

Neurophysiological Fluctuation Detects Mental Fatigue Prior to Subjective Awareness

Supplementary Information

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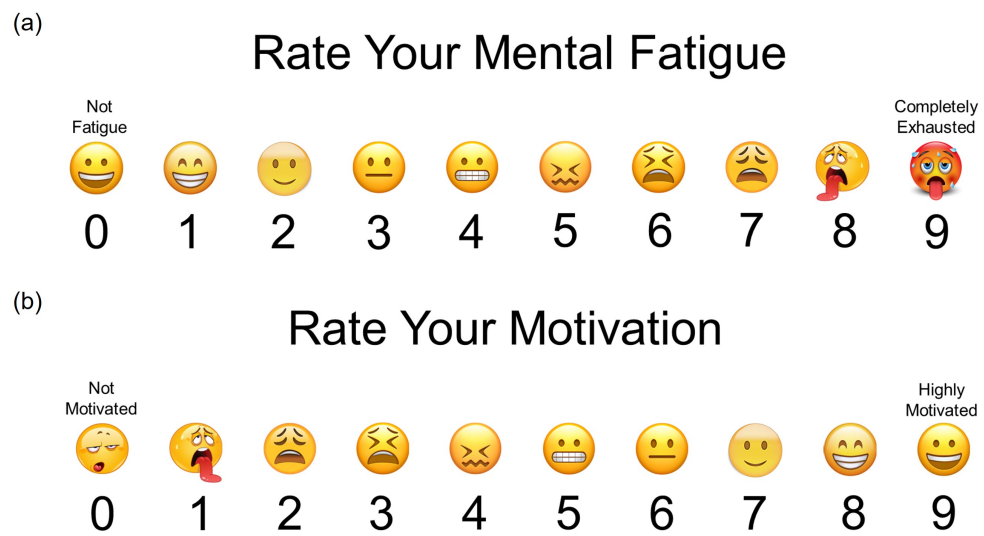
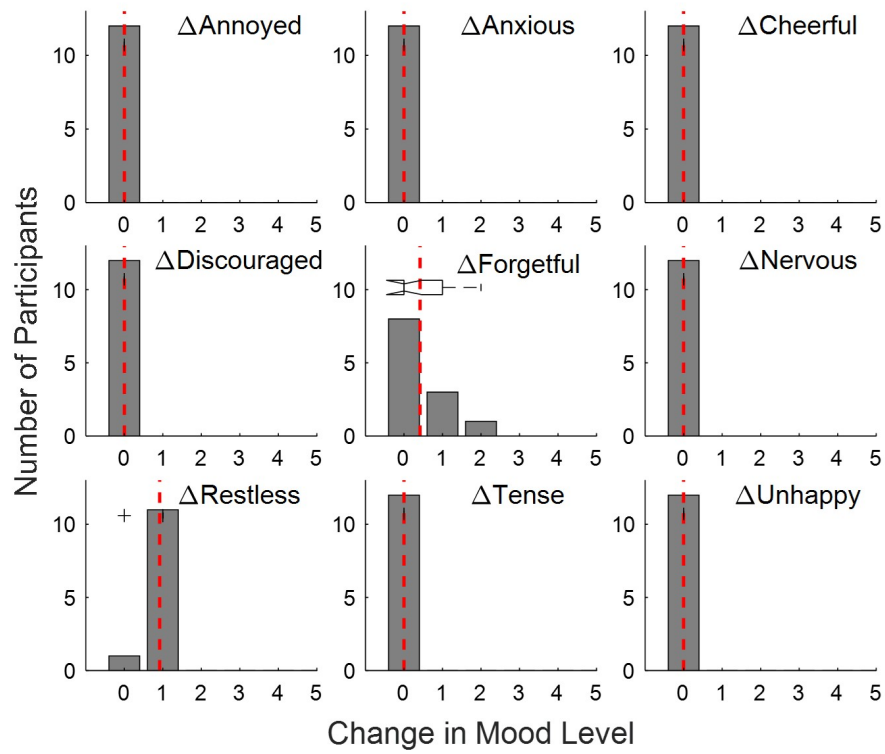


Fig. S1: Visual analog scale (VAS) for subjective (a) mental fatigue, (b) motivation reporting.

Table 1: Mood screening questionnaire used during Pre- and Post-session mood screening.

	Feeling	Not at all	A little	Moderate	Quite a bit	Extremely
1	Annoyed	0	1	2	3	4
2	Anxious	0	1	2	3	4
3	Cheerful	0	1	2	3	4
4	Discouraged	0	1	2	3	4
5	Forgetful	0	1	2	3	4
6	Nervous	0	1	2	3	4
7	Restless	0	1	2	3	4
8	Tense	0	1	2	3	4
9	Unhappy	0	1	2	3	4
10	Bored	0	1	2	3	4

(a)



(b)

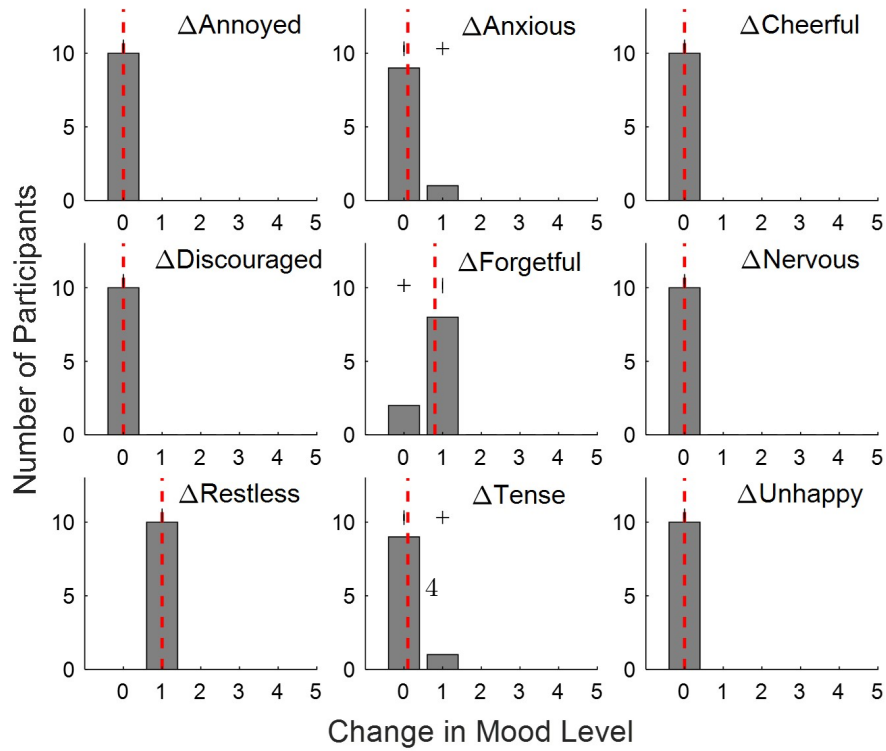


Fig. S2: Self-reported change in moods during Pre- and Post-session mood screening during (a) phase 1 and (b) phase 2. Red dashed line: average self-reported change in moods by all participants. Box plot indicates the data spread.

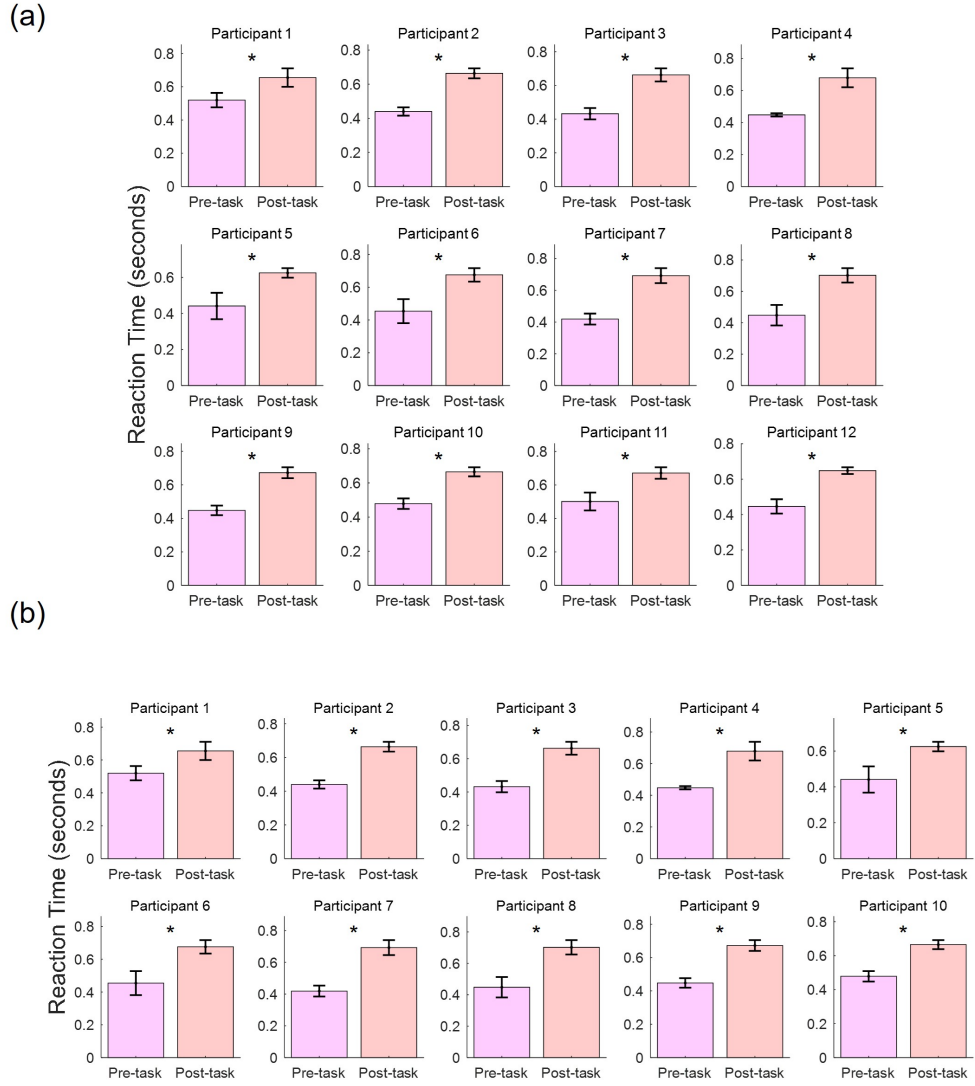
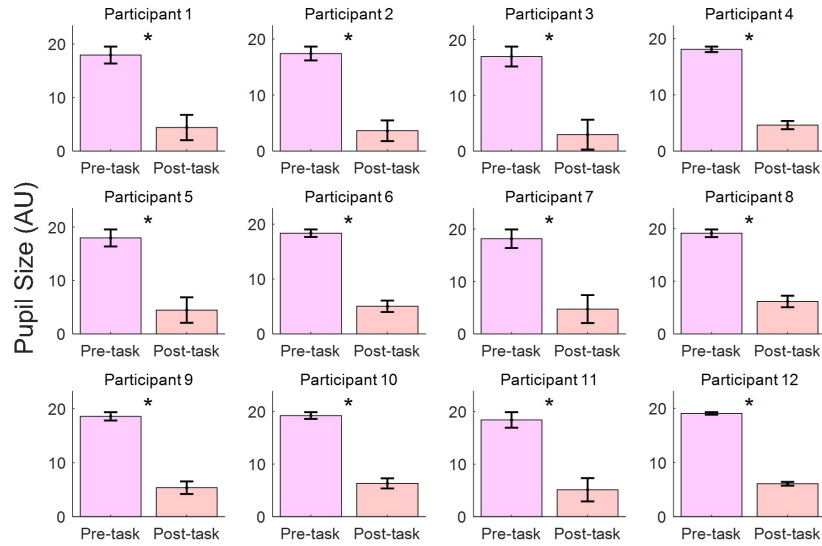


Fig. S3: Increased Reaction times for individual participants during post-task psychomotor vigilance task (PVT) compared to pre-task PVT for (a) phase 1 and (b) phase 2. Asterisk sign indicates p-value very less than 0.001 obtained by two-sample t-test.

