Supplementary Material

for

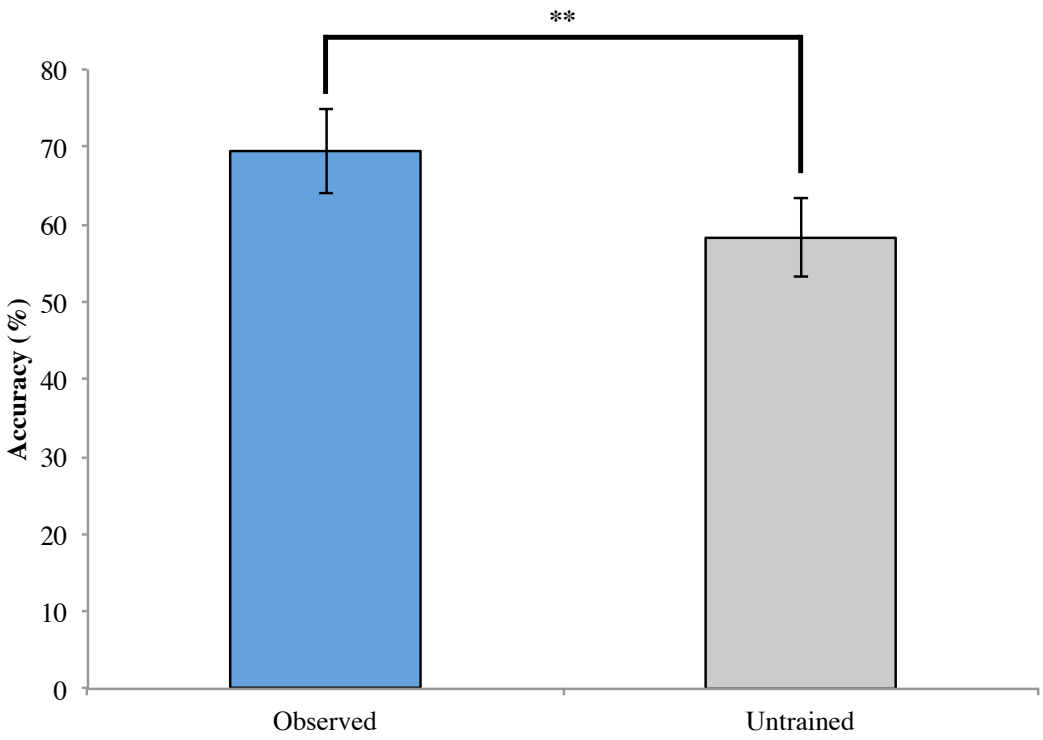
Using guitar learning to probe the Action Observation Network's response to visumotor familiarity

by Gardner, Aglinskas & Cross (2017), *Neuroimage*, 156, 174-189

The ROI contrast (p>0.0001)

***p < 0.001* uncorrected**								
R Precentral Gyrus	**4**	**27**	**-13**	**64**	**PrCG**	**12.62**	**5731**	**<0.001**
R Precentral Gyrus	4/5	-36	-16	58	**PrCG**	11.97		
R Middle Temporal Gyrus	39	51	-70	1	MTG	10.7		
R Inferior Frontal Gyrus	**44**	**57**	**11**	**7**	**IFG**	**6.65**	**46**	**0.002**
L Inferior Frontal Gyrus	**44**	**-57**	**5**	**-5**	**IFG**	**6.45**	**28**	**0.014**
L Inferior Frontal Gyrus	44	-45	2	-5	IFG	4.93		
R Putamen		**30**	**17**	**1**	**PUT**	**6.24**	**58**	**0.001**

Retest results of the guitar sequences that were observed



Retest results of the guitar sequences that were observed throughout the training process and untrained sequences from the observation condition. Accuracy is the % of notes hit. **p < 0.001; error bars represent the standard error of the mean.

