

1 **Supplementary material** for Van der Burght et al.: Differential contributions of inferior frontal gyrus  
 2 subregions to sentence processing guided by intonation

3  
 4 **Table S1:** Analysis of log response times. Results from linear mixed effects model including as fixed  
 5 effects the interaction terms TMS site (aIFG, pIFG, vertex) \* decision type (syntactic, semantic) and  
 6 focus position (subject, object) \* decision type. Random effects included by-subject random slopes  
 7 for the interaction between decision type and TMS site and for focus position, and random intercepts  
 8 for subject and items. Model formula:  $\log(\text{RT}) \sim \text{decision type} * \text{TMS site} + \text{decision type} * \text{focus}$   
 9  $\text{position} + (1 + \text{decision type} * \text{TMS site} + \text{focus position} | \text{subject}) + (1 | \text{item})$

| <i>fixed effect name</i>       |                             | <i>estimate</i> | <i>SE</i>           | <i>t</i> |       |       |        |       |
|--------------------------------|-----------------------------|-----------------|---------------------|----------|-------|-------|--------|-------|
| (Intercept)                    |                             | 6.615           | 0.027               | 247.648  |       |       |        |       |
| decision.syntactic             |                             | -0.103          | 0.017               | -5.882   |       |       |        |       |
| TMS.pIFG                       |                             | -0.023          | 0.028               | -0.824   |       |       |        |       |
| TMS.aIFG                       |                             | -0.007          | 0.028               | -0.251   |       |       |        |       |
| foc.subject                    |                             | 0.001           | 0.004               | 0.235    |       |       |        |       |
| decision.syntactic:TMS.pIFG    |                             | -0.027          | 0.014               | -1.933   |       |       |        |       |
| decision.syntactic:TMS.aIFG    |                             | -0.017          | 0.011               | -1.493   |       |       |        |       |
| decision.syntactic:foc.subject |                             | 0.012           | 0.002               | 5.590    |       |       |        |       |
| <i>random effect group</i>     | <i>random effect name</i>   | <i>SD</i>       | <i>correlations</i> |          |       |       |        |       |
| item                           | (Intercept)                 | 0.038           |                     |          |       |       |        |       |
| subj                           | (Intercept)                 | 0.142           |                     |          |       |       |        |       |
|                                | decision.syntactic          | 0.093           | 0.030               |          |       |       |        |       |
|                                | TMS.pIFG                    | 0.153           | 0.199               | 0.091    |       |       |        |       |
|                                | TMS.aIFG                    | 0.148           | 0.136               | 0.100    | 0.455 |       |        |       |
|                                | foc.subject                 | 0.017           | -0.306              | 0.048    | 0.258 | 0.063 |        |       |
|                                | decision.syntactic:TMS.pIFG | 0.077           | 0.365               | -0.343   | 0.139 | 0.243 | -0.100 |       |
|                                | decision.syntactic:TMS.aIFG | 0.055           | 0.218               | -0.318   | 0.345 | 0.261 | -0.367 | 0.515 |
|                                | Residual                    | 0.253           |                     |          |       |       |        |       |

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13 **Table S2:** Analysis of accuracy rates. Results from generalized linear mixed effects model including as  
 14 fixed effects the interaction terms TMS site (aIFG, pIFG, vertex) \* decision type (syntactic, semantic)  
 15 and focus position (subject, object) \* decision type. Random effects included intercepts for subjects  
 16 and items, and by-subject slopes for decision type and TMS site. Model formula: response ~ decision  
 17 type \* TMS + decision type \* focus position + (1 + decision type + TMS site | subject) + (1 | item)  
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| <i>fixed effect</i>            |                           | <i>estimate</i> | <i>SE</i>           | <i>z</i> | <i>p</i> |
|--------------------------------|---------------------------|-----------------|---------------------|----------|----------|
| (Intercept)                    |                           | 2.368           | 0.189               | 12.560   | <.001    |
| decision.syntactic             |                           | 0.153           | 0.068               | 2.253    | 0.024    |
| TMS.pIFG                       |                           | -0.391          | 0.155               | -2.531   | 0.011    |
| TMS.aIFG                       |                           | -0.156          | 0.146               | -1.070   | 0.285    |
| foc.subject                    |                           | 0.108           | 0.023               | 4.608    | <.001    |
| decision.syntactic:TMS.pIFG    |                           | 0.001           | 0.060               | 0.013    | 0.989    |
| decision.syntactic:TMS.aIFG    |                           | 0.020           | 0.061               | 0.334    | 0.738    |
| decision.syntactic:foc.subject |                           | -0.076          | 0.023               | -3.236   | 0.001    |
| <i>random effect group</i>     | <i>random effect name</i> | <i>SD</i>       | <i>correlations</i> |          |          |
| item                           | (Intercept)               | 0.280           |                     |          |          |
| subj                           | (Intercept)               | 0.966           |                     |          |          |
|                                | decision.syntactic        | 0.268           | 0.747               |          |          |
|                                | TMS.pIFG                  | 0.756           | -0.408              | -0.352   |          |
|                                | TMS.aIFG                  | 0.689           | -0.189              | -0.206   | 0.524    |