(a)



(b)

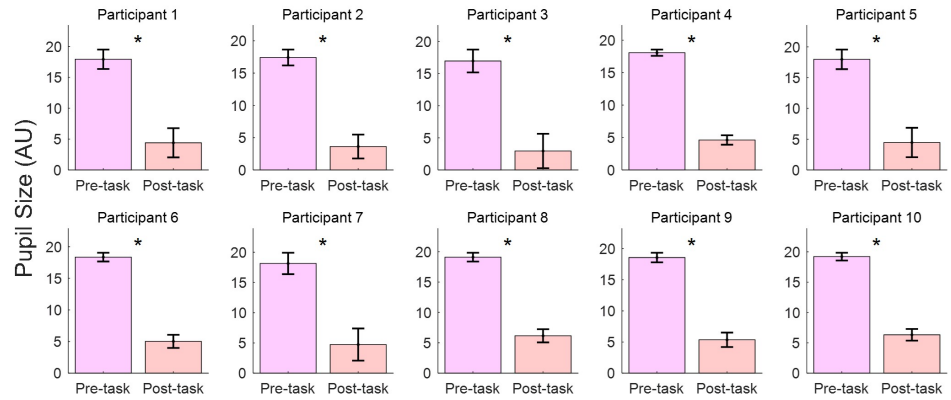
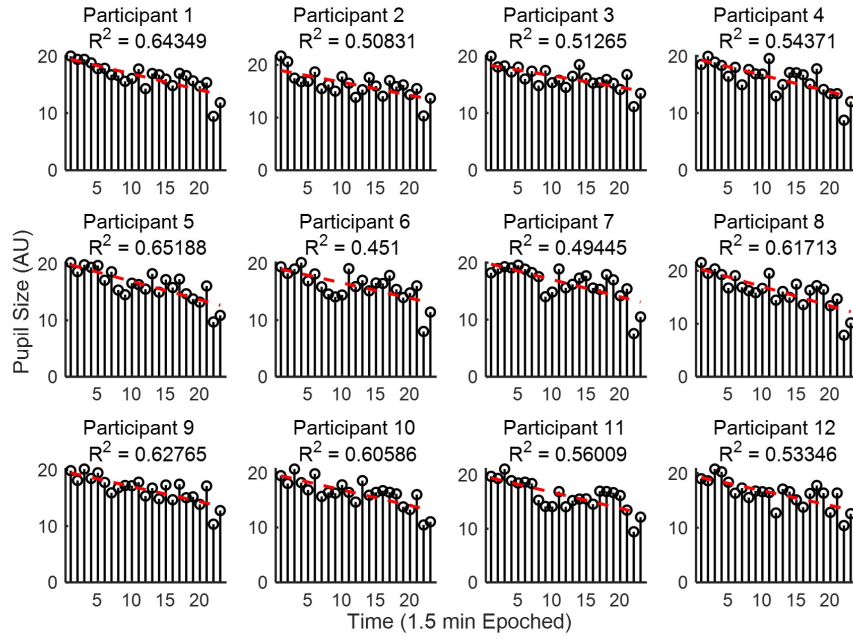


Fig. S4: Decline in pupil size during post-task PVT for each participant compared to pre-task PVT for (a) phase 1 and (b) phase 2. Asterisk symbol indicates p-value very less than 0.001 obtained by two-sample t-test.

(a)



(b)

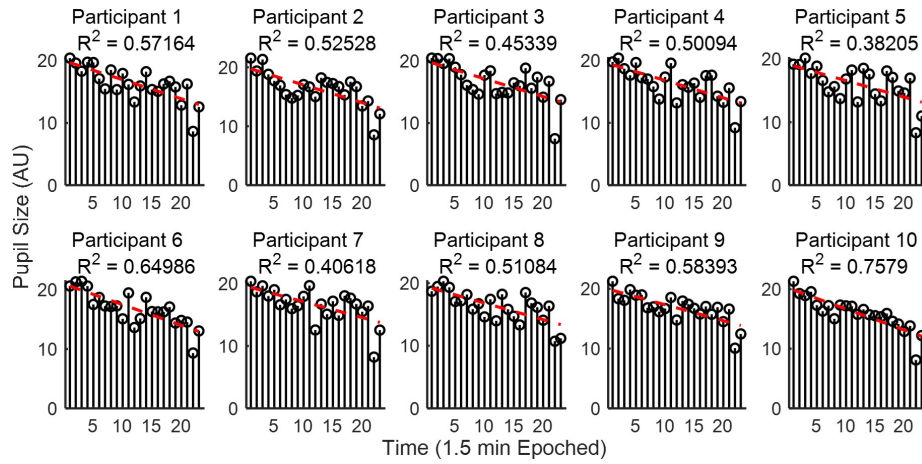


Fig. S5: Gradual decrease in pupil size over time for individual participants during adaptive N-back task in (a) phase 1 and (b) phase 2. Red dashed line: trend line obtained by linear regression.

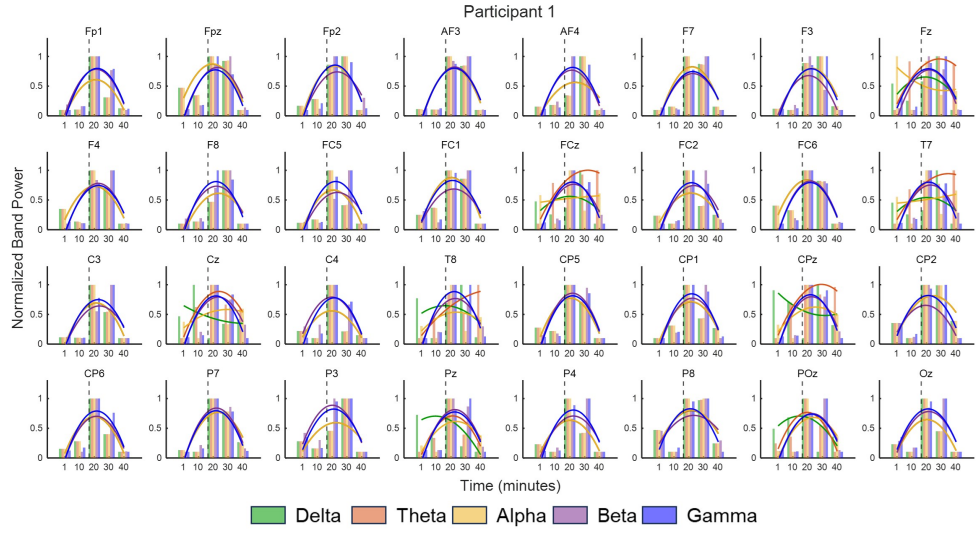


Fig. S6a. Dynamics of normalized band powers for Participant 1 at 1st, 10th, 20th, 30th and 40th minute during the adaptive N-back task across all 32 channels. Bars: normalized band powers. Lines: trend of the dynamical changes of the band powers, obtained by fitting a quadratic function.

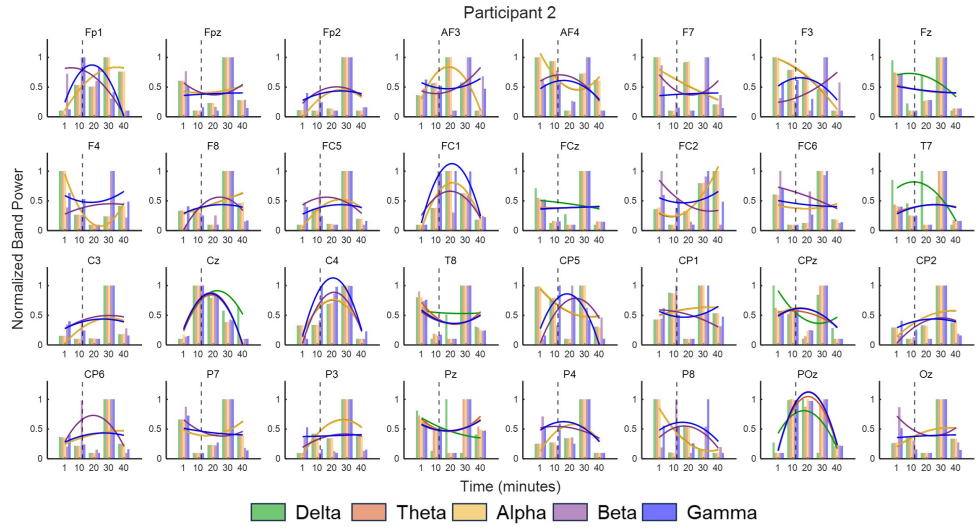


Fig. S6b. Dynamics of normalized band powers for Participant 2. Details are same as Figure S6a.

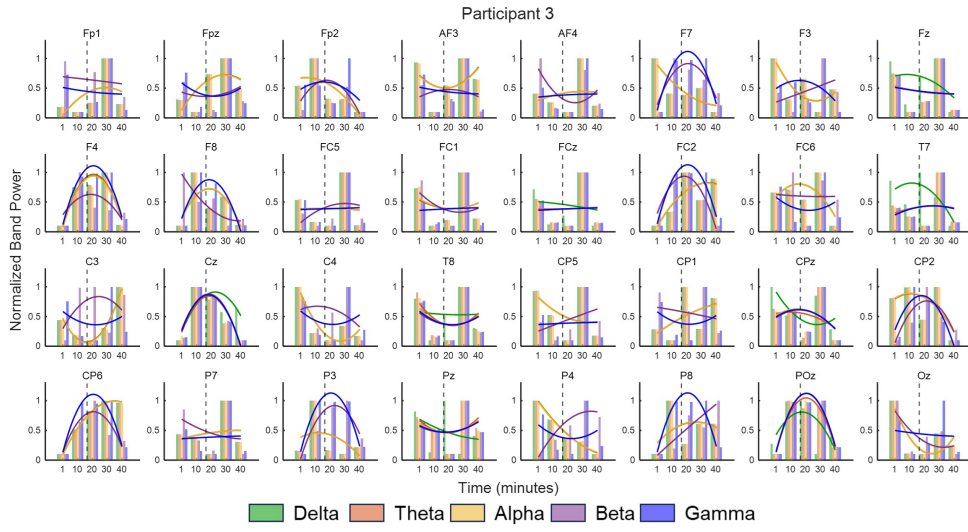


Fig. S6c. Dynamics of normalized band powers for Participant 3. Details are same as Figure S6a.

