Supplementary Results

Cross-sectional correlations.
Table 1 reports cross-sectional correlations between age, testosterone, and PDS for females (highlighted in pink) and males (highlighted in blue) for each time point.

Table 1.

Timepoint 1			
	PDS	Testosterone	Age
PDS	--	0.45**	0.44**
Testosterone	0.40*	--	.43**
Age	0.25	0.51**	--
Timepoint 2			
	PDS	Testosterone	Age
PDS	--	.39*	.60**
Testosterone	.55***	--	.42**
Age	.39*	.41*	--
Timepoint 3			
	PDS	Testosterone	Age
PDS	--	0.28	.56***
Testosterone	0.61***	--	0.25
Age	0.69***	.52***	--

* (females=pink, males=blue)

Inclusion of additional covariates in longitudinal analyses

Supplementary analyses confirmed that all significant findings remained unchanged when we included additional covariates related to motion, "not sure" responses, and total number of trials. Initial values at T1 and change since T1 in each of these variables was added to the final models selected for hippocampus (Table 2) and DLPFC (Table 3).

Motion. Motion was measured as the number of repaired volumes based on ArtRepair (>1mm motion or >2% signal change) for each participant. Children's average number repaired volumes was *M(SD)*=14.22(11.92) at T1, *M(SD)*=10.72(10.03) at T2, and *M(SD)*=7.87(8.47) at T3 corresponding to 4 to 7% of volumes. The number of repaired volumes was negatively related to age at T1 (r=-.25, p=.02) and T2 (r=-.27, p=.01), and marginally at T3 (r=-.20, p=.08). To account for these developmental effects, we added the number of repaired volumes at T1 and change in repaired volumes since T1 in our final models of hippocampal and DLPFC activation. Repaired volumes at T1 was not a significant predictor of activation (ps>.29), but change in number of repaired volumes was significant when added to the final hippocampal models (PDS model: b=-.01, p=.003, Testosterone model: b=-.01, p=.003), indicating that children whose number of repaired volumes decreased over time exhibited higher hippocampal activation. Neither initial or change in repaired volumes was significant for the DLPFC models (ps>.50). Importantly, all our main findings still held for the both the hippocampal (PDS model: main effect of region b=.02, p=.04; time^2 b=1.32 p<.001; T1 age x Change in PDS b=.15, p<.001; Testosterone model: T1 age x Gender x Change in Testosterone, b=-.01, p<.001) and DLPFC models (PDS Model: time^2 b=2.02 p<.001; Testosterone model: T1 age x Gender x Change in Testosterone, b=-.01, p=.03).

Not Sure Rates. "Not sure" rates were measured as the number of "not sure" responses divided by the total number of hits. Children's "not sure" response rates were *M(SD)*=.26(.19) at T1, *M(SD)*=.17(.13) at T2, and *M(SD)*=.14(.12) at T3. "Not sure" rates negatively associated with age at T1 (r=-.33, p=.001) and T2 (r=-.25, p=.02), but not T3 (r=-.15, p=.19). To account for these developmental effects, we added "not sure" rates at T1 and change in "not sure" rates since T1 in our final models. Neither "not sure" rate at T1 or change in "not sure" rate were significant predictors when added to the final hippocampal models p>.49; when added to the final DLPFC model, the change in "not sure" rates marginally predicted DLPFC activation (PDS model: b=-.41, p=.06, Testosterone model: b=-.37, p=.07). However, all our main findings remain significant for the both the hippocampal (PDS model: main effect of region b=.02, p=.04; time^2 b=1.27 p<.001; T1 age x Change in PDS b=.14, p<.001; Testosterone model: T1 age x Gender x Change in Testosterone, b=-.01, p<.001) and DLPFC models (PDS Model: time^2 b=1.26 p<.001; Testosterone model: T1 age x Gender x Change in Testosterone, b=-.01, p=.02).