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21 **Table S3:** Analysis of log response times in function of electric field (Efield) strength. Results from  
 22 linear mixed effects model including as fixed effects the interaction terms Efield-aIFG \* decision type  
 23 (syntactic, semantic), Efield-pIFG \* decision type, decision type \* focus position (subject, object), and  
 24 session number as main effect. Random effects included intercepts for subjects and items, and by-  
 25 subject slopes for decision type and focus position. Model formula:  $\log(RT) = Efield\text{-}aIFG * decision$   
 26  $type + Efield\text{-}pIFG * decision\ type + decision\ type * focus\ position + session\ number + (1 + decision$   
 27  $type + focus\ position | subject) + (1 | item)$ .  
 28

| <i>fixed effect</i>            | <i>estimate</i>           | <i>SE</i> | <i>t</i>            |        |
|--------------------------------|---------------------------|-----------|---------------------|--------|
| (Intercept)                    | 6.701                     | 0.038     | 176.274             |        |
| Efield.aIFG                    | 0.001                     | 0.009     | 0.065               |        |
| decision.syntactic             | -0.118                    | 0.020     | -5.800              |        |
| Efield.pIFG                    | -0.017                    | 0.005     | -3.333              |        |
| sess.no2                       | -0.101                    | 0.007     | -14.732             |        |
| sess.no3                       | -0.192                    | 0.007     | -27.604             |        |
| foc.subject                    | -0.001                    | 0.004     | -0.049              |        |
| Efield.aIFG:decision.syntactic | -0.043                    | 0.008     | -5.395              |        |
| decision.syntactic:Efield.pIFG | -0.010                    | 0.005     | -2.020              |        |
| decision.syntactic:foc.subject | 0.010                     | 0.002     | 4.221               |        |
| <i>random effect group</i>     | <i>random effect name</i> | <i>SD</i> | <i>correlations</i> |        |
| item                           | (Intercept)               | 0.036     |                     |        |
| subj                           | (Intercept)               | 0.204     |                     |        |
|                                | decision.syntactic        | 0.109     | 0.382               |        |
|                                | foc.subject               | 0.015     | -0.093              | -0.080 |
| Residual                       |                           | 0.260     |                     |        |

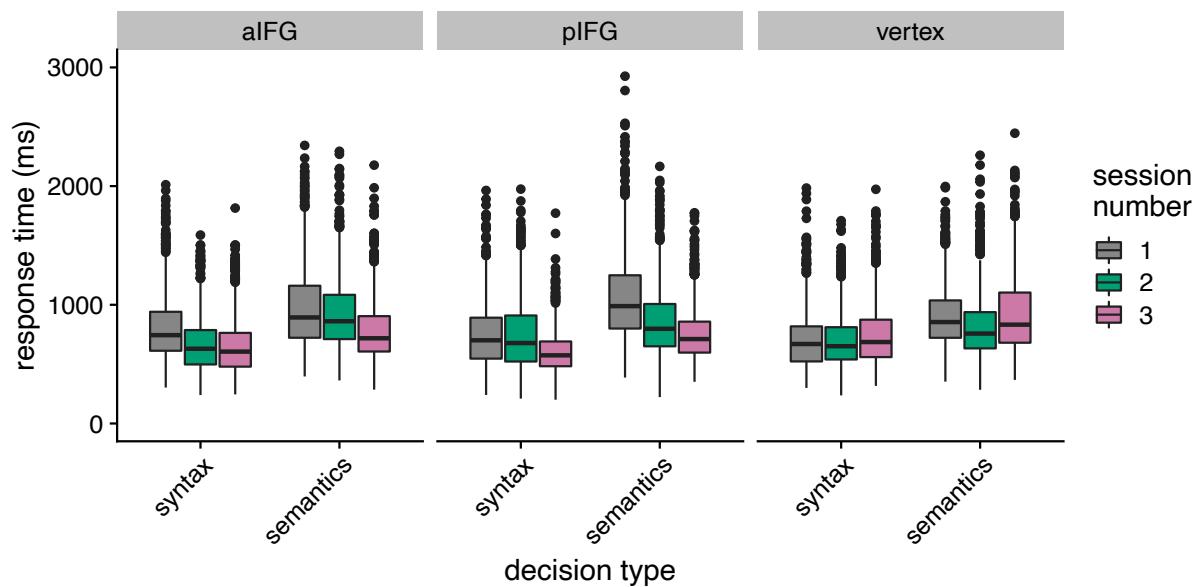
29  
 30 **Table S4:** Analysis of accuracy rates in function of electric field (Efield) strength. Results from  
 31 generalised linear mixed effects model including as fixed effects the interaction terms Efield-aIFG \*  
 32 decision type (syntactic, semantic), Efield-pIFG \* decision type, decision type \* focus position  
 33 (subject, object), and session number as main effect. Random effects included intercepts for subjects  
 34 and items. Model formula:  $response = Efield\text{-}aIFG * decision\ type + Efield\text{-}pIFG * decision\ type +$   
 35  $decision\ type * focus\ position + session\ number + (1 + decision\ type + violation\ type | subject) + (1 |$   
 36  $item)$