Percent signal change analysis

To explore the changes in percent signal change across ROIs, two separate 10x2x2 repeated measures ANOVAs (one for execution and one for observation) for the variables Brain Region (10 ROI regions), Scanning Session (1 and 2), and Block (1 and 2). These ANOVAs enabled us to address three main questions: 1) does the percent signal change differ reliably across ROIs?; 2) Do we see a main effect of scanning session?; and 3) Do any differences between blocks emerge within scanning sessions? This final question enables us to address whether neural efficiency processes are at play, as this should manifest as reduced activity from block 1 to block 2, regardless of scan session.

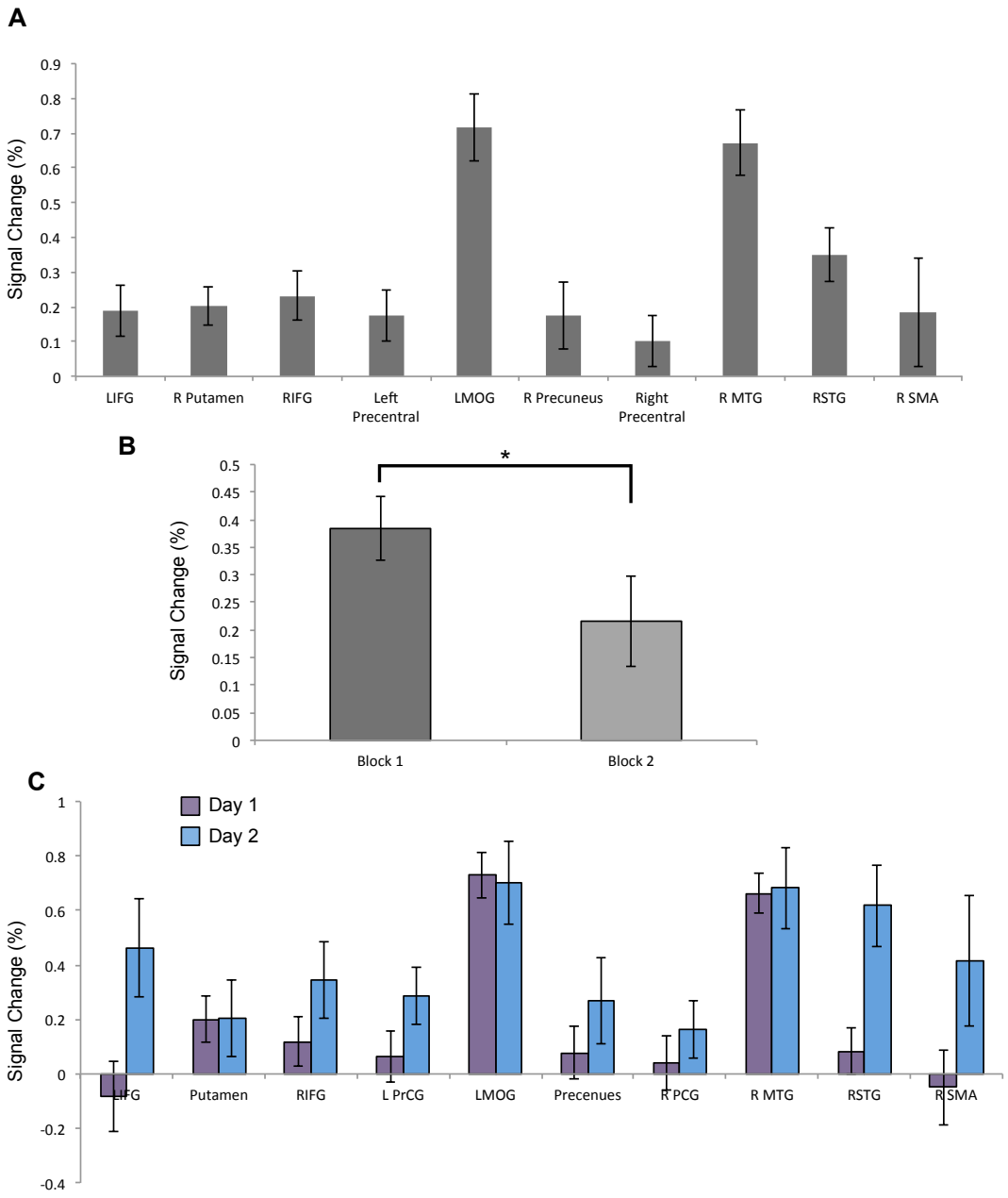


Figure I. Results of the repeated measures ANOVA on the percent signal change of the observation condition. ***A***, the main effect of Area, ***B***, the main effect of Block and ***C***, the interaction between scanning session and Area. Error bars represent the standard errors of the mean, * = $p<0.05$.

For the Observation condition, the repeated measures ANOVA revealed a main effect of Brain Region, $F(9, 171) = 9.91$, $p<0.001$, indicating reliable differences in average signal change across ROIs (shown in *Figure 11 A*). Post-hoc analyses (Bonferonni corrected) showed significant differences between LMOG (M=0.715, SE=0.094) and the following regions; LIFG (M=0.190, SE=0.073; p=0.005), right Putamen (M=0.203, SE=0.055; p=0.005), RIFG

(*M*=0.232, *SE*=0.069; *p*=0.006), L PrCG (*M*=0.175, *SE*=0.072; *p*=0.003), right Precuneus (*M*=0.173, *SE*=0.094; *p*<0.001), R PrCG (*M*=0.101, *SE*=0.071; *p*=0.001) and RSTG (*M*=0.351, *SE*=0.076; *p*=0.004). Significant differences also emerged between RMTG and the following regions; LIFG (*p*=0.018), right Putamen (*p*=0.009), RIFG (*p*=0.009), L PrCG (*p*=0.004), right Precuneus (*p*=0.001), R PrCG (*p*<0.001) and RSTG (*p*=0.005). These results clearly show that compared to the other ROIs, the signal percent change is greater for LMOG and RMTG, which could possibly be associated with the increased demands to be visually attentive to the palming actions during the Observation task. There was not a main effect of Scanning session, $F(1, 19) = 2.30$, $p=0.146$, but there is a main effect of Block, $F(1, 19) = 4.73$, $p=0.043$, indicating a difference between blocks within each scanning session (shown in *Figure 11 B*). Post-hoc analysis showed that the percent signal change was greater for the first Block (*M*=0.384, *SE*=0.058) than the second (*M*=0.216, *SE*=0.082; *p*=0.043). This provides support for the concept of neural efficiency, whereby activity should be reduced across blocks within each scanning session. However, this conclusion is tentative, as we did not find evidence for a significant main effect of Scanning session (a finding that would consolidate this conclusion if an overall reduction in activity from Scan Session 1 to 2 emerged). Finally for the observation condition, an interaction emerged between Area and Scan Session, $F(9, 18) = 4.73$, $p=0.003$ (shown in *Figure 11 C*). Driving this interaction is a difference between scan sessions amongst the ROIs. Right STG is the only region that survives the correction for multiple comparisons, with the percent signal change in Scanning session 2 (*M*=0.617, *SE*=0.150) significantly greater than Scanning session 1 (*M*=0.084, *SE*=0.086; *p*=0.012). As such, this brain region does not show the classic neural efficiency pattern of reduced engagement following increased practice. As such, this finding appears more in line with the direct matching hypothesis that postulates a (linear) increase in sensorimotor activity with familiarity.

