in RT across subjects does not substantially influence the results obtained.

Exploratory t-tests comparing PES and PEA as a function of age

An a priori decision was made to conduct all analyses of age using regression or correlation-based measures, treating age as a continuous variable. Nonetheless, for exploratory purposes, a series of t-tests were conducted in order to determine whether PES or PEA varied between the four arbitrary age groups that were created for display purposes. None of the paired comparisons were significant for either PES (all $p > .5$) or PEA (all $p > .53$).

Exploratory t-tests comparing PES and PEA as a function of age

An a priori decision was made to conduct all analyses of age using regression or correlation-based measures, treating age as a continuous variable. Nonetheless, for exploratory purposes, a series of *t*-tests were conducted in order to determine whether estimated source activity in each of the 14 ROIs varied between the four arbitrary age groups that were created for display purposes. Given the large number of t-tests that were run, only *t*-tests with a significance of $p < .10$ are reported here. Group one displayed a non-significant reduction in the IFG (p = .096), compared to group three. Group one displayed significant reductions in the precentral/ postcentral gyrus (p = .044), insula (p = .046) and IFG (p = .016), compared to group four. Group two displayed non-significant reductions in the OFC (p = .085), ventral anterior cingulate (p = .084) and IFG (p = .081), compared to group four.