Total Number of Trials. The total number of trials was calculated as the sum of correct and incorrect item-context trials that were included for *f*MRI activation estimates. Total trial number was *M(SD)*=102(24) at T1, *M(SD)*=111(25) at T2, and *M(SD)*=119(18) at T3. Total trial number was marginally positively associated with age at T1 (r=.19, p=.07), significantly at T2 (r=.27, p=.02), and not significantly at T3 (r=.12, p=.30). To account for these developmental effects, we added total trial number at T1 and change in total trial number since T1 in our final models. Total trial number at T1 was not a significant predictor of activation (ps>.27), but change in number of total trials was significant when added to the final hippocampal models (PDS model: b=.003, p<.001, Testosterone model: b=.004, p<.001), indicating that children whose number of total trials increased over time exhibited higher hippocampal activation. Initial total trial number was not significant for the DLPFC models (ps>.20) but change in number of total trials was marginal for the model including PDS (b=.002, p=.08) and significant for the model including testosterone (b=.004, p<.001). Importantly, our main results remain significant for the hippocampal model (PDS model: main effect of region b=.02, p=.04; time^2 b=1.34 p<.001; T1 age x Change in PDS b=.11, p=.006; Testosterone model: T1 age x Gender x Change in Testosterone, b=-.01, p<.001). Our main results also remain largely the same for the DLPFC models (PDS Model: time^2 b=2.12 p<.001; Testosterone model: T1 age x Gender x Change in Testosterone, b=-.01, p=.058), although we note the 3-way interaction was marginal at p=.058.

Table 2. Longitudinal Model Results for Hippocampal Item-Context Association Activation Including Additional Covariates

Hippocampus

	SD	b	SE	df	*t*	*p*		95% CI Lower	95% CI Upper
PDS									
Random Effect									
Intercept	0.284							0.247	0.327
Time	0.248							0.207	0.296
Fixed Effect									
Intercept		-0.033	0.039	1291	-0.84	0.40		-0.111	0.044
Initial Age		-0.047	0.025	117	-1.93	0.06	.	-0.096	0.001
region:Body		0.024	0.012	1291	2.02	0.04	*	0.001	0.046
region:Head		0.018	0.012	1291	1.58	0.12		-0.005	0.041
Time		-4.176	1.245	1291	-3.35	<.001	***	-6.619	-1.733
Time^2		1.362	0.346	1291	3.94	<.001	***	0.683	2.040
Gender		0.001	0.051	117	0.02	0.99		-0.100	0.102
Hemisphere		0.001	0.010	1291	0.14	0.89		-0.017	0.020
Initial PDS		0.010	0.057	117	0.17	0.86		-0.103	0.122
Change in PDS		0.131	0.043	1291	3.04	0.002	**	0.046	0.216
Initial Repaired Scans		-0.002	0.002	117	-0.86	0.39		-0.006	0.002
Change in Repaired Scans		-0.003	0.002	1291	-1.50	0.13		-0.007	0.001
Initial Not Sure Rate		-0.008	0.130	117	-0.06	0.95		-0.266	0.251
Change in Not Sure Rate		0.025	0.134	1291	0.19	0.85		-0.238	0.289
Initial Trial Count		0.000	0.001	117	-0.12	0.90		-0.002	0.002
Change in Trial Count		0.002	0.001	1291	3.28	0.001	**	0.001	0.004
Initial Age*Change in PDS		0.119	0.041	1291	2.94	0.003	**	0.039	0.198
Testosterone									
Random Effect									
Intercept	0.291							0.253	0.335
Time	0.287							0.239	0.345
Fixed Effect									
Intercept		0.013	0.039	1187	0.35	0.73		-0.063	0.090
Initial Age		0.012	0.036	111	0.33	0.74		-0.059	0.083
region:Body		0.017	0.011	1187	1.57	0.12		-0.004	0.039
region:Head		0.014	0.011	1187	1.25	0.21		-0.008	0.036
Time		-2.461	1.257	1187	-1.96	0.05	*	-4.928	0.006
Time^2		0.921	0.331	1187	2.79	0.01	**	0.272	1.570
Gender		-0.037	0.050	111	-0.74	0.46		-0.136	0.062
Hemisphere		0.004	0.009	1187	0.47	0.64		-0.014	0.022
Initial Testosterone		0.000	0.002	111	-0.16	0.87		-0.004	0.003
Change in Testosterone		-0.003	0.002	1187	-2.00	0.05	*	-0.006	0.000
Initial Repaired Scans		-0.003	0.002	111	-1.24	0.22		-0.008	0.002
Change in Repaired Scans		-0.002	0.002	1187	-1.32	0.19		-0.006	0.001
Initial Not Sure Rate		0.142	0.138	111	1.03	0.31		-0.132	0.416
Change in Not Sure Rate		0.193	0.129	1187	1.50	0.13		-0.060	0.446
Initial Trial Count		-0.001	0.001	111	-1.11	0.27		-0.003	0.001
Change in Trial Count		0.004	0.001	1187	6.15	<.001	***	0.003	0.005
Gender * Change in Testosterone		0.004	0.002	1187	1.78	0.08	.	0.000	0.008
Initial Age*Change in Testosterone		0.008	0.001	1187	5.58	<.001	***	0.005	0.011
Initial Age * Gender		-0.025	0.046	111	-0.54	0.59		-0.115	0.066
Initial Age* Gender * Change in Testosterone		-0.007	0.002	1187	-3.29	<.001	***	-0.012	-0.003