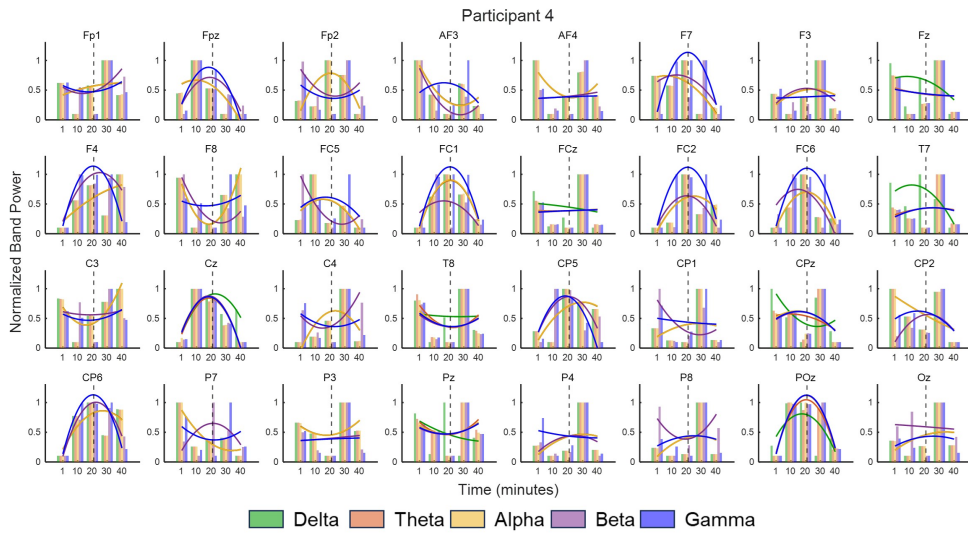


Fig. S6d. Dynamics of normalized band powers for Participant 4. Details are same as Figure S6a.

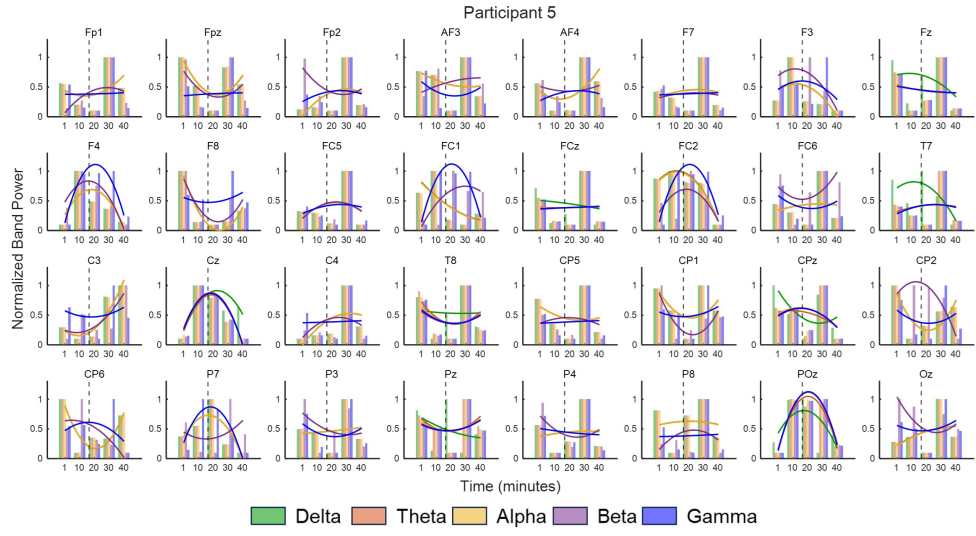


Fig. S6e. Dynamics of normalized band powers for Participant 5. Details are same as Figure S6a.

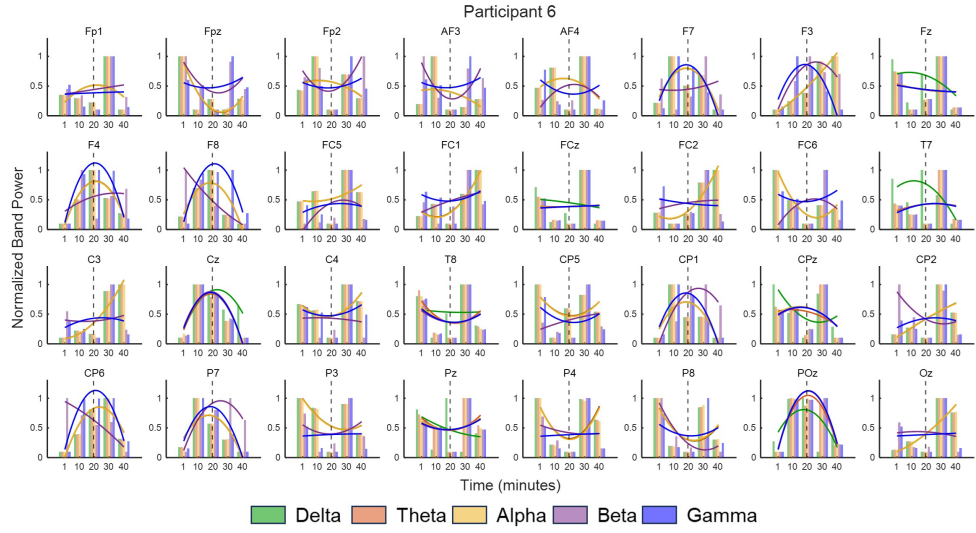


Fig. S6f. Dynamics of normalized band powers for Participant 6. Details are same as Figure S6a.

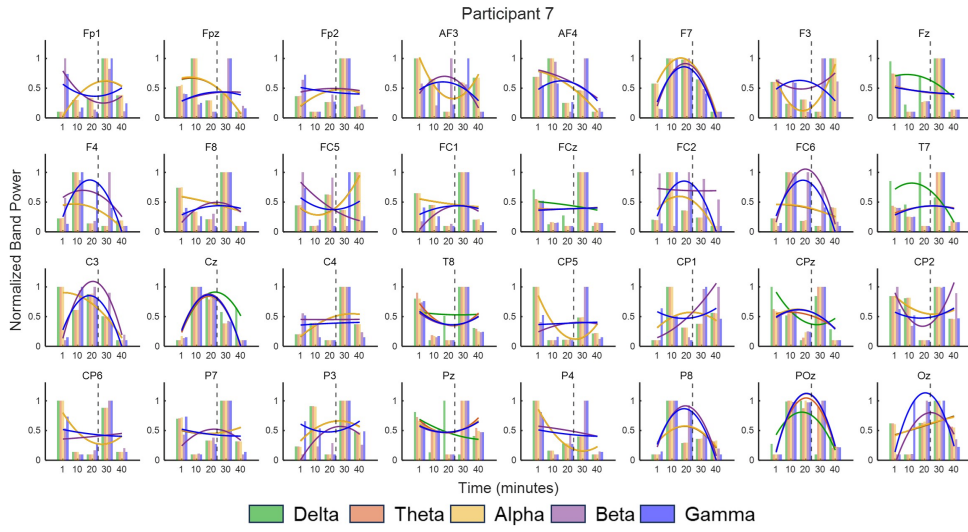


Fig. S6g. Dynamics of normalized band powers for Participant 7. Details are same as Figure S6a.

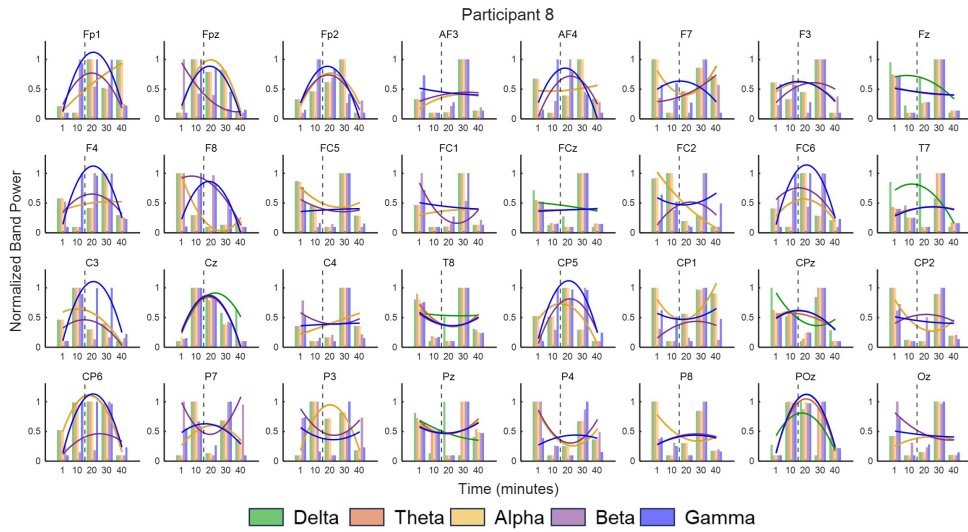


Fig. S6h. Dynamics of normalized band powers for Participant 8. Details are same as Figure S6a.

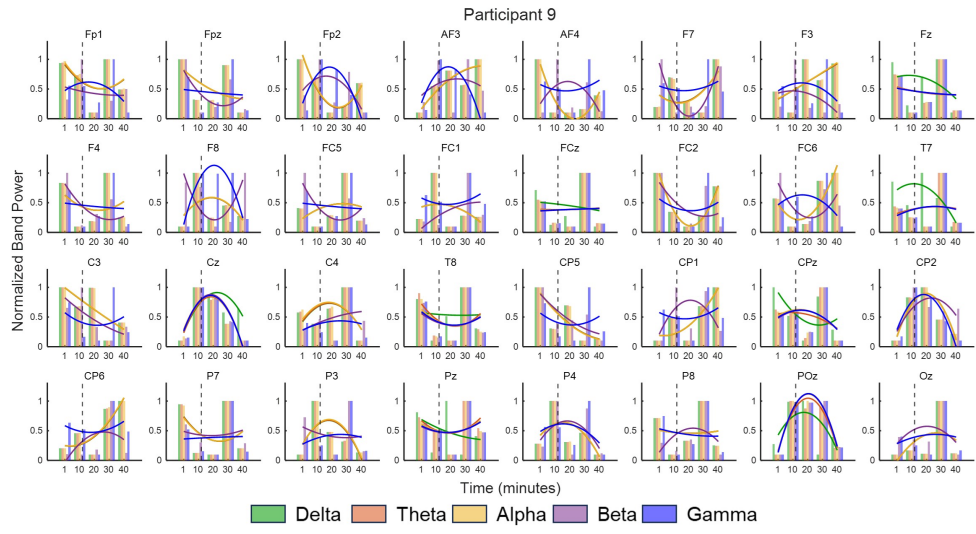


Fig. S6i. Dynamics of normalized band powers for Participant 9. Details are same as Figure S6a.

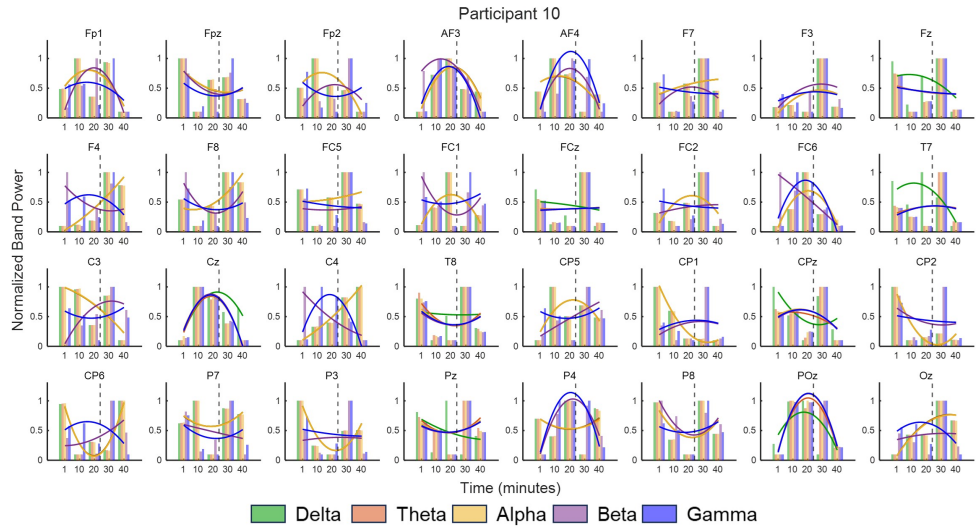


Fig. S6j. Dynamics of normalized band powers for Participant 10. Details are same as Figure S6a.