| <i>fixed effect</i>            | <i>estimate</i>           | <i>SE</i> | <i>z</i>            | <i>p</i> |
|--------------------------------|---------------------------|-----------|---------------------|----------|
| (Intercept)                    | 1.538                     | 0.199     | 7.719               | <.001    |
| Efield.aIFG                    | 0.007                     | 0.097     | 0.076               | 0.939    |
| decision.syntactic             | 0.176                     | 0.061     | 2.859               | 0.004    |
| Efield.pIFG                    | -0.159                    | 0.066     | -2.417              | 0.016    |
| sess.no2                       | 0.580                     | 0.080     | 7.277               | <.001    |
| sess.no3                       | 0.982                     | 0.087     | 11.322              | <.001    |
| foc.subject                    | 0.021                     | 0.083     | 0.260               | 0.795    |
| Efield.aIFG:decision.syntactic | -0.014                    | 0.052     | -0.266              | 0.790    |
| decision.syntactic:Efield.pIFG | -0.036                    | 0.053     | -0.687              | 0.492    |
| decision.syntactic:foc.subject | -0.064                    | 0.029     | -2.221              | 0.026    |
| <i>random effect group</i>     | <i>random effect name</i> | <i>SD</i> | <i>correlations</i> |          |
| item                           | (Intercept)               | 0.246     |                     |          |
| subj                           | (Intercept)               | 1.004     |                     |          |
|                                | decision.syntactic        | 0.240     | 0.814               |          |
|                                | foc.subject               | 0.413     | -0.272              | -0.090   |

37 **Table S5:** Acoustic analysis of the experimental stimuli. For each noun phrase, minimum and  
 38 maximum pitch and mean intensity were extracted (measured across the duration of the noun  
 39 phrase). The means (and standard deviations) across all stimuli are displayed here. Note the marked  
 40 differences in pitch and intensity when each noun phrase was in focus as compared to when the  
 41 noun phrase was not in focus. These differences were significant for the pitch differences (subject  
 42 noun phrase:  $z = -5.84$ ,  $p < .001$ ; object noun phrase  $z = -5.81$ ,  $p < .001$ ) as well as for intensity (subject:  
 43  $t(44) = 5.42$ ,  $p < .001$ ; object:  $t(44) = -11.63$ ,  $p < .001$ ). The effect for intensity was tested using a paired  
 44 t-test, whereas pitch differences were tested with a Wilcoxon paired rank test because normality  
 45 assumptions were not met.  
 46

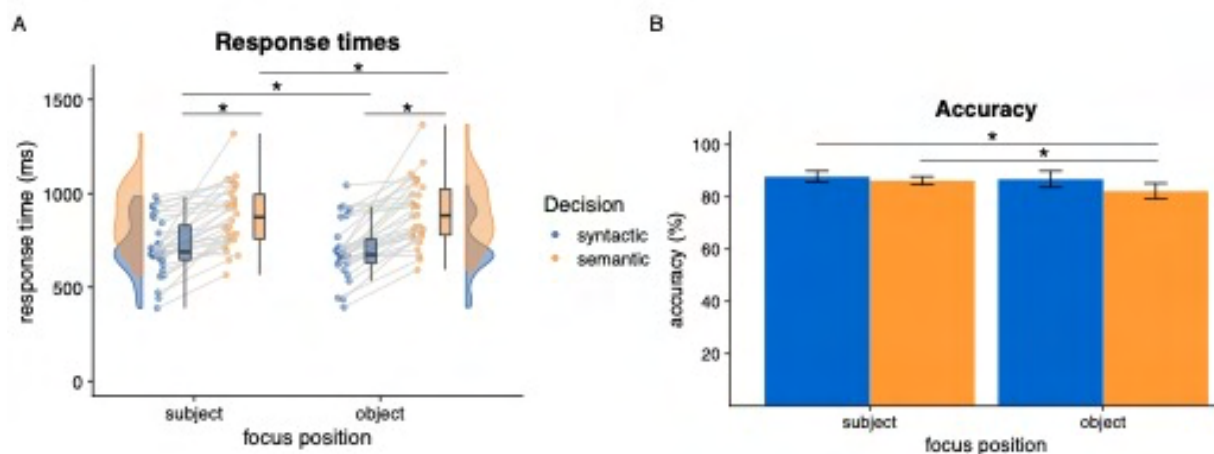
| Noun phrase | Focus   | $\Delta$ Pitch (Hz) | Intensity (Db) |
|-------------|---------|---------------------|----------------|
| subject     | subject | 103,6 (14,0)        | 61,7 (1,9)     |
| subject     | object  | 49,1 (11,0)         | 60,7 (1,9)     |
| object      | subject | 31,2 (21,4)         | 58,8 (2,1)     |
| object      | object  | 108,5 (15,4)        | 61,9 (2,0)     |

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48

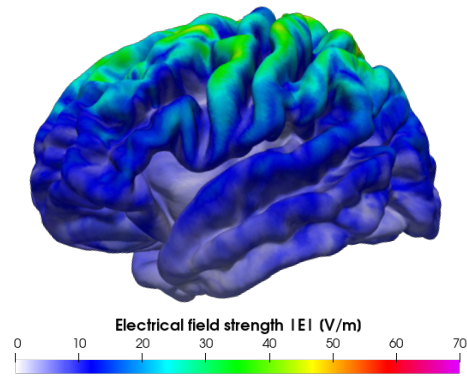
49 **Supplementary Figure 1** Response times for both tasks and all TMS conditions, separately for each  
 50 experimental session.