Table 3. Longitudinal Model Results for DLPFC Item-Context Association Activation Including Additional Covariates

	DLPFC								
								95% CI	
	SD	b	SE	df	*t*	*p*		Lower	Upper
PDS									
Random Effect									
Intercept	0.339							0.291	0.396
Time	0.226							0.180	0.284
Fixed Effect									
Intercept		-0.018	0.056	334	-0.33	0.74		-0.128	0.091
Initial Age		-0.004	0.033	117	-0.11	0.92		-0.069	0.062
Time		-1.052	0.896	334	-1.17	0.24		-2.816	0.711
$Time^2$		2.123	0.361	334	5.88	<.001	***	1.412	2.833
Gender		-0.147	0.070	117	-2.11	0.04	*	-0.285	-0.009
Hemisphere		-0.005	0.019	334	-0.25	0.80		-0.043	0.033
Initial PDS		-0.114	0.077	117	-1.48	0.14		-0.268	0.039
Change in PDS		0.106	0.069	334	1.54	0.12		-0.030	0.242
Initial Repaired Scans		-0.003	0.003	117	-0.92	0.36		-0.009	0.003
Change in Repaired Scans		0.004	0.003	334	1.41	0.16		-0.002	0.010
Initial Not Sure Rate		-0.127	0.178	117	-0.71	0.48		-0.480	0.226
Change in Not Sure Rate		-0.460	0.216	334	-2.13	0.03	*	-0.885	-0.034
Initial Trial Count		-0.002	0.001	117	-1.64	0.10		-0.005	0.000
Change in Trial Count		0.002	0.001	334	1.95	0.05	*	0.000	0.004
Initial Age*Change in PDS		0.058	0.055	334	1.04	0.30		-0.051	0.166
Testosterone									
Random Effect									
Intercept	0.349							0.300	0.407
Time	0.218							0.170	0.278
Fixed Effect									
Intercept		0.012	0.050	304	0.24	0.81		-0.086	0.110
Initial Age		-0.001	0.047	111	-0.02	0.98		-0.095	0.093
Time		-0.611	0.703	304	-0.87	0.39		-1.994	0.772
$Time^2$		1.643	0.347	304	4.73	<.001	***	0.960	2.326
Gender		-0.152	0.067	111	-2.29	0.02	*	-0.284	-0.020
Hemisphere		0.001	0.019	304	0.06	0.95		-0.036	0.038
Initial Testosterone		-0.003	0.003	111	-1.30	0.20		-0.008	0.002
Change in Testosterone		-0.004	0.003	304	-1.47	0.14		-0.009	0.001
Initial Repaired Scans		-0.001	0.003	111	-0.37	0.72		-0.007	0.005
Change in Repaired Scans		0.005	0.003	304	1.69	0.09		-0.001	0.010
Initial Not Sure Rate		-0.022	0.185	111	-0.12	0.90		-0.389	0.345
Change in Not Sure Rate		-0.326	0.207	304	-1.57	0.12		-0.732	0.081
Initial Trial Count		-0.001	0.001	111	-0.71	0.48		-0.004	0.002
Change in Trial Count		0.004	0.001	304	3.74	<.001	***	0.002	0.006
Gender * Change in Testosterone		0.007	0.003	304	2.14	0.03	*	0.001	0.014
Initial Age*Change in Testosterone		0.006	0.003	304	2.23	0.03	*	0.001	0.011
Initial Age * Gender		0.007	0.060	111	0.12	0.90		-0.112	0.127
Initial Age* Gender * Change in Testosterone		-0.007	0.004	304	-2.02	0.04	*	-0.015	0.000