Table-2a: Coefficient of determinations (R^2 Value) for delta band across all channels for the quadratic fittings of trends in Figure S5 for individual participants (P1-P10)

	Delta (0.1-4 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	0.47	0.82	0.26	0.06	0.15	0.11	0.50	0.55	0.19	0.38
Fpz	0.55	0.02	0.46	0.60	0.43	0.79	0.54	0.87	0.25	0.18
Fp2	0.68	0.23	0.59	0.57	0.22	0.10	0.10	0.54	0.91	0.76
AF3	0.62	0.86	0.16	0.58	0.07	0.10	0.73	0.06	0.76	0.76
AF4	0.33	0.45	0.03	0.22	0.29	0.11	0.60	0.01	0.89	0.33
F7	0.67	0.24	0.72	0.50	0.02	0.64	0.99	0.34	0.31	0.10
F3	0.59	0.99	0.57	0.08	0.38	0.94	0.79	0.13	0.41	0.17
Fz	0.19	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
F4	0.45	0.94	0.88	0.45	0.53	0.85	0.20	0.03	0.06	0.71
F8	0.45	0.17	0.52	0.85	0.90	0.73	0.07	0.96	0.21	0.53
FC5	0.58	0.25	0.00	0.30	0.08	0.13	0.64	0.12	0.08	0.04
FC1	0.74	0.83	0.02	0.96	0.48	0.81	0.02	0.01	0.12	0.39
FCz	0.11	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
FC2	0.35	0.89	0.66	0.42	0.92	0.91	0.43	0.77	1.00	0.27
FC6	0.59	0.01	0.43	0.59	0.02	0.86	0.06	0.19	0.77	0.61
T7	0.10	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
C3	0.58	0.20	0.98	0.63	0.88	0.87	0.80	0.51	0.52	0.57
Cz	0.14	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
C4	0.32	0.50	0.78	0.47	0.35	0.24	0.21	0.16	0.30	0.97
T8	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CP5	0.60	0.23	0.18	0.50	0.06	0.15	0.57	0.63	0.64	0.44
CP1	0.65	0.02	0.26	0.06	0.24	0.56	0.09	0.40	0.75	0.98
CPz	0.16	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
CP2	0.42	0.28	0.46	0.31	0.61	0.39	0.11	0.21	0.84	0.77
CP6	0.64	0.07	1.00	0.50	0.77	0.81	0.22	0.94	0.72	0.86
P7	0.60	0.07	0.03	0.68	0.65	0.61	0.01	0.13	0.13	0.08
P3	0.28	0.52	0.17	0.10	0.01	0.31	0.11	0.81	0.51	0.77
Pz	0.51	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
P4	0.44	0.27	0.99	0.14	0.01	0.36	0.63	0.38	0.44	0.05
P8	0.31	0.58	0.16	0.13	0.01	0.28	0.20	0.19	0.00	0.21
POz	0.34	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
Oz	0.45	0.15	0.63	0.13	0.15	0.61	0.15	0.03	0.23	0.75

Table-2b: Coefficient of determinations (R^2 Value) for theta band across all channels for the quadratic fittings of trends in Figure S5 for individual participants (P1-P10)

	Theta (4-7 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	0.47	0.83	0.26	0.06	0.15	0.11	0.50	0.55	0.19	0.38
Fpz	0.55	0.02	0.46	0.60	0.43	0.78	0.55	0.87	0.25	0.17
Fp2	0.67	0.23	0.59	0.57	0.22	0.09	0.10	0.54	0.90	0.75
AF3	0.62	0.87	0.15	0.59	0.07	0.10	0.73	0.06	0.77	0.76
AF4	0.33	0.45	0.03	0.22	0.29	0.11	0.60	0.01	0.89	0.33
F7	0.67	0.24	0.72	0.50	0.02	0.64	0.99	0.34	0.31	0.10
F3	0.59	0.99	0.56	0.08	0.38	0.94	0.79	0.13	0.42	0.17
Fz	0.71	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
F4	0.45	0.94	0.88	0.46	0.53	0.85	0.20	0.03	0.06	0.71
F8	0.45	0.17	0.52	0.85	0.90	0.73	0.07	0.96	0.21	0.53
FC5	0.59	0.25	0.00	0.30	0.08	0.13	0.64	0.12	0.08	0.04
FC1	0.74	0.83	0.02	0.96	0.48	0.81	0.02	0.01	0.12	0.39
FCz	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FC2	0.35	0.89	0.66	0.42	0.92	0.91	0.43	0.78	1.00	0.27
FC6	0.60	0.01	0.43	0.59	0.02	0.86	0.06	0.20	0.77	0.61
T7	0.89	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
C3	0.58	0.20	0.98	0.63	0.88	0.87	0.80	0.51	0.52	0.57
Cz	0.87	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
C4	0.32	0.50	0.78	0.47	0.36	0.24	0.21	0.16	0.31	0.97
T8	0.72	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
CP5	0.60	0.23	0.18	0.50	0.06	0.15	0.57	0.64	0.65	0.44
CP1	0.65	0.02	0.26	0.06	0.24	0.55	0.09	0.40	0.75	0.98
CPz	0.91	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
CP2	0.42	0.28	0.46	0.31	0.61	0.39	0.11	0.21	0.84	0.77
CP6	0.64	0.07	1.00	0.50	0.77	0.81	0.22	0.95	0.72	0.86
P7	0.60	0.07	0.03	0.68	0.65	0.61	0.01	0.13	0.12	0.08
P3	0.28	0.52	0.17	0.10	0.01	0.31	0.11	0.81	0.52	0.77
Pz	0.64	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
P4	0.44	0.27	0.99	0.14	0.01	0.36	0.63	0.38	0.44	0.05
P8	0.31	0.58	0.16	0.13	0.01	0.28	0.20	0.19	0.00	0.21
POz	0.73	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Oz	0.45	0.15	0.63	0.13	0.15	0.62	0.15	0.03	0.23	0.74

Table-2c: Coefficient of determinations (R^2 Value) for alpha band across all channels for the quadratic fittings of trends in Figure S5 for individual participants (P1-P10)

	Alpha (8-13 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	0.47	0.83	0.26	0.07	0.15	0.11	0.51	0.54	0.21	0.39
Fpz	0.55	0.02	0.46	0.61	0.42	0.78	0.56	0.88	0.25	0.17
Fp2	0.67	0.22	0.60	0.57	0.22	0.09	0.10	0.53	0.89	0.75
AF3	0.62	0.87	0.15	0.60	0.07	0.10	0.74	0.06	0.78	0.76
AF4	0.33	0.44	0.03	0.21	0.29	0.12	0.60	0.01	0.89	0.34
F7	0.67	0.23	0.72	0.52	0.02	0.64	0.99	0.34	0.33	0.09
F3	0.59	0.99	0.56	0.08	0.39	0.94	0.79	0.13	0.42	0.17
Fz	0.17	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
F4	0.45	0.94	0.86	0.46	0.53	0.84	0.21	0.03	0.06	0.71
F8	0.45	0.18	0.52	0.85	0.90	0.74	0.07	0.96	0.22	0.53
FC5	0.59	0.25	0.00	0.30	0.07	0.12	0.65	0.11	0.08	0.04
FC1	0.74	0.84	0.03	0.97	0.47	0.82	0.02	0.01	0.12	0.39
FCz	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FC2	0.36	0.88	0.66	0.41	0.92	0.91	0.43	0.78	1.00	0.27
FC6	0.60	0.01	0.43	0.59	0.02	0.85	0.07	0.20	0.78	0.61
T7	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
C3	0.58	0.20	0.98	0.63	0.88	0.86	0.80	0.52	0.53	0.57
Cz	0.14	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
C4	0.32	0.51	0.77	0.47	0.36	0.23	0.21	0.16	0.31	0.96
T8	0.13	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
CP5	0.60	0.24	0.18	0.50	0.06	0.16	0.57	0.64	0.65	0.44
CP1	0.66	0.03	0.26	0.06	0.24	0.55	0.09	0.40	0.75	0.98
CPz	0.24	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
CP2	0.42	0.28	0.47	0.31	0.61	0.39	0.11	0.21	0.84	0.77
CP6	0.64	0.07	1.00	0.49	0.77	0.81	0.22	0.95	0.71	0.86
P7	0.60	0.07	0.03	0.68	0.66	0.62	0.01	0.13	0.12	0.09
P3	0.28	0.51	0.16	0.10	0.01	0.31	0.11	0.81	0.53	0.76
Pz	0.34	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
P4	0.44	0.27	0.98	0.14	0.01	0.36	0.62	0.38	0.44	0.04
P8	0.31	0.59	0.16	0.13	0.01	0.25	0.19	0.19	0.00	0.22
POz	0.52	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Oz	0.45	0.14	0.63	0.14	0.16	0.62	0.15	0.03	0.23	0.73

Table-2d: Coefficient of determinations (R^2 Value) for beta band across all channels for the quadratic fittings of trends in Figure S5 for individual participants (P1-P10)

	Beta (13-30 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	0.61	0.87	0.01	0.25	0.22	0.03	0.24	0.58	0.03	0.90
Fpz	0.65	0.05	0.03	0.50	0.15	0.31	0.03	0.93	0.36	0.19
Fp2	0.62	0.09	0.37	0.20	0.17	0.48	0.00	0.47	0.35	0.19
AF3	0.61	0.30	0.02	0.67	0.08	0.53	0.36	0.03	0.07	0.98
AF4	0.73	0.23	0.30	0.01	0.02	0.18	0.19	0.66	0.29	0.79
F7	0.53	0.13	0.74	0.31	0.01	0.03	0.92	0.29	0.91	0.10
F3	0.59	0.34	0.19	0.10	0.68	0.90	0.11	0.12	0.16	0.23
Fz	0.61	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
F4	0.60	0.04	0.29	0.79	0.83	0.12	0.19	0.19	0.44	0.19
F8	0.53	0.35	0.87	0.81	0.62	0.97	0.13	0.87	0.70	0.35
FC5	0.44	0.08	0.14	0.89	0.09	0.30	0.33	0.04	0.45	0.00
FC1	0.36	0.32	0.08	0.19	0.55	0.16	0.17	0.51	0.23	0.59
FCz	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FC2	0.60	0.26	0.95	0.41	0.40	0.03	0.00	0.17	0.34	0.03
FC6	0.70	0.11	0.00	0.57	0.25	0.21	0.95	0.34	0.41	0.98
T7	0.67	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
C3	0.46	0.07	0.24	0.01	0.60	0.01	0.97	0.19	0.49	0.79
Cz	0.71	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
C4	0.68	0.78	0.15	0.42	0.12	0.01	0.00	0.04	0.14	0.83
T8	0.69	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
CP5	0.65	0.76	0.19	0.44	0.02	0.09	0.03	0.63	0.68	0.39
CP1	0.63	0.12	0.04	0.35	0.66	0.89	0.73	0.09	0.35	0.06
CPz	0.67	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
CP2	0.38	0.20	0.75	0.27	0.97	0.29	0.56	0.03	0.48	0.07
CP6	0.57	0.24	0.77	1.00	0.56	0.87	0.01	0.13	0.27	0.23
P7	0.72	0.06	0.11	0.32	0.11	0.94	0.10	0.51	0.01	0.05
P3	0.53	0.06	0.90	0.01	0.15	0.05	0.40	0.28	0.03	0.00
Pz	0.65	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
P4	0.49	0.05	0.87	0.08	0.10	0.03	0.03	0.36	0.19	1.00
P8	0.26	0.16	0.82	0.21	0.12	0.84	0.77	0.04	0.20	0.46
POz	0.56	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Oz	0.49	0.11	0.50	0.01	0.45	0.01	0.64	0.20	0.15	0.02