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53 **Supplementary Figure 2** Response times and accuracy rates in function of decision type and focus  
 54 position, across all TMS sessions.

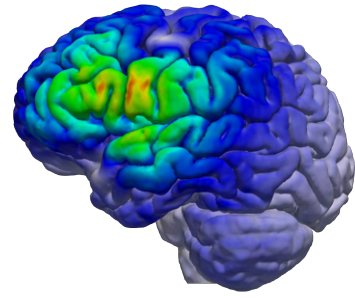
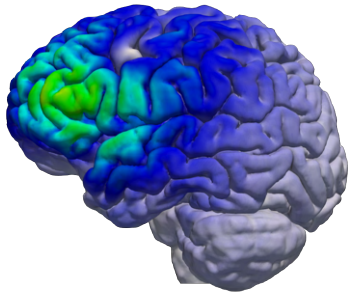


55  
56 **Supplementary Figure 3** Electric field induced by TMS for the vertex stimulation condition in a  
57 representative sample subject.

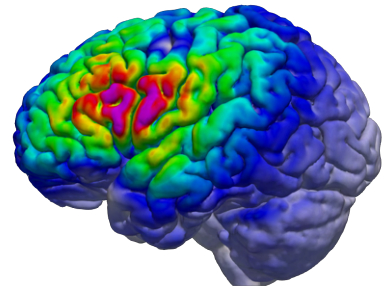
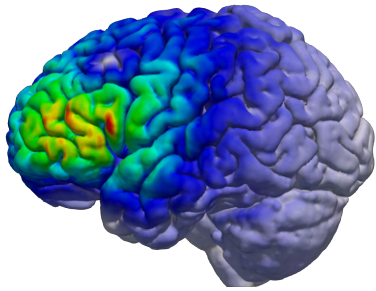
aIFG session

pIFG session

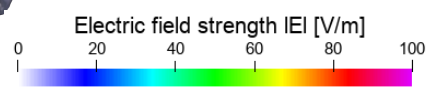
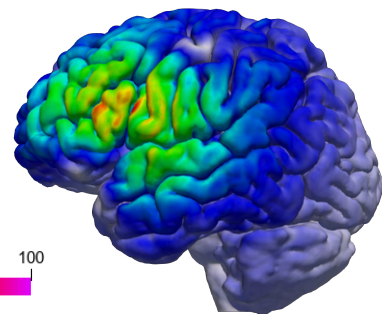
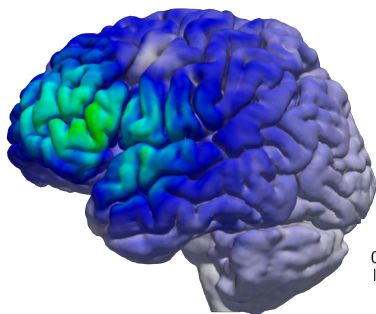
subject 1



subject 2



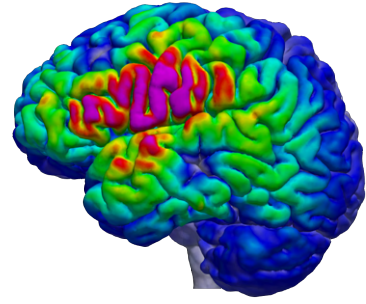
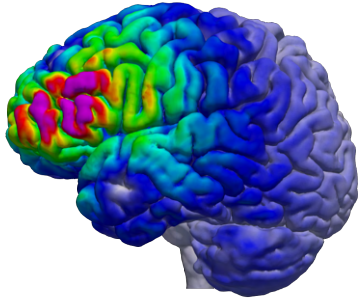
subject 3



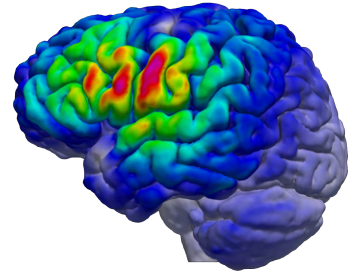
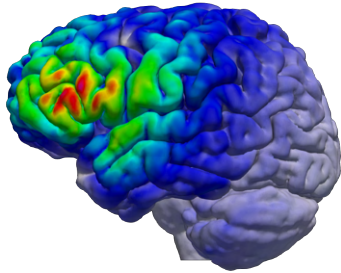
aIFG session

pIFG session

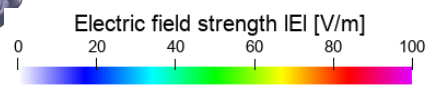
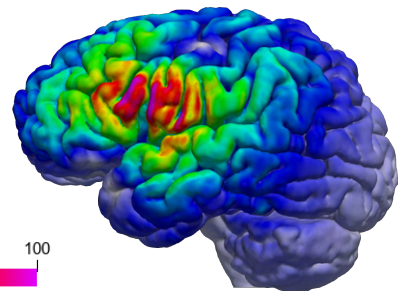
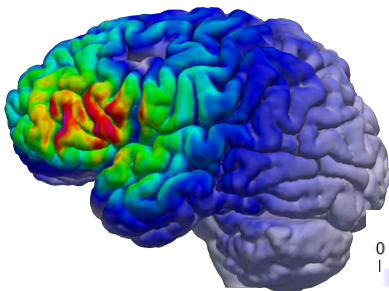
subject 4



