Supplemental Material to "Effective Connectivity Inference in the Whole-Brain Network by Using rDCM Method for Investigating the Distinction between Emotional States in fMRI Data"

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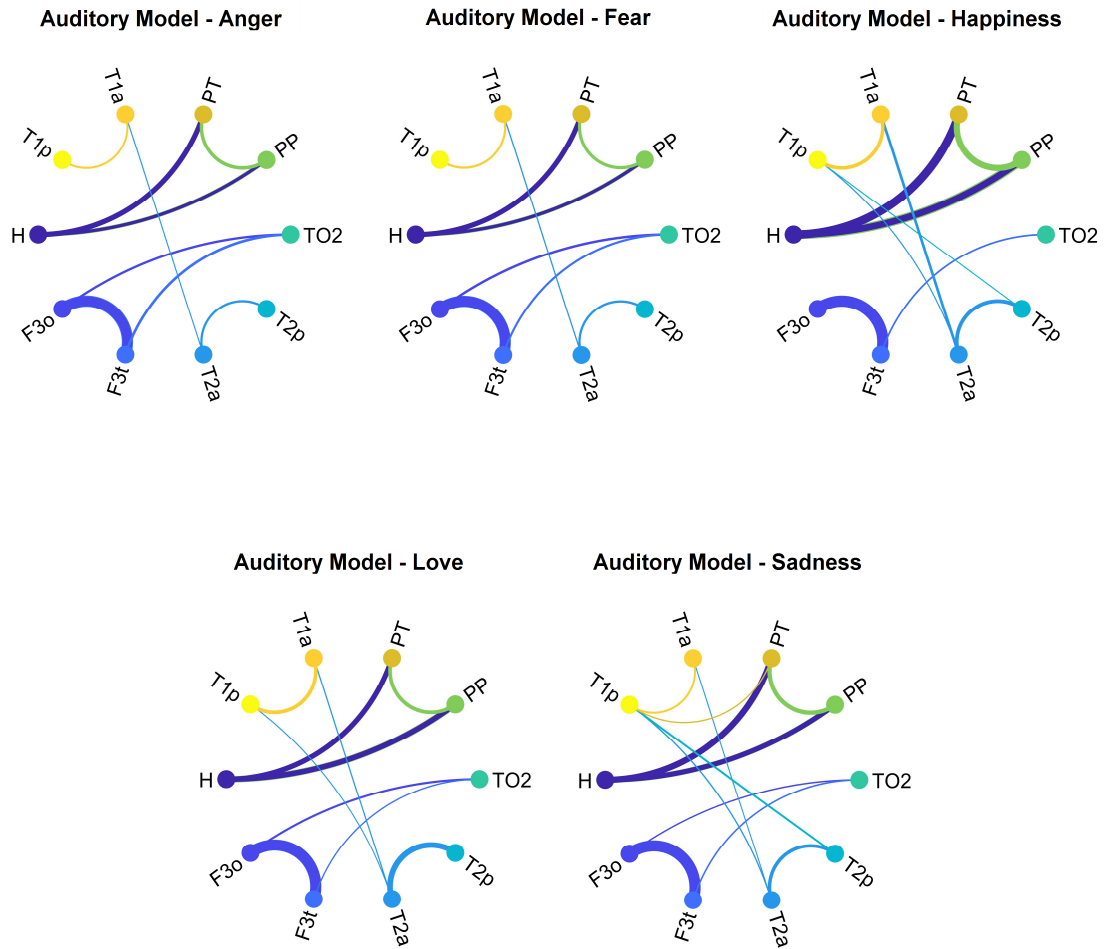Islamic Azad University Science and Research Branch, Tehran, Iran.
