Supporting Information
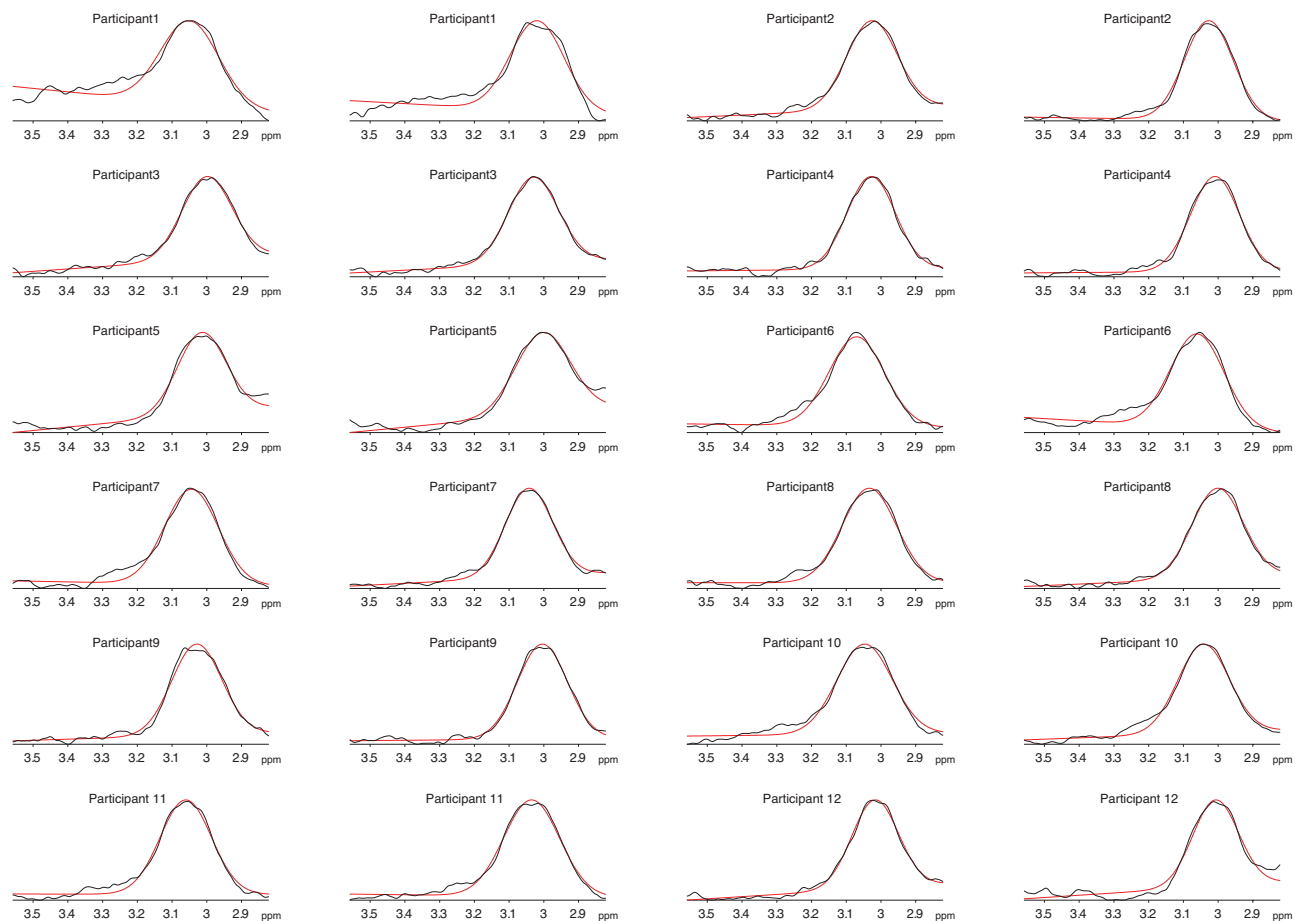
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Fig. S1. Fitting of MRS spectra. All 24 (12 participants × 2 repeats) GABA-edited spectra are displayed in black, demonstrating excellent SNR, and the fitted Gaussian model is in red. Fitting was performed over the range shown (2.82–3.56 ppm), using a Gaussian of variable width, amplitude, and offset. The baseline is modeled as a straight line. Y scaling is arbitrary.