subject 5



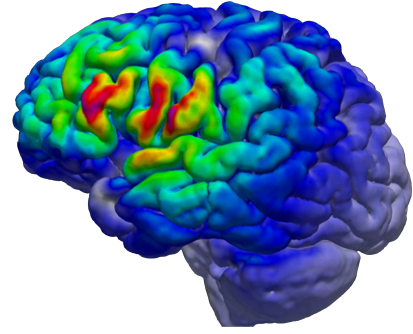
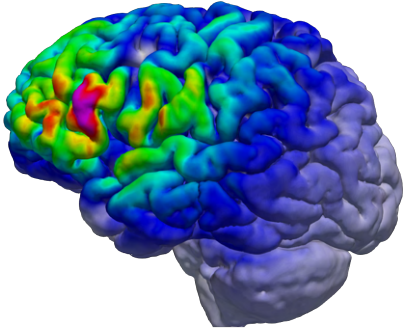
subject 6



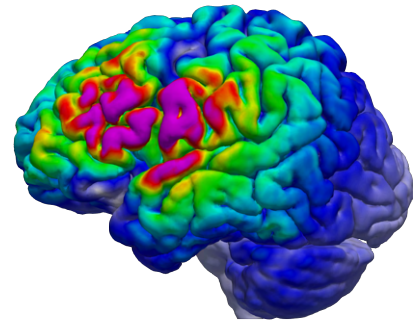
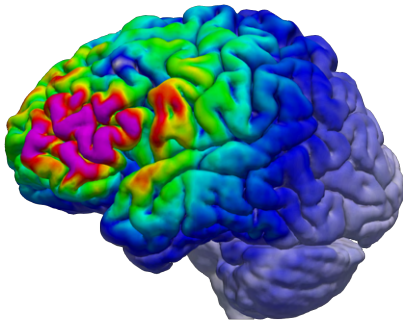
aIFG session

pIFG session

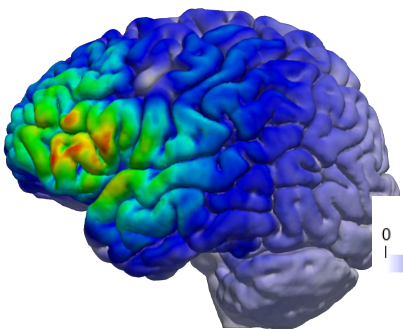
subject 7



subject 8

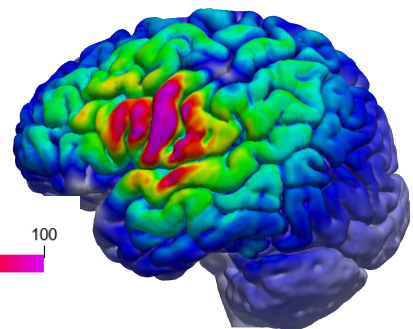


subject 9



Electric field strength  $|E|$  [V/m]

0 20 40 60 80 100

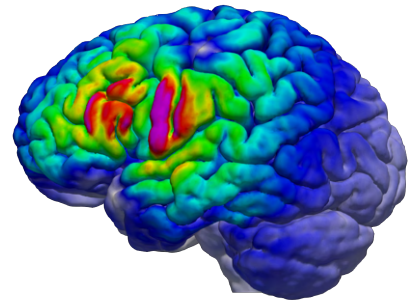
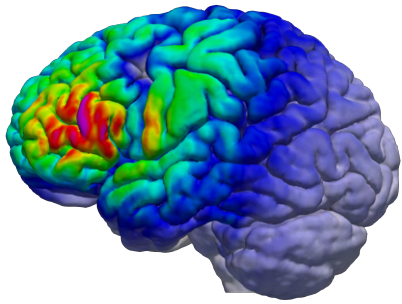




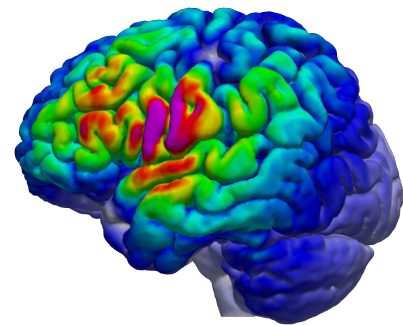
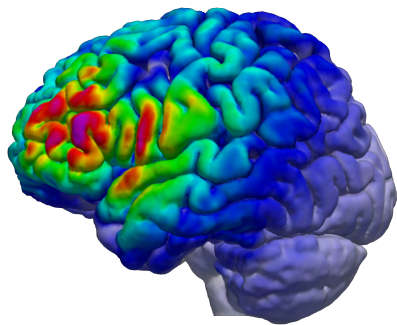
aIFG session