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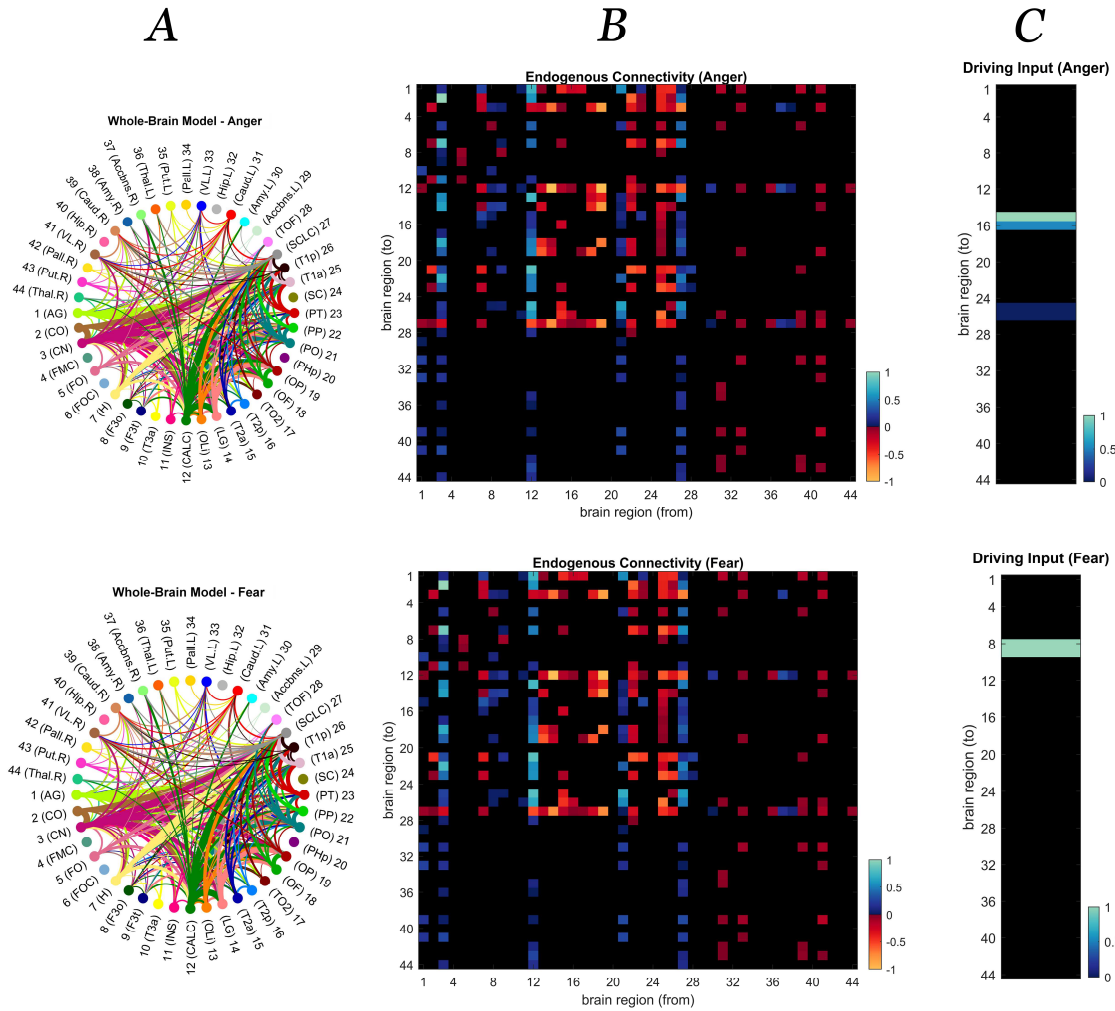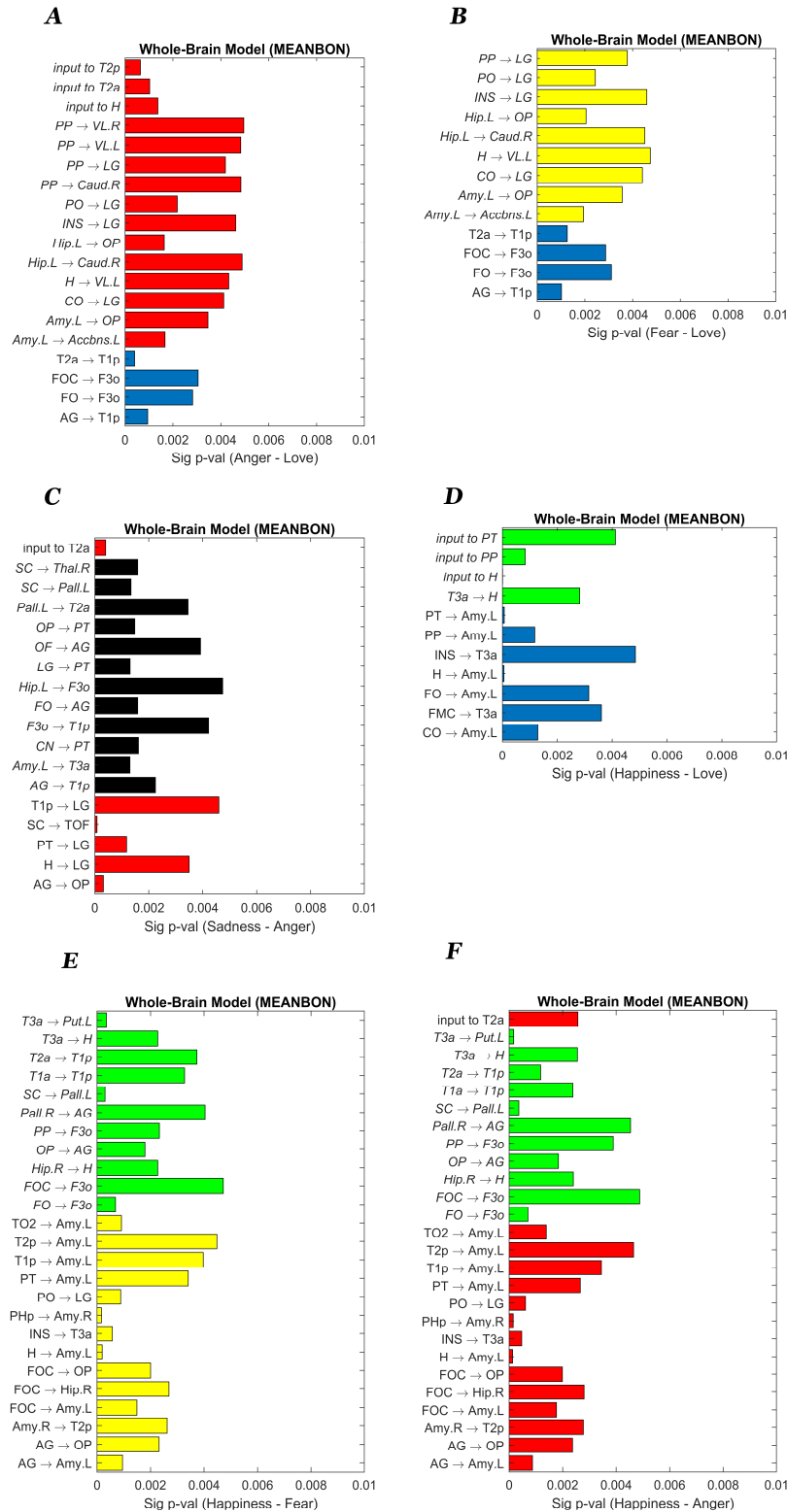
Fig. S1. Pattern of coupling between regions (*A* matrix) in the auditory model in five emotions. Each connection is displayed as an edge between two nodes (by abbreviation) that the width of each edge represents the strength of each connection. The absolute strength of connectivity was shown. We used the codes that are available at https://github.com/paul-kassebaum-mathworks/circularGraph to illustrate the strength of connections.