Table-2e: Coefficient of determinations (R^2 Value) for lower gamma band across all channels for the quadratic fittings of trends in Figure S5 for individual participants (P1-P10)

	Lower Gamma (31-45 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	0.68	0.80	0.01	0.05	0.00	0.00	0.05	0.96	0.14	0.12
Fpz	0.69	0.00	0.05	0.81	0.00	0.05	0.03	0.79	0.01	0.05
Fp2	0.71	0.03	0.12	0.05	0.04	0.04	0.01	0.81	0.79	0.06
AF3	0.60	0.05	0.01	0.15	0.06	0.04	0.12	0.01	0.80	0.79
AF4	0.64	0.13	0.00	0.00	0.03	0.06	0.15	0.79	0.05	0.93
F7	0.55	0.00	0.95	0.95	0.00	0.78	0.79	0.16	0.04	0.01
F3	0.60	0.18	0.15	0.00	0.12	0.79	0.16	0.15	0.12	0.03
Fz	0.45	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
F4	0.55	0.05	0.96	0.95	0.95	0.97	0.79	0.94	0.01	0.15
F8	0.64	0.03	0.80	0.05	0.04	0.95	0.03	0.78	0.95	0.04
FC5	0.61	0.03	0.00	0.14	0.03	0.03	0.05	0.00	0.01	0.01
FC1	0.47	0.96	0.00	0.96	0.94	0.05	0.03	0.01	0.05	0.04
FCz	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FC2	0.67	0.06	0.95	0.93	0.93	0.01	0.78	0.06	0.04	0.01
FC6	0.67	0.01	0.05	0.95	0.05	0.06	0.80	0.95	0.16	0.79
T7	0.68	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
C3	0.56	0.03	0.05	0.05	0.04	0.03	0.78	0.97	0.05	0.05
Cz	0.66	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
C4	0.69	0.94	0.06	0.05	0.00	0.05	0.00	0.00	0.03	0.80
T8	0.69	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
CP5	0.64	0.79	0.00	0.81	0.00	0.06	0.00	0.94	0.05	0.05
CP1	0.71	0.05	0.05	0.01	0.04	0.79	0.05	0.05	0.05	0.03
CPz	0.64	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
CP2	0.46	0.03	0.79	0.14	0.06	0.03	0.04	0.01	0.81	0.01
CP6	0.67	0.03	0.94	0.95	0.13	0.95	0.01	0.95	0.05	0.17
P7	0.67	0.01	0.00	0.05	0.80	0.79	0.01	0.15	0.00	0.05
P3	0.46	0.00	0.95	0.00	0.05	0.00	0.06	0.04	0.03	0.01
Pz	0.58	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
P4	0.60	0.15	0.05	0.02	0.01	0.00	0.01	0.03	0.14	0.95
P8	0.47	0.13	0.95	0.03	0.00	0.04	0.80	0.03	0.02	0.05
POz	0.55	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Oz	0.47	0.00	0.01	0.03	0.05	0.00	0.94	0.01	0.03	0.16

Table-3a: Time delay between first reported self-evaluated subjective fatigue and highest peak of the trend line for delta band across all channels for individual participants (P1-P10)

	Delta (0.1-4 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	2	22	9	22	8	1	9	20.5	1	0.5
Fpz	2	8	9	8	2	9	11	0.5	19	10.5
Fp2	2	12	20	2	12	11	9	0.5	1	9.5
AF3	2	2	1	12	12	11	1	10.5	19	0.5
AF4	2	12	9	2	8	1	20	9.5	1	9.5
F7	2	22	19	8	12	1	1	0.5	11	20.5
F3	2	17	9	2	8	20	1	0.5	20	10.5
Fz	2	8	11	8	8	11	11	9.5	11	9.5
F4	2	2	1	22	2	1	11	10.5	1	18.5
F8	2	17	1	2	2	1	20	10.5	1	9.5
FC5	2	12	1	2	2	11	11	10.5	9	18.5
FC1	2	2	1	2	22	11	19	20.5	11	0.5
FCz	2	17	20	17	17	20	20	18.5	20	18.5
FC2	2	8	9	2	8	11	1	20.5	1	0.5
FC6	2	2	1	2	12	9	20	0.5	11	0.5
T7	2	8	11	8	8	11	11	9.5	11	9.5
C3	2	12	1	2	8	20	20	9.5	19	18.5
Cz	22	2	1	2	2	1	1	0.5	1	0.5
C4	2	2	9	2	12	1	9	20.5	1	18.5
T8	2	12	9	12	12	9	9	10.5	9	10.5
CP5	2	12	9	12	12	1	9	0.5	19	0.5
CP1	2	22	19	12	2	1	1	0.5	20	10.5
CPz	12	12	9	12	12	9	9	10.5	9	10.5
CP2	2	22	11	22	2	19	9	10.5	1	10.5
CP6	2	22	19	12	2	1	9	0.5	20	0.5
P7	2	2	19	12	2	1	1	0.5	1	0.5
P3	2	12	11	2	17	9	9	0.5	1	0.5
Pz	8	22	19	22	22	19	19	20.5	19	20.5
P4	2	2	19	12	12	1	9	0.5	1	0.5
P8	2	12	9	12	2	1	1	10.5	1	0.5
POz	8	2	1	2	2	1	1	0.5	1	0.5
Oz	2	22	1	12	22	20	20	10.5	9	20.5

Table-3b: Time delay between first reported self-evaluated subjective fatigue and highest peak of the trend line for theta band across all channels for individual participants (P1-P10)

	Theta (4-7 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	2	12	9	22	8	1	9	20.5	1	0.5
Fpz	2	8	9	8	2	9	11	0.5	19	10.5
Fp2	2	12	20	2	12	11	9	0.5	1	9.5
AF3	2	2	1	12	12	11	1	10.5	19	0.5
AF4	2	12	9	2	8	1	20	9.5	1	9.5
F7	2	22	19	8	12	1	1	0.5	11	20.5
F3	2	17	9	2	8	20	1	0.5	20	10.5
Fz	12	22	19	22	22	19	19	20.5	19	20.5
F4	2	2	1	22	2	1	11	10.5	1	18.5
F8	2	17	1	2	2	1	20	10.5	1	9.5
FC5	2	12	1	2	2	11	11	10.5	9	18.5
FC1	2	2	1	2	22	11	19	20.5	11	0.5
FCz	12	8	11	8	8	11	11	9.5	11	9.5
FC2	2	8	9	2	8	11	1	20.5	1	0.5
FC6	2	2	1	2	12	9	20	0.5	11	0.5
T7	12	12	9	12	12	9	9	10.5	9	10.5
C3	2	12	1	2	8	20	20	9.5	19	18.5
Cz	2	2	1	2	2	1	1	0.5	1	0.5
C4	2	2	9	2	12	1	9	20.5	1	18.5
T8	22	2	1	2	2	1	1	0.5	1	0.5
CP5	2	12	9	12	12	1	9	0.5	19	0.5
CP1	2	22	19	12	2	1	1	0.5	20	10.5
CPz	12	8	11	8	8	11	11	9.5	11	9.5
CP2	2	22	11	22	2	19	9	10.5	1	10.5
CP6	2	22	19	12	2	1	9	0.5	20	0.5
P7	2	2	19	12	2	1	1	0.5	1	0.5
P3	2	12	11	2	17	9	9	0.5	1	0.5
Pz	2	2	1	2	2	1	1	0.5	1	0.5
P4	2	2	19	12	12	1	9	0.5	1	0.5
P8	2	12	9	12	2	1	1	10.5	1	0.5
POz	2	2	1	2	2	1	1	0.5	1	0.5
Oz	2	22	1	12	22	20	20	10.5	9	20.5

Table-3c:Time delay between first reported self-evaluated subjective fatigue and highest peak of the trend line for alpha band across all channels for individual participants (P1-P10)

	Alpha (8-13 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	2	12	9	22	8	1	9	20.5	1	0.5
Fpz	2	8	9	8	2	9	11	0.5	19	10.5
Fp2	2	12	20	2	12	11	9	0.5	1	9.5
AF3	2	2	1	12	12	11	1	10.5	19	0.5
AF4	2	12	9	2	8	1	20	9.5	1	9.5
F7	2	22	19	8	12	1	1	0.5	11	20.5
F3	2	17	9	12	8	20	1	0.5	20	10.5
Fz	12	22	19	22	22	19	19	20.5	19	20.5
F4	2	2	1	22	2	1	11	10.5	1	18.5
F8	2	17	1	2	2	1	20	10.5	1	9.5
FC5	2	12	11	2	2	11	11	10.5	9	18.5
FC1	2	2	1	2	22	11	19	20.5	11	0.5
FCz	22	17	20	17	17	20	20	18.5	20	18.5
FC2	2	8	9	2	8	11	1	20.5	1	0.5
FC6	2	2	1	2	12	9	20	0.5	11	0.5
T7	17	12	9	12	12	9	9	10.5	9	10.5
C3	2	12	1	2	8	20	20	9.5	19	18.5
Cz	12	2	1	2	2	1	1	0.5	1	0.5
C4	2	2	9	2	12	1	9	20.5	1	18.5
T8	2	2	1	2	2	1	1	0.5	1	0.5
CP5	2	12	9	12	12	1	9	0.5	19	0.5
CP1	2	22	19	12	2	1	1	0.5	20	10.5
CPz	12	8	11	8	8	11	11	9.5	11	9.5
CP2	2	22	11	22	2	19	9	10.5	1	10.5
CP6	2	22	19	12	2	1	9	0.5	20	0.5
P7	2	2	19	12	2	1	1	0.5	1	0.5
P3	2	12	11	2	17	9	9	0.5	1	0.5
Pz	2	2	1	2	2	1	1	0.5	1	0.5
P4	2	2	19	12	12	1	9	0.5	1	0.5
P8	2	12	9	12	2	1	1	10.5	1	0.5
POz	2	2	1	2	2	1	1	0.5	1	0.5
Oz	2	22	1	12	22	20	19	10.5	9	20.5

Table-3d:Time delay between first reported self-evaluated subjective fatigue and highest peak of the trend line for beta band across all channels for individual participants (P1-P10)

	Beta (14-30 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	2	17	20	8	12	19	9	0.5	19	0.5
Fpz	2	2	1	2	2	1	9	20.5	9	10.5
Fp2	2	2	1	2	12	1	1	0.5	1	0.5
AF3	2	8	1	12	22	1	1	10.5	1	9.5
AF4	2	8	1	17	2	1	20	0.5	1	0.5
F7	2	2	1	8	2	11	1	18.5	1	0.5
F3	2	17	20	2	8	9	1	10.5	11	10.5
Fz	2	22	19	22	22	19	19	20.5	19	20.5
F4	2	12	1	2	2	9	11	0.5	9	10.5
F8	2	2	19	12	2	19	1	9.5	1	0.5
FC5	2	2	9	12	2	9	19	10.5	9	0.5
FC1	2	2	9	2	12	19	9	10.5	19	0.5
FCz	2	22	19	22	22	19	19	20.5	19	20.5
FC2	2	12	1	2	2	19	9	0.5	9	20.5
FC6	2	17	9	8	2	1	1	0.5	1	18.5
T7	2	12	9	12	12	9	9	10.5	9	10.5
C3	2	12	1	2	8	11	1	9.5	19	10.5
Cz	2	2	1	2	2	1	1	0.5	1	0.5
C4	2	2	11	8	2	11	1	0.5	19	20.5
T8	2	2	1	2	2	1	1	0.5	1	0.5
CP5	2	2	19	2	2	19	9	0.5	19	20.5
CP1	2	17	20	12	2	9	20	10.5	1	10.5
CPz	2	2	1	2	2	1	1	0.5	1	0.5
CP2	2	12	1	2	8	9	1	0.5	1	10.5
CP6	2	2	1	2	17	20	20	0.5	9	18.5
P7	2	12	19	2	2	1	1	0.5	1	20.5
P3	2	12	1	17	12	1	9	0.5	9	10.5
Pz	2	2	1	2	2	1	1	0.5	1	0.5
P4	2	8	19	2	2	9	20	0.5	1	0.5
P8	2	2	19	2	2	9	1	10.5	1	0.5
POz	2	2	1	2	2	1	1	0.5	1	0.5
Oz	2	2	9	17	12	11	1	20.5	1	10.5