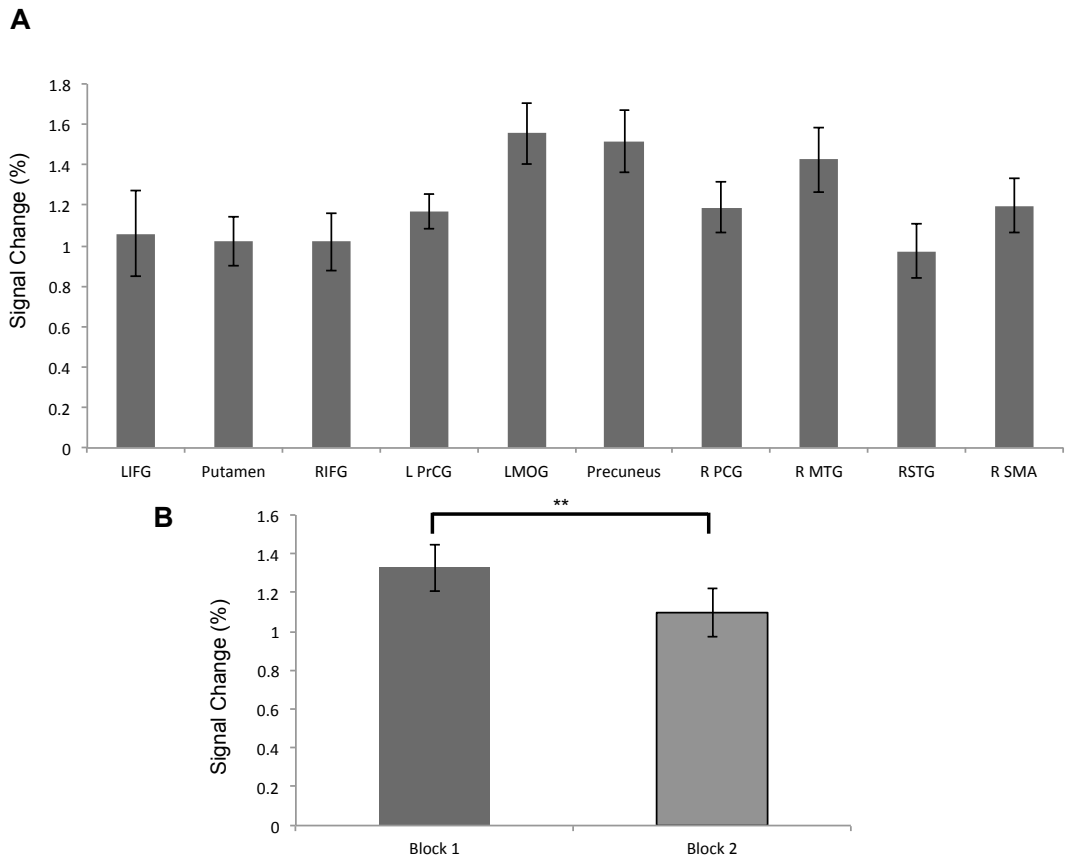


Figure II. Results of the repeated measures ANOVA on the percent signal change of the execution condition. ***A***, the main effect of Area, ***B***, the main effect of Block. Error bars represent the standard errors of the mean, * *= p<0.01.

For the Execution condition (illustrated in *Figure 12*), the repeated measures ANOVA revealed a main effect of Brain Region, $F(9, 171) = 5.456$, $p<0.001$, indicating reliable differences in average signal change across ROIs (shown in *Figure 12 A*). Post-hoc analysis (Bonferonni corrected) showed significant differences between right Precuneus (M=1.515, SE=0.152) and the following regions; right Putamen (M=1.021, SE=0.124; p=0.010), RIFG (M=1.018, SE=0.141; p=0.026) and RSTG (M=0.974, SE=0.137; p=0.007). These results show the percent signal change of the right Precuneus is greater than some regions tested, albeit not all. No main effect emerged for Scan Session, $F(1, 19) = 0.580$, p=0.456, whereas a main effect of Block was present, $F(1, 19) = 10.462$, p=0.004. Post-hoc analysis revealed that this difference (shown in *Figure 12 B),* like the observation condition, falls in line with the neural efficiency account; signal percent change was greater for the Block 1 (M=1.328, SE=0.120) than Block 2 (M=1.097, SE=0.124; p=0.004). No interactions emerged between any of the variables in the execution condition.