

## Supplemental Material S2. Model selection for the raw variable analysis.

### Word Rate: Model Selected = Model 5

Model	df	AIC	BIC	Likelihood ratio test	$f^2$
<b>Model 1:</b> lmer(word rate ~ (Condition + Age + MattisTotal + DiseaseDuration + DiseaseSeverity + Education) + (1  Participant))	10	17.94	42.94	$\chi^2(1) = 1.88$ , $p = .170$	.05
<b>Model 2:</b> lmer(word rate ~ (Condition + Age + MattisTotal + DiseaseDuration + DiseaseSeverity) + (1  Participant))	9	17.94	40.33	$\chi^2(1) < 0.01$ , $p = .967$	0
<b>Model 3:</b> lmer(word rate ~ (Condition + Age + MattisTotal + DiseaseDuration) + (1  Participant))	8	15.83	35.83	$\chi^2(1) = 0.08$ , $p = .784$	0
<b>Model 4:</b> lmer(word rate ~ (Condition + Age + MattisTotal) + (1  Participant))	7	13.91	31.40	$\chi^2(1) = 1.08$ , $p = .299$	.04
<b>Model 5:</b> lmer(word rate ~ (Condition + Age) + (1  Participant))	6	12.99	27.98	$\chi^2(1) = 6.37$ , $p = .012$	.21
<b>Model 6:</b> lmer(word rate ~ (Condition) + (1  Participant))	5	17.36	29.86	$\chi^2(2) = 4.79$ , $p = .091$	.01
<b>Model 7:</b> lmer(word rate ~ 1 + (1  Participant))	3	18.15	25.65		

### Model 5 Parameters

lmer(word rate ~ (Condition + Age) + (1  Participants), data=data[abs(scale(resid(model5)))<2.5,], REML=FALSE)			
Effect	F	df	p
Condition	3.60	2, 57.17	.034
Age	7.28	1, 29.98	.011

Dual-processing speed:  $B = -0.002$ , Std Error  $B = 0.030$ ,  $t(57.19) = -0.06$ ,  $p = .953$

Dual-inhibition:  $B = -0.072$ , Std Error  $B = 0.031$ ,  $t(57.23) = -2.36$ ,  $p = .022$

### Syllable Rate: Model Selected = Model 5

Model	df	AIC	BIC	Likelihood ratio test	$f^2$
<b>Model 1:</b> lmer(syllable rate log ~ (Condition + Age + MattisTotal + DiseaseDuration + DiseaseSeverity + Education) + (1  Participant))	10	-273.06	-248.06	$\chi^2(1) = 3.05$ , $p = .081$	.09
<b>Model 2:</b> lmer(syllable rate log ~ (Condition + Age + MattisTotal + DiseaseDuration + DiseaseSeverity) + (1  Participant))	9	-272.00	-249.51	$\chi^2(1) < 0.01$ , $p = .958$	0
<b>Model 3:</b> lmer(syllable rate log ~ (Condition + Age + MattisTotal + DiseaseDuration) + (1  Participant))	8	-274.00	-254.00	$\chi^2(1) = 0.69$ , $p = .407$	.02
<b>Model 4:</b> lmer(syllable rate log ~ (Condition + Age + MattisTotal) + (1  Participant))	7	-275.31	-257.82	$\chi^2(1) = 0.02$ , $p = .899$	0
<b>Model 5:</b> lmer(syllable rate log ~ (Condition + Age) + (1  Participant))	6	-277.30	-262.30	$\chi^2(1) = 3.84$ , $p = .049$	.14
<b>Model 6:</b> lmer(syllable rate log ~ (Condition) + (1  Participant))	5	-275.46	-262.96	$\chi^2(2) = 3.82$ , $p = .148$	< .01
<b>Model 7:</b> lmer(syllable rate log ~ 1 + (1  Participant))	3	-275.64	-268.14		