Table-3e:Time delay between first reported self-evaluated subjective fatigue and highest peak of the trend line for lower gamma band across all channels for individual participants (P1-P10)

	Lower Gamma (31-45 Hz)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Fp1	2	2	19	2	17	19	1	0.5	1	9.5
Fpz	2	22	1	2	22	1	9	0.5	19	0.5
Fp2	2	12	1	2	12	1	19	0.5	1	0.5
AF3	2	2	19	2	2	1	1	20.5	1	0.5
AF4	2	2	19	22	12	1	1	0.5	1	0.5
F7	2	22	1	2	22	1	1	0.5	1	20.5
F3	2	2	1	22	2	1	1	0.5	1	10.5
Fz	2	22	19	22	22	19	19	20.5	19	20.5
F4	2	2	1	2	2	1	1	0.5	19	0.5
F8	2	12	1	2	2	1	9	0.5	1	0.5
FC5	2	12	20	2	12	9	1	20.5	19	20.5
FC1	2	2	19	2	2	1	9	20.5	1	0.5
FCz	2	22	19	22	22	19	19	20.5	19	20.5
FC2	2	2	1	2	2	19	1	0.5	1	20.5
FC6	2	22	1	2	2	1	1	0.5	1	0.5
T7	2	12	9	12	12	9	9	10.5	9	10.5
C3	2	12	1	2	2	9	1	0.5	1	0.5
Cz	2	2	1	2	2	1	1	0.5	1	0.5
C4	2	2	1	2	17	1	19	20.5	9	0.5
T8	2	2	1	2	2	1	1	0.5	1	0.5
CP5	2	2	19	2	22	1	19	0.5	1	0.5
CP1	2	2	1	22	2	1	1	0.5	1	10.5
CPz	2	2	1	2	2	1	1	0.5	1	0.5
CP2	2	12	1	2	2	9	1	20.5	1	20.5
CP6	2	12	1	2	2	1	19	0.5	1	0.5
P7	2	22	19	2	2	1	19	0.5	19	0.5
P3	2	17	1	22	2	19	1	0.5	9	20.5
Pz	2	2	1	2	2	1	1	0.5	1	0.5
P4	2	2	1	22	22	19	19	10.5	1	0.5
P8	2	2	1	12	17	1	1	10.5	19	0.5
POz	2	2	1	2	2	1	1	0.5	1	0.5
Oz	2	22	19	12	2	19	1	20.5	9	0.5

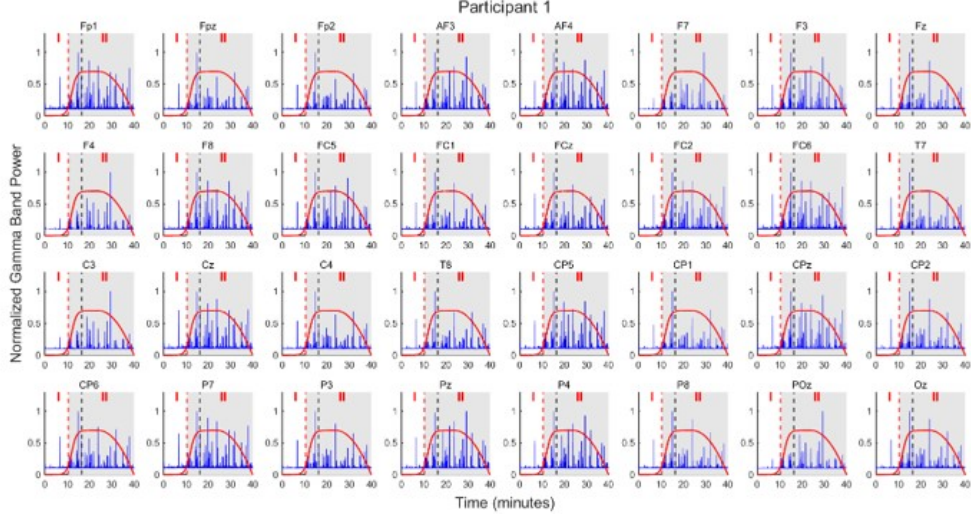


Fig. S7a. Dynamics of gamma band power over time during adaptive N-back task for Participant 1 across all channels. Solid red line: trend of band power variations obtained by fitting a skewed bell curve to the band power. Dashed red line: the first significant change in band power fluctuations. Black dashed line: time when most of the participants reported their highest metal fatigue scores for the first time. Statistical significance in band power variations between pre (marked as ‘I’ with white background) and post potential onset of mental fatigue (marked as ‘II’ with a gray background) has been computed using Wilcoxon rank sum test with a confidence level of 0.01.

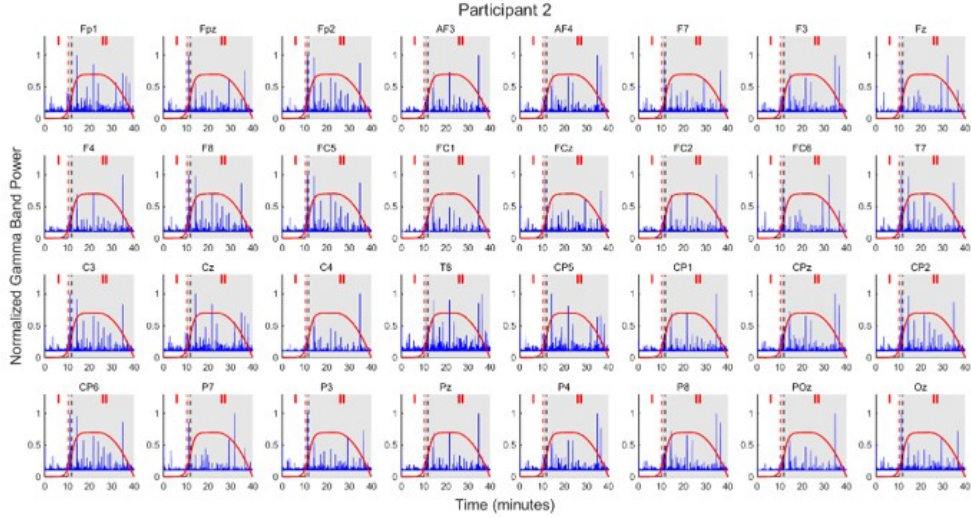


Fig. S7b. Dynamics of gamma band power over time during adaptive N-back task for Participant 2 across all channels. Details are same as Figure S7a.

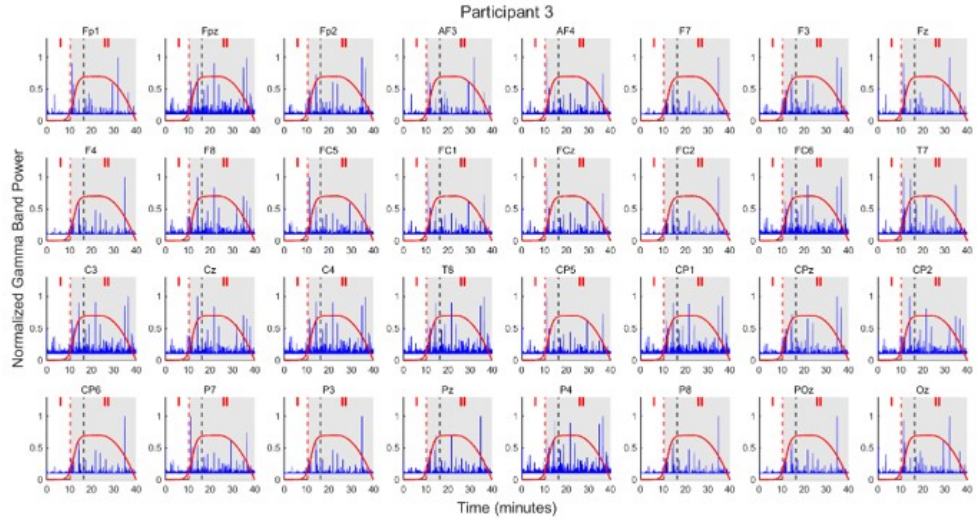


Fig. S7c. Dynamics of gamma band power over time during adaptive N-back task for Participant 3 across all channels. Details are same as Figure S7a.

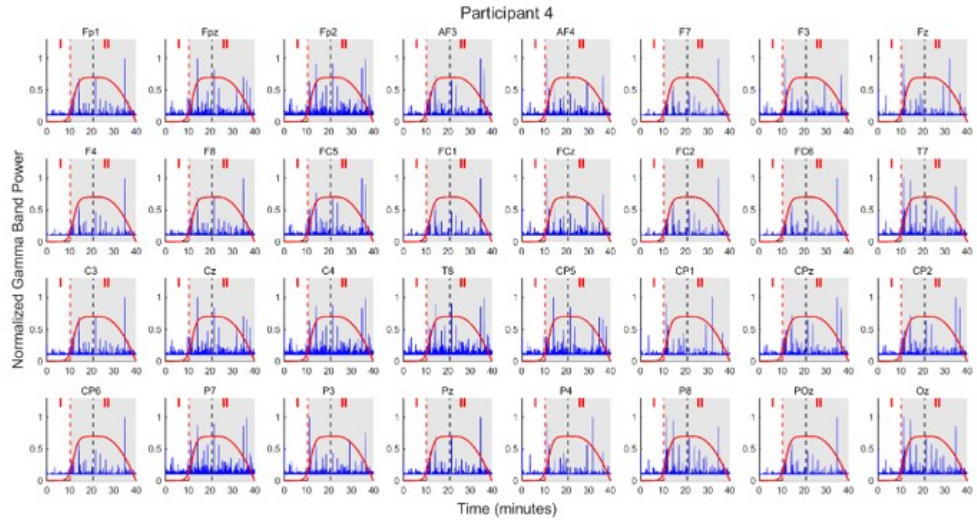


Fig. S7d. Dynamics of gamma band power over time during adaptive N-back task for Participant 4 across all channels. Details are same as Figure S7a.

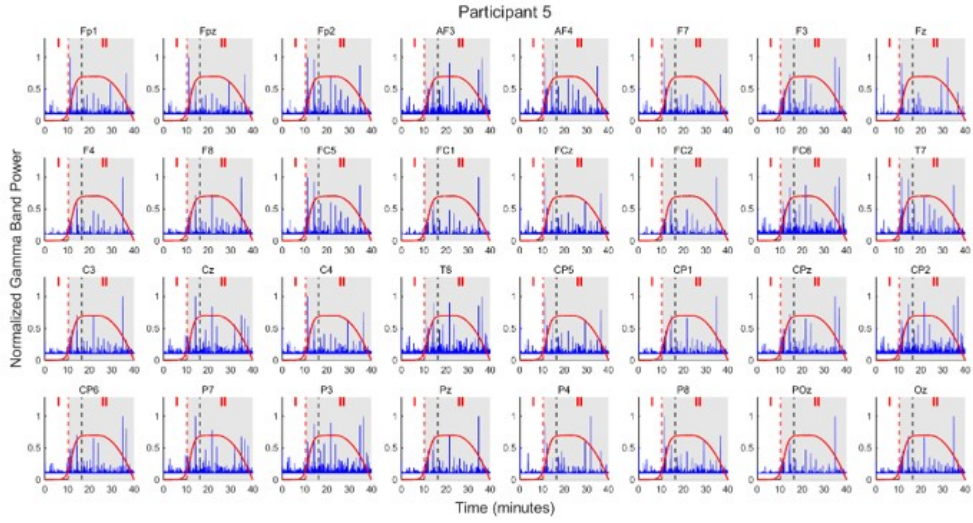


Fig. S7e. Dynamics of gamma band power over time during adaptive N-back task for Participant 5 across all channels. Details are same as Figure S7a.