Supplementary Figures

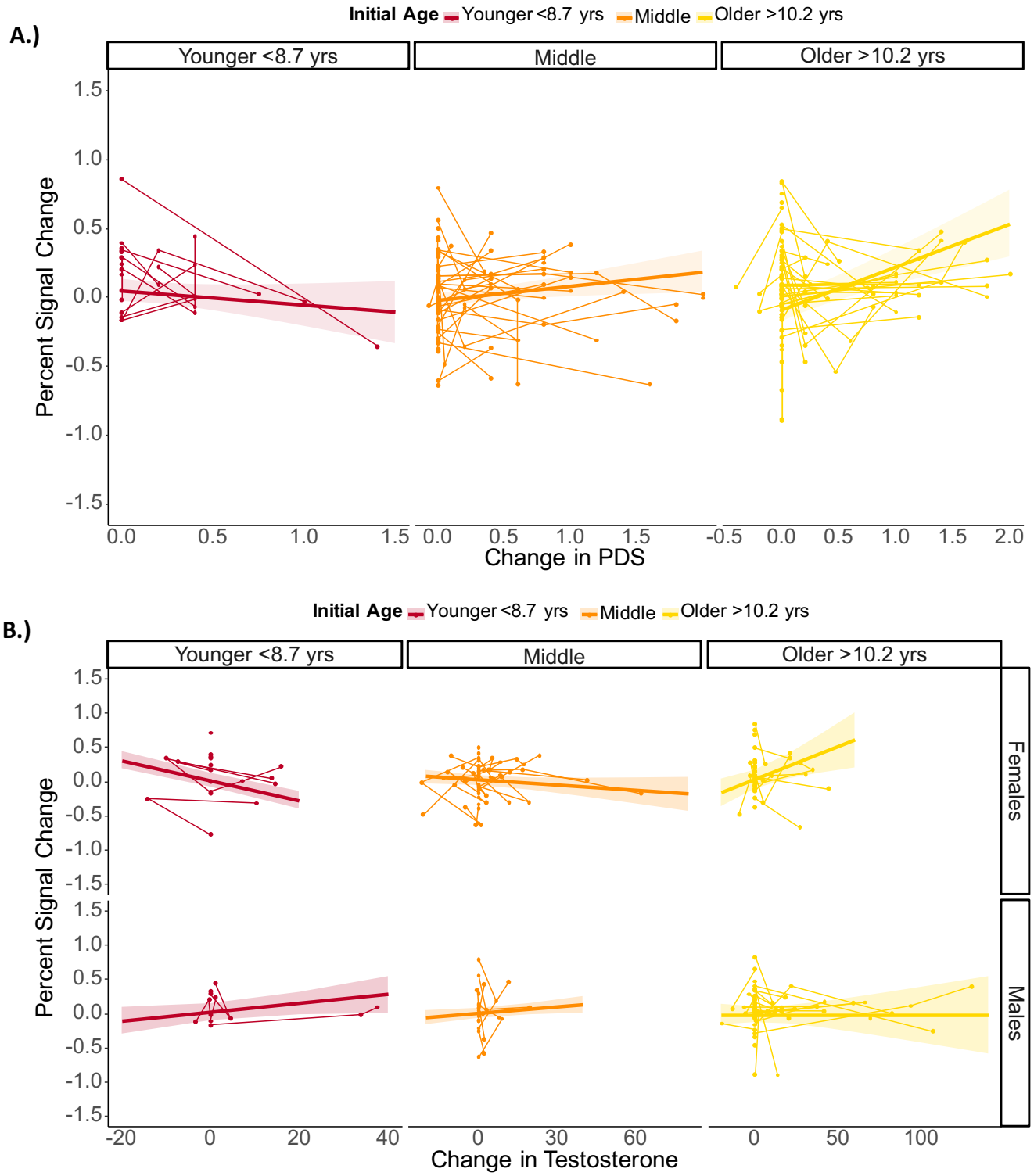

Figure 1. Longitudinal results for hippocampal item-context association activation. A.) depicts the change in puberty score by initial age interaction, and B.) depicts the change in testosterone by initial age by gender interaction. Individual values are plotted by points and individual participants are connected by horizontal lines. Participants were separated into three age groups based on initial age (younger <8.7 yrs, middle >8.7 and <10.2, older >10.2 yrs). The plotted regression lines were estimated from the full longitudinal models reported in the manuscript for three specific initial ages (8.7 years, 10.2 years, and 11.7 years).