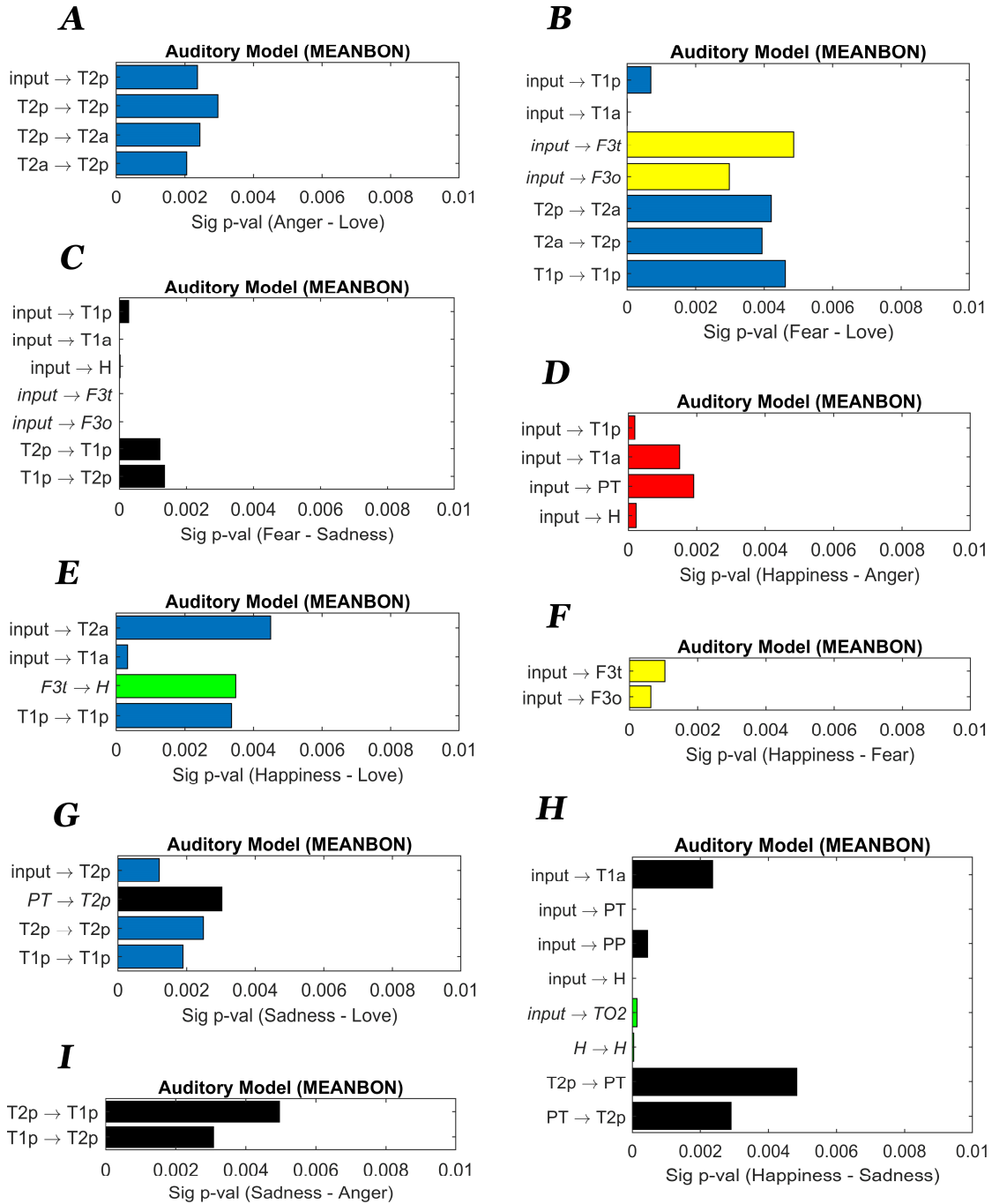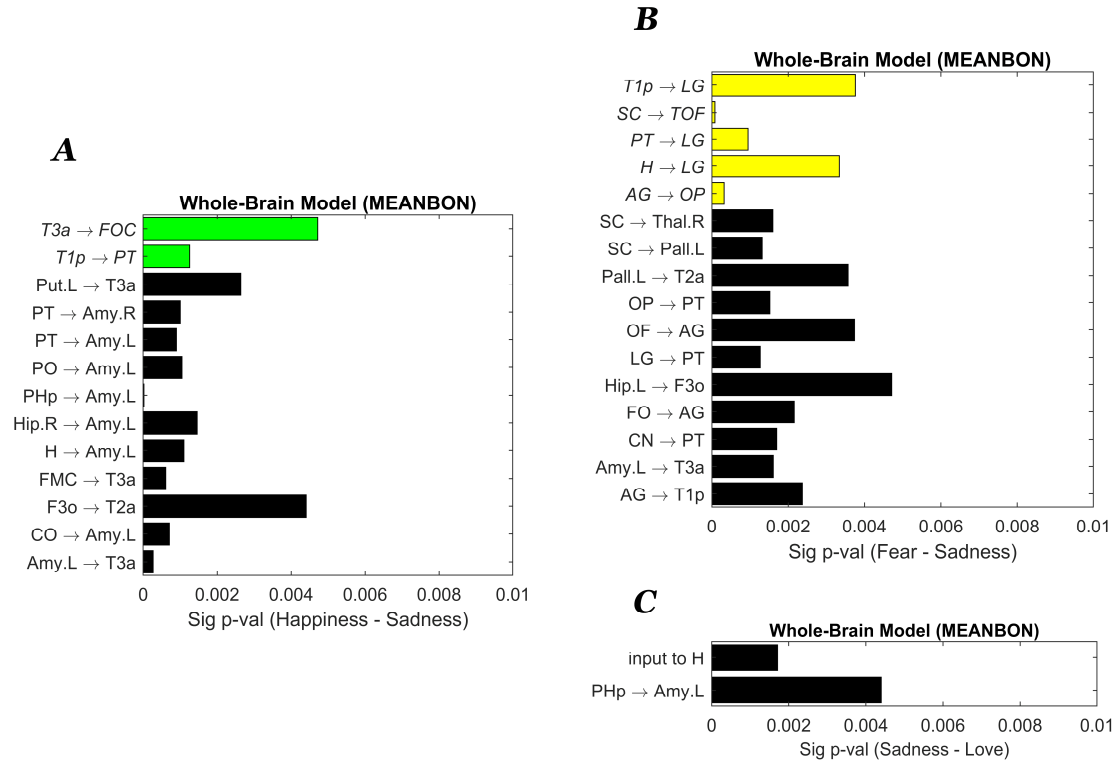
Fig. S2. Significant coupling between regions (*A* matrix) and driving inputs (*C* matrix) in the auditory model (by test statistic of mean-difference) between emotions of (**A**) anger and love, (**B**) fear and love, (**C**) fear and sadness, (**D**) happiness and anger, (**E**) happiness and love, (**F**) happiness and fear, (**G**) sadness and love, (**H**) happiness and sadness, (**I**) sadness and anger. The values of connections were Bonferroni-corrected ($p \leq 0.005$). The connections' color indicates that the mean value of connections of all subjects in one emotion is higher than another. Belonging to anger, fear, happiness, love, and sadness is demonstrated by red, yellow, green, blue, and black, respectively.

Fig. S3. Whole-brain effective connectivity pattern in Anger and Fear. The values of inhibitory connections were normalized between -1 and 0, and excitatory connections were normalized between 0 and 1. **(A)** Coupling between regions in the whole-brain model. The absolute strength of connectivity (after normalization) was shown. Each connection is displayed as an edge between two nodes (by abbreviation) that the width of each edge represents the strength of each connection. The color of each edge represents the direction of connection, that takes the color of the first node. We used the codes that are available at https://github.com/paul-kassebaum-mathworks/circularGraph to illustrate the strength of connections. **(B)** Endogenous connectivity architecture (*A* matrix). **(C)** Driving inputs (*C* matrix).

Fig. S4. Significant coupling between regions (*A* matrix) and driving inputs (*C* matrix) in the whole-brain model (by test statistic of mean-difference) between emotions of **(A)** anger and love, **(B)** fear and love, **(C)** sadness and anger, **(D)** happiness and love, **(E)** happiness and fear, **(F)** happiness and anger. The values of connections were Bonferroni-corrected ($p \leq 0.005$). The connections' color indicates that the mean value of connections of all subjects in one emotion is higher than another. Belonging to anger, fear, happiness, love, and sadness is demonstrated by red, yellow, green, blue, and black, respectively.

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Fig. S5. Significant coupling between regions (*A* matrix) and driving inputs (*C* matrix) in the whole-brain model (by test statistic of mean-difference) between emotions of **(A)** happiness and sadness, **(B)** fear and sadness, **(C)** sadness and love. The values of connections were Bonferroni-corrected ($p \leq 0.005$). The connections' color indicates that the mean value of connections of all subjects in one emotion is higher than another. Belonging to happiness, love, and sadness is demonstrated by green, blue, and black, respectively.