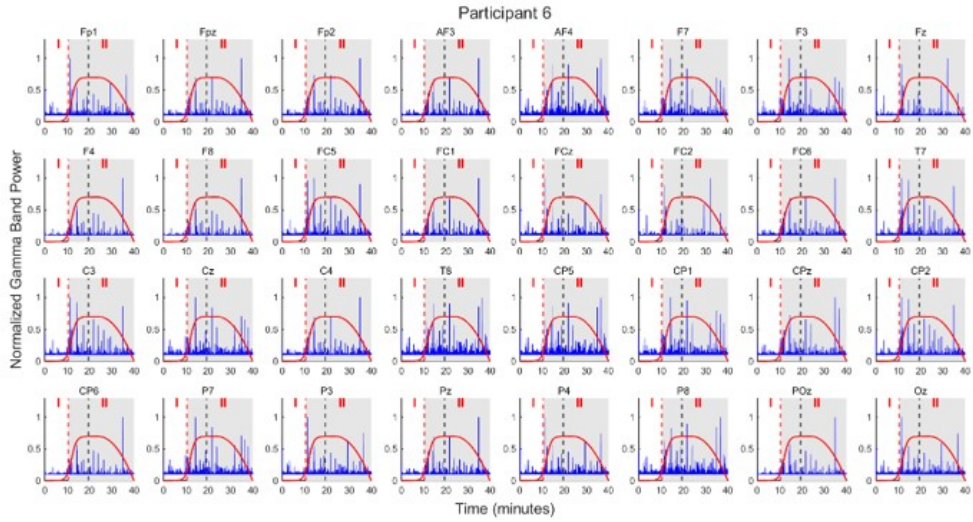


Fig. S7f. Dynamics of gamma band power over time during adaptive N-back task for Participant 6 across all channels. Details are same as Figure S7a.

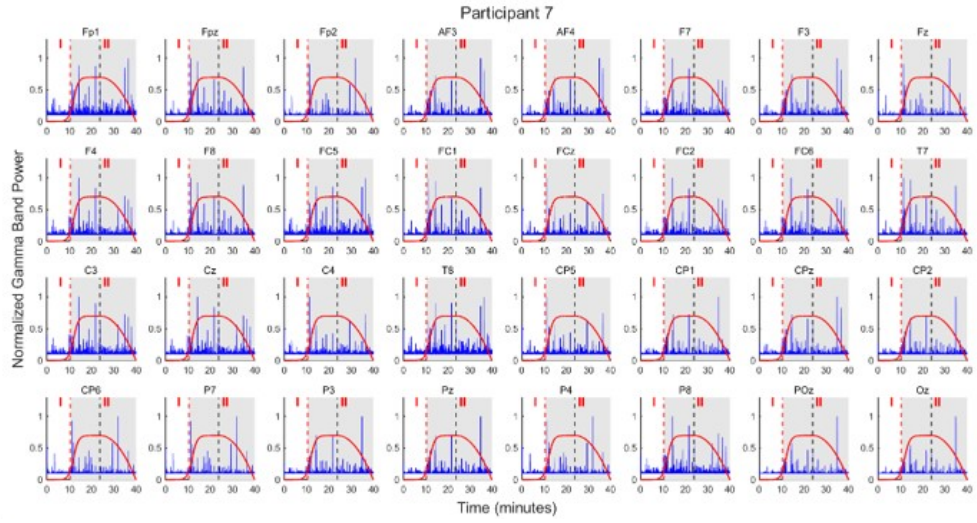


Fig. S7g. Dynamics of gamma band power over time during adaptive N-back task for Participant 7 across all channels. Details are same as Figure S7a.

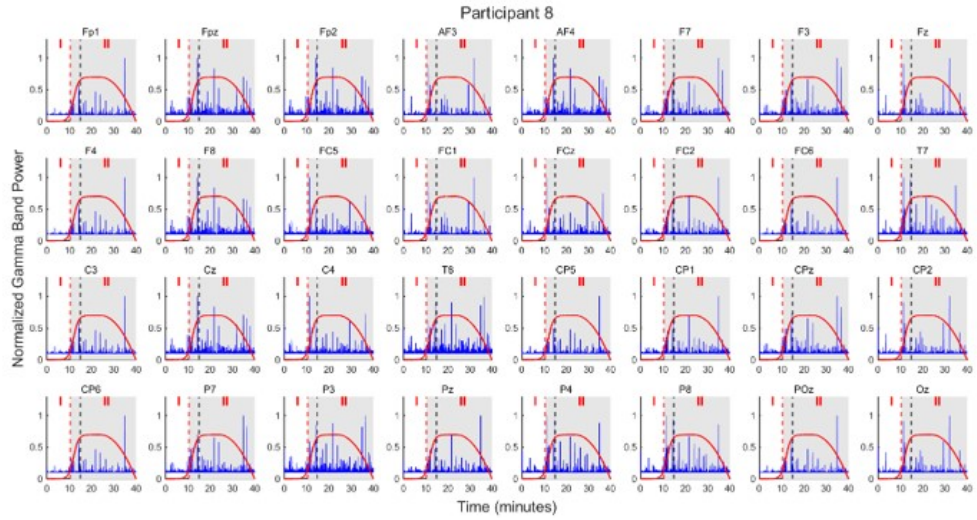


Fig. S7h. Dynamics of gamma band power over time during adaptive N-back task for Participant 8 across all channels. Details are same as Figure S7a.

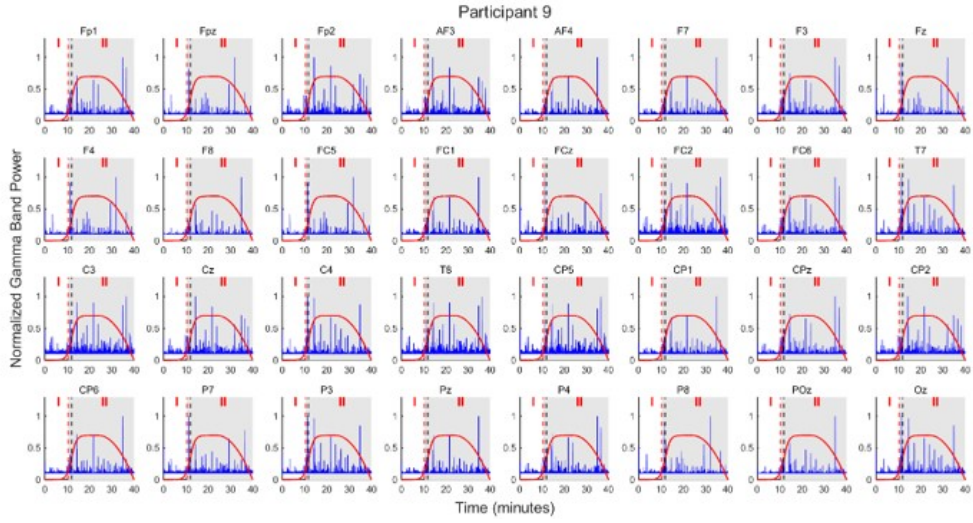


Fig. S7i. Dynamics of gamma band power over time during adaptive N-back task for Participant 9 across all channels. Details are same as Figure S7a.

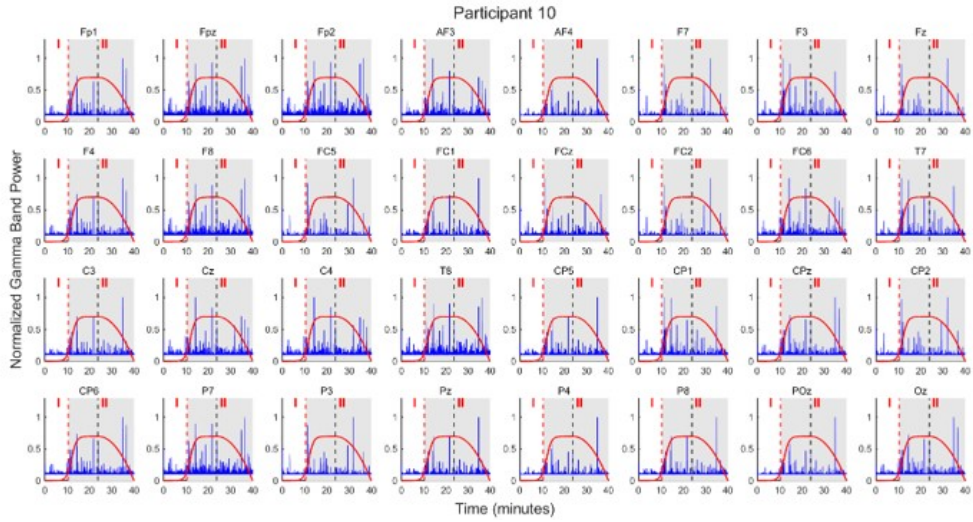


Fig. S7j. Dynamics of gamma band power over time during adaptive N-back task for Participant 10 across all channels. Details are same as Figure S7a.

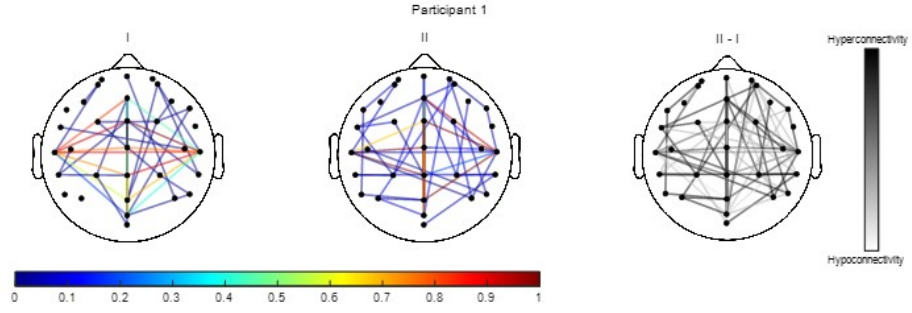


Fig. S8a.Functional connectivity plots for Participant 1 during pre-onset of potential fatigue (I), post-onset of mental fatigue (II) and their differences in terms of hyper-hypo connectivity networks (II-I). For each participant, only top 10% of the most altered connections (obtained by $\text{abs}(\text{II}-\text{I})$) has been highlighted by adding sparsity to the networks to identify most significant connections.

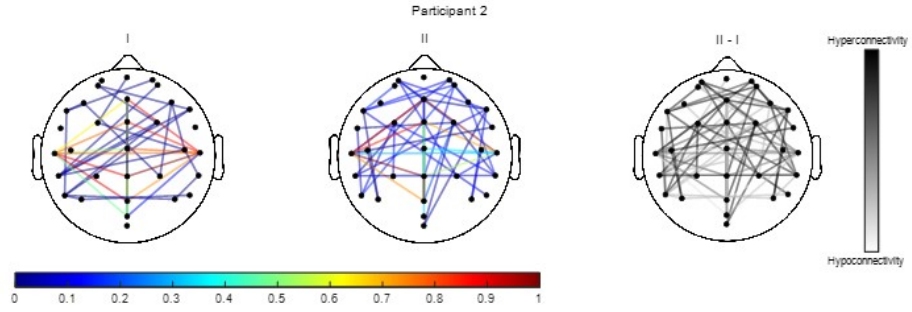


Fig. S8b.Functional connectivity plots for Participant 2. Details are same as Figure S8a.