### Model 5 Parameters

lmer(syllable ratelog ~ (Condition + Age) + (1 Participants), data=data[abs(scale(resid(model5)))<2.5,], REML=FALSE)			
Effect	F	df	p
Condition	2.89	2, 55.48	.064
Age	5.21	1, 29.34	.030

Dual-processing speed: B = 0.011, Std Error B = 0.006,  $t(55.47) = 2.03$ ,  $p = .048$

Dual-inhibition: B = -0.001, Std Error B = 0.062,  $t(55.42) = -0.14$ ,  $p = .888$

### RTs: Model Selected = Model 3

Model	df	AIC	BIC	Likelihood ratio test	$f^2$
<b>Model 1:</b> lmer(RTlog ~ (Task + Condition + Condition:Task + Age + MattisTotal + DiseaseDuration + DiseaseSeverity + Education) + (1  Participant))	11	-330.86	-300.20	$\chi^2(1) = 0.79$ , $p = .375$	.03
<b>Model 2:</b> lmer(RTlog ~ (Task + Condition + Condition:Task + Age + MattisTotal + DiseaseDuration + DiseaseSeverity) + (1  Participant))	10	-332.08	-304.20	$\chi^2(1) = 0.02$ , $p = .891$	0
<b>Model 3:</b> lmer(RTlog ~ (Task + Condition + Condition:Task + Age + MattisTotal + DiseaseDuration) + (1  Participant))	9	<b>-334.06</b>	<b>-308.97</b>	$\chi^2(1) = 10.94$ , <b><math>p &lt; .001</math></b>	<b>.24</b>
<b>Model 4:</b> lmer(RTlog ~ (Task + Condition + Condition:Task + Age + MattisTotal) + (1  Participant))	8	-325.12	-302.82	$\chi^2(1) = 0.13$ , $p = .714$	.02
<b>Model 5:</b> lmer(RTlog ~ (Task + Condition + Condition:Task + Age + (1  Participant))	7	-326.99	-307.47	$\chi^2(1) = 1.44$ , $p = .230$	.02
<b>Model 6:</b> lmer(RTlog ~ (Task + Condition + Condition:Task) + (1  Participant))	6	<b>-327.55</b>	<b>-310.82</b>	$\chi^2(1) = 13.20$ , <b><math>p &lt; .001</math></b>	<b>.05</b>
<b>Model 7:</b> lmer(RTlog ~ (Task + Condition) + (1  Participant))	5	<b>-316.35</b>	<b>-302.41</b>	$\chi^2(1) = 43.18$ , <b><math>p &lt; .001</math></b>	<b>.21</b>
<b>Model 8:</b> lmer(RTlog ~ (Task) + (1  Participant))	4	<b>-275.17</b>	<b>-264.02</b>	$\chi^2(1) = 63.80$ , <b><math>p &lt; .001</math></b>	<b>.47</b>
<b>Model 9:</b> lmer(RTlog ~ (1) + (1  Participant))	3	-213.37	-205.01		

### Model 3 Parameters

lmer(RTlog ~ (Task + Condition + Condition:Task + Age + MattisTotal + DiseaseDuration), data=data[abs(scale(resid(model3)))<2.5,], REML=FALSE)			
Effect	F	Df	p
Task	<b>234.89</b>	<b>1, 87.70</b>	<b>&lt; .001</b>
Condition	<b>67.07</b>	<b>1, 87.70</b>	<b>&lt; .001</b>
Condition by Task	<b>18.48</b>	<b>1, 87.72</b>	<b>&lt; .001</b>
Age	0.94	1, 29.37	.804
Mattis total	0.06	1, 29.61	.341
Disease duration	<b>15.45</b>	<b>1, 29.86</b>	<b>&lt; .001</b>

Post-hoc comparison for condition by task interaction (Tukey correction):

**Condition effect for processing speed: B = -0.095, Std Error B = 0.011,  $t(91.20) = -8.68$ ,  $p < .001$**

**Condition effect for inhibition: B = -0.030, Std Error B = 0.011,  $t(91.20) = -2.71$ ,  $p = .008$**