pIFG session

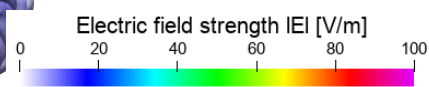
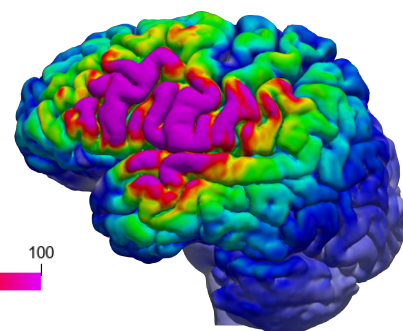
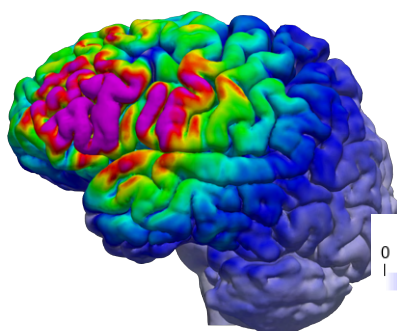
subject 10



subject 11



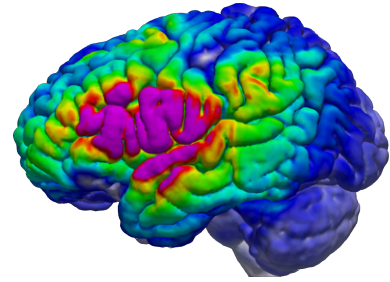
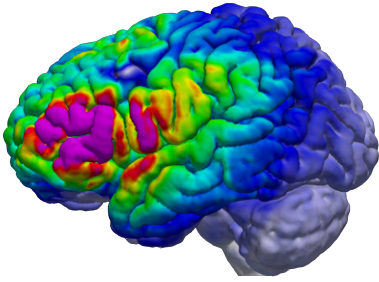
subject 12



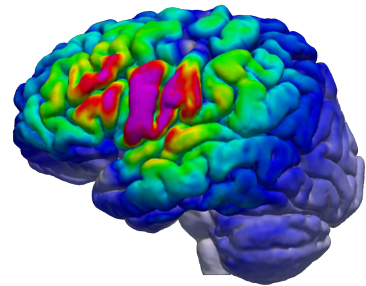
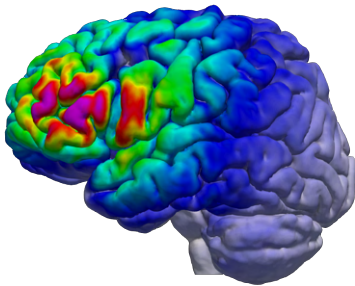
aIFG session

pIFG session

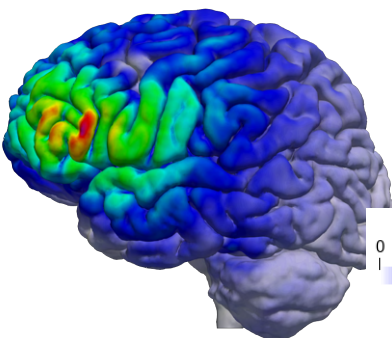
subject 13



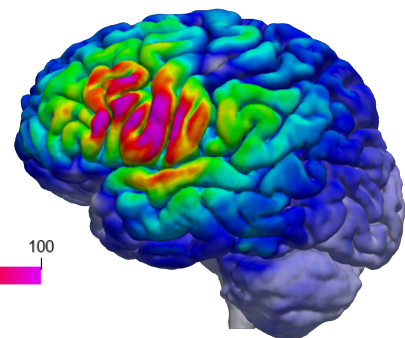
subject 14



subject 15



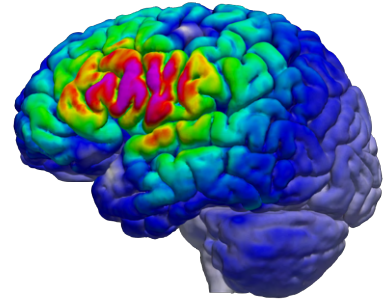
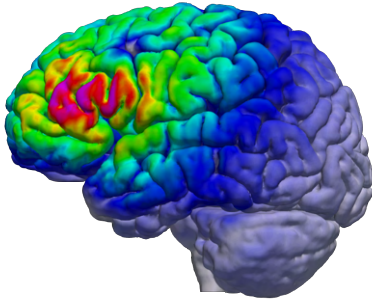
Electric field strength  $|E|$  [V/m]

A horizontal color scale bar ranging from 0 to 100 V/m. The colors transition from blue at 0, through green, yellow, and orange, to red at 100.

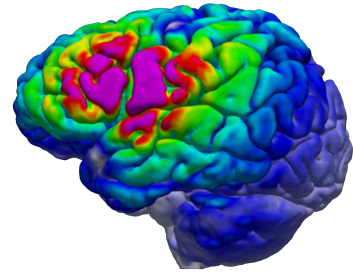
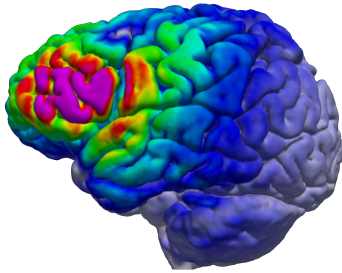
aIFG session