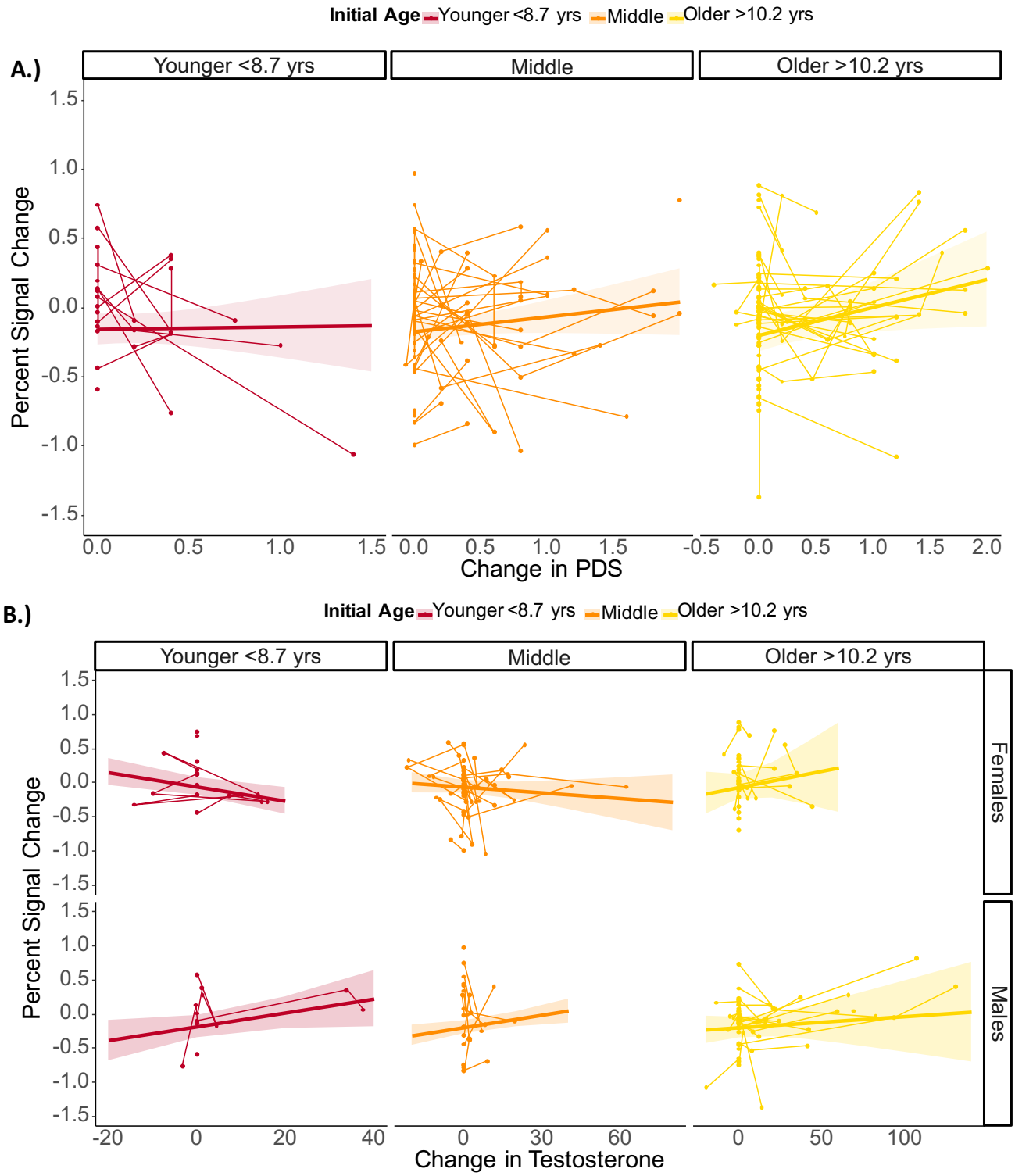

Figure 2. Longitudinal results for DLPFC item-context association activation. A.) depicts the change in puberty score by initial age interaction, and B.) depicts the change in testosterone by initial age by gender interaction. Individual values are plotted by points and individual participants are connected by horizontal lines. Participants were separated into three age groups based on initial age (younger <8.7 yrs, middle >8.7 and <10.2, older >10.2 yrs). The plotted regression lines were estimated from the full longitudinal models reported in the manuscript for three specific initial ages (8.7 years, 10.2 years, and 11.7 years).