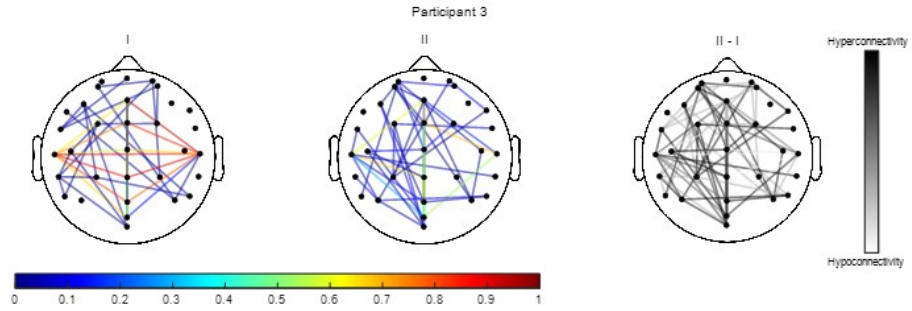


Fig. S8c.Functional connectivity plots for Participant 3. Details are same as Figure S8a.

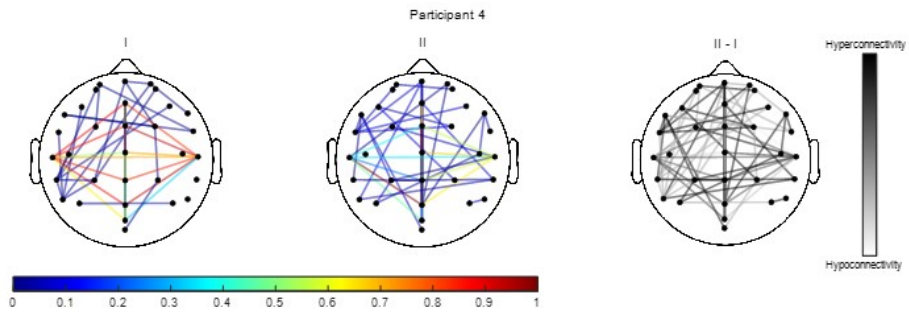


Fig. S8d.Functional connectivity plots for Participant 4. Details are same as Figure S8a.

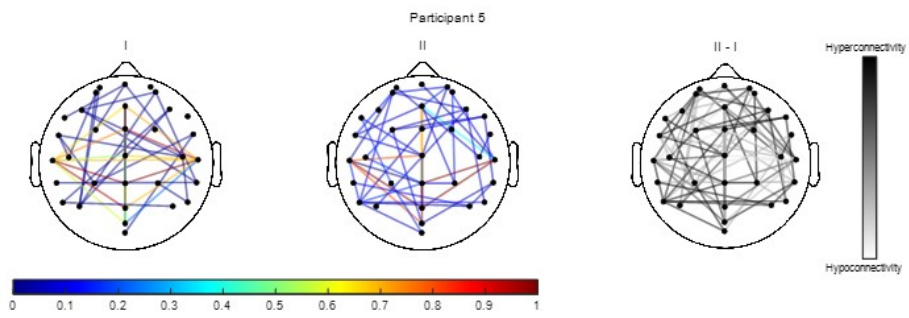


Fig. S8e.Functional connectivity plots for Participant 5. Details are same as Figure S8a.

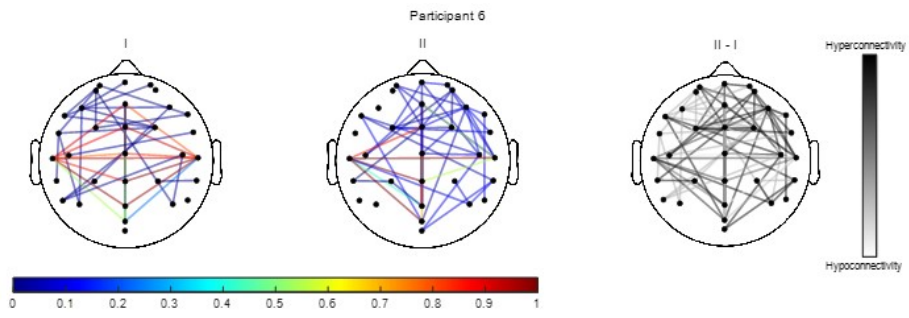


Fig. S8f.Functional connectivity plots for Participant 6. Details are same as Figure S8a.

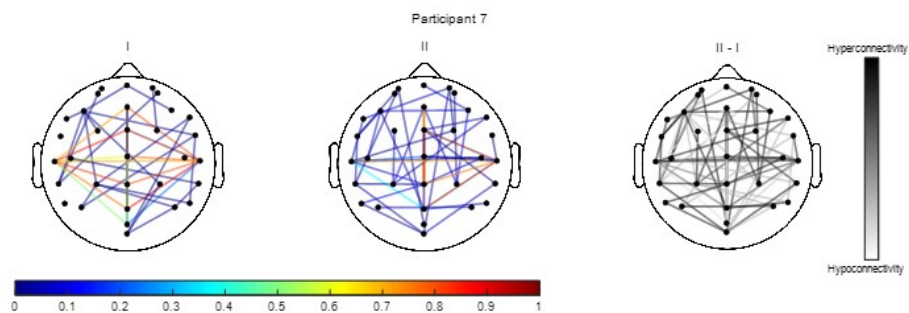


Fig. S8g.Functional connectivity plots for Participant 7. Details are same as Figure S8a.

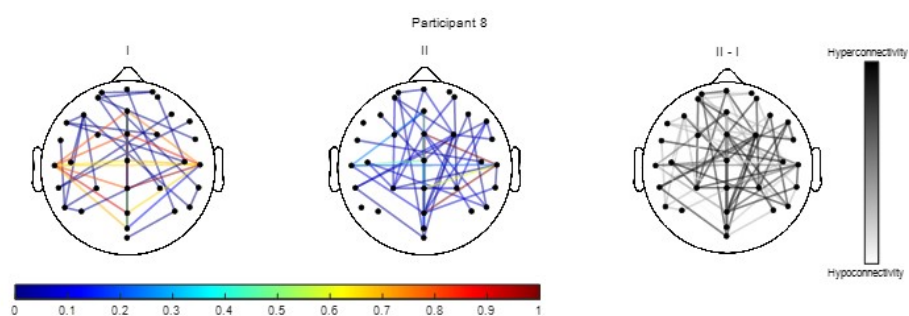


Fig. S8h.Functional connectivity plots for Participant 8. Details are same as Figure S8a.

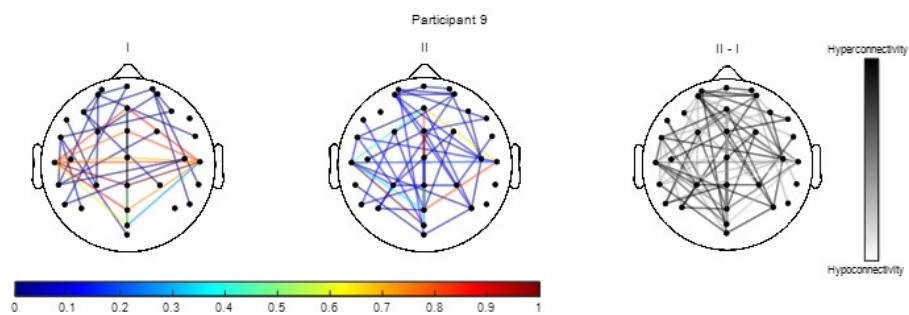


Fig. S8i.Functional connectivity plots for Participant 9. Details are same as Figure S8a.

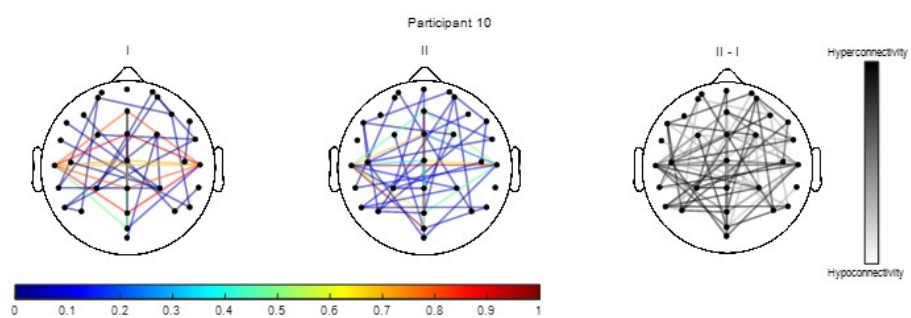


Fig. S8j.Functional connectivity plots for Participant 10. Details are same as Figure S8a.

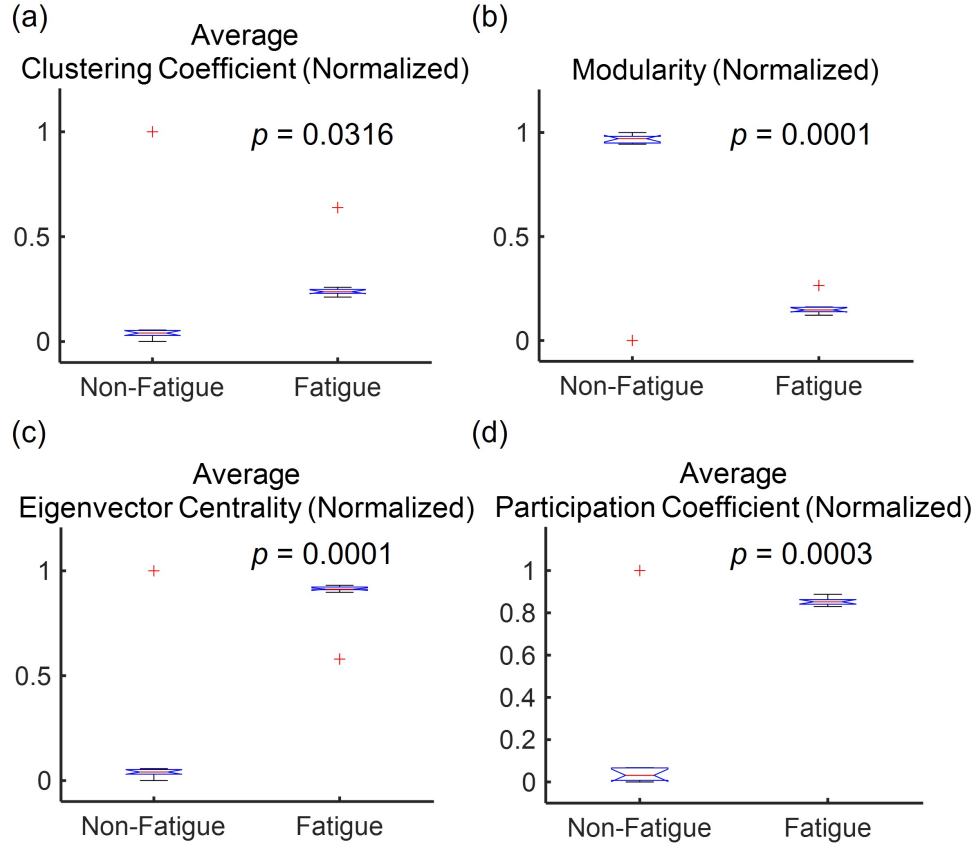


Fig. S9. Box-Whisker plot of the network topological measures for non-fatigue and fatigue states: (a) Average clustering coefficient, (b) modularity, (c) eigenvector centrality, (d) average participation coefficient. p values are obtained by performing two-sample paired t-test.