pIFG session

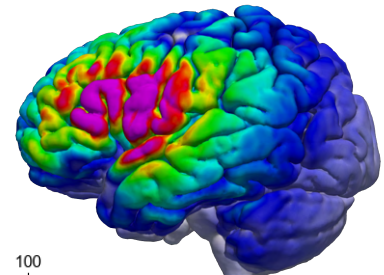
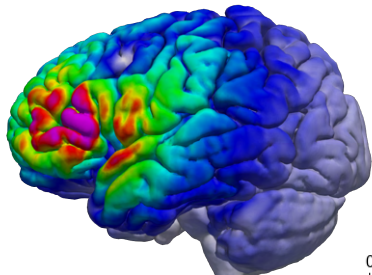
subject 16



subject 17



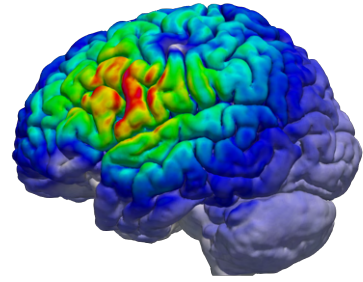
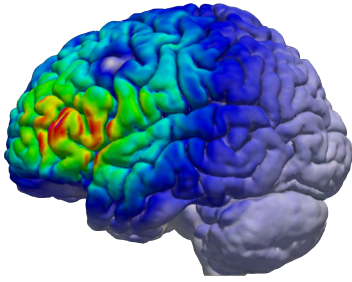
subject 18



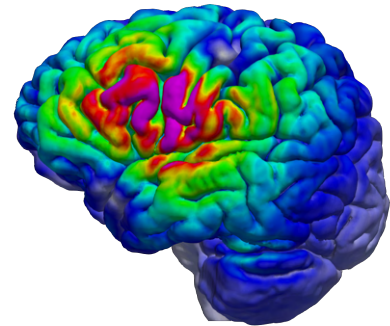
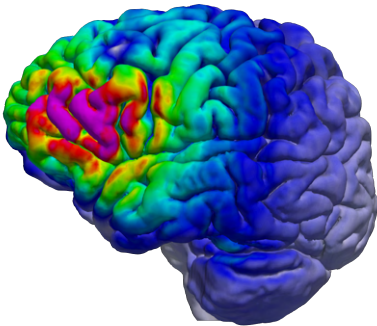
aIFG session

pIFG session

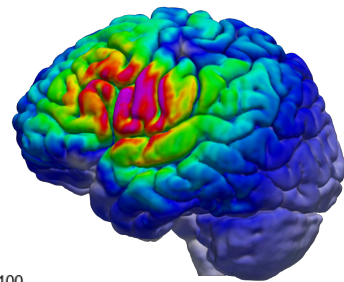
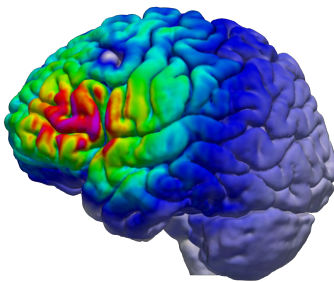
subject 19



subject 20



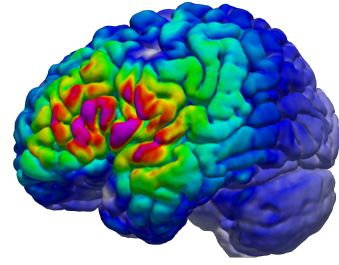
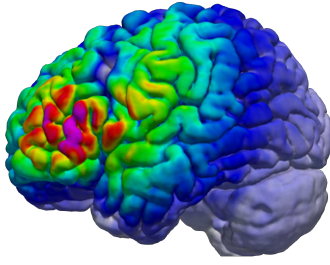
subject 21



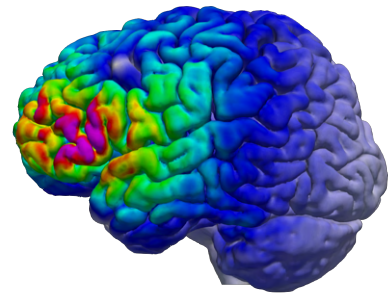
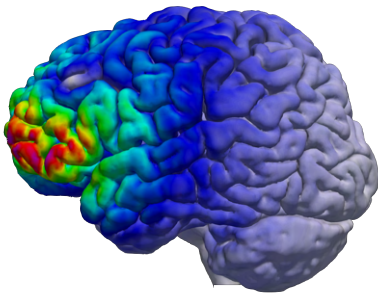
aIFG session

pIFG session

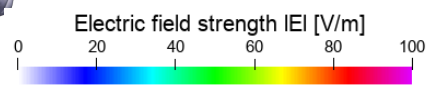
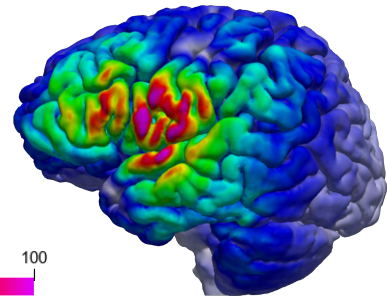
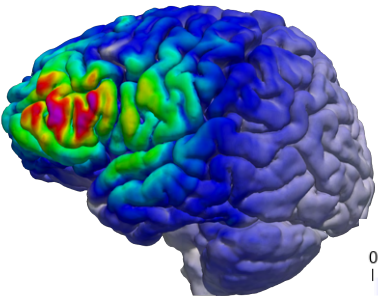
subject 22



subject 23



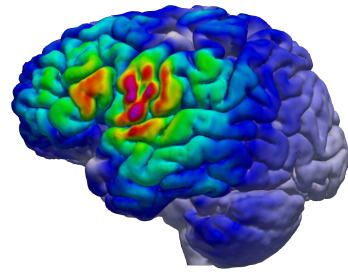
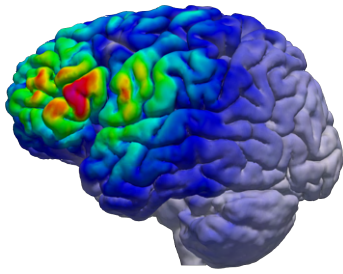
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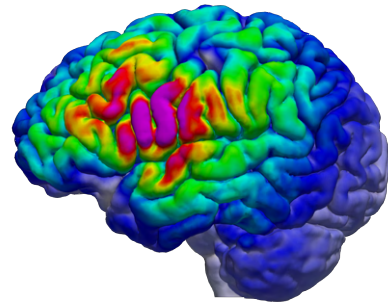
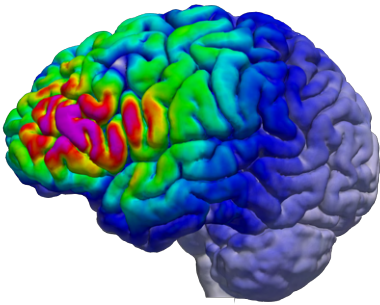
aIFG session

pIFG session

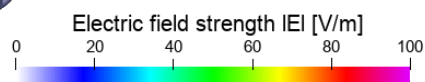
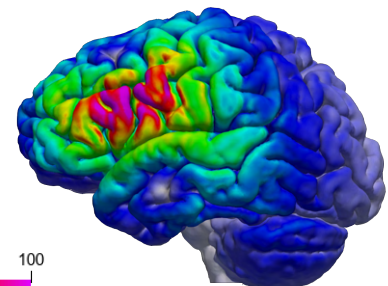
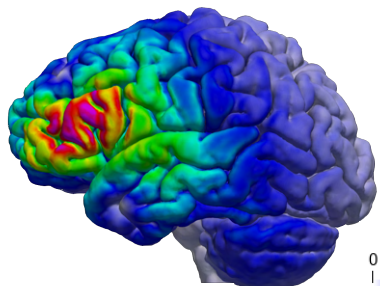
subject 25



subject 26



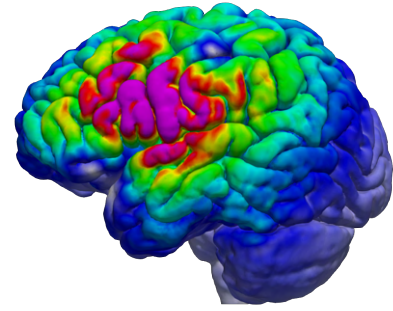
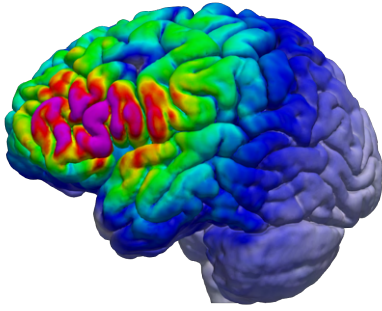
subject 27



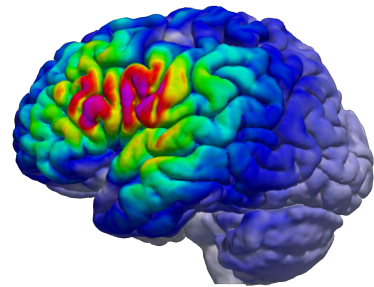
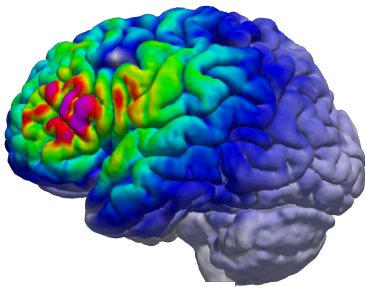
aIFG session

pIFG session

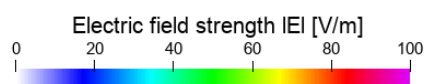
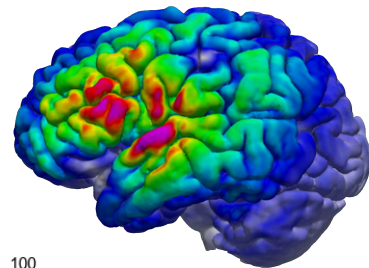
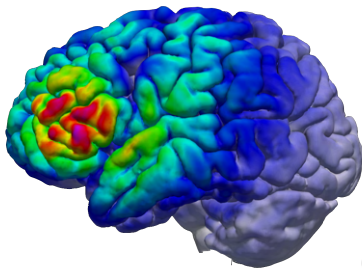
subject 28



subject 29



subject 30



Supplementary Figure 4: Electric fields induced by TMS for the aIFG and pIFG stimulation conditions for each experimental subject. The legend shows induced electrical fields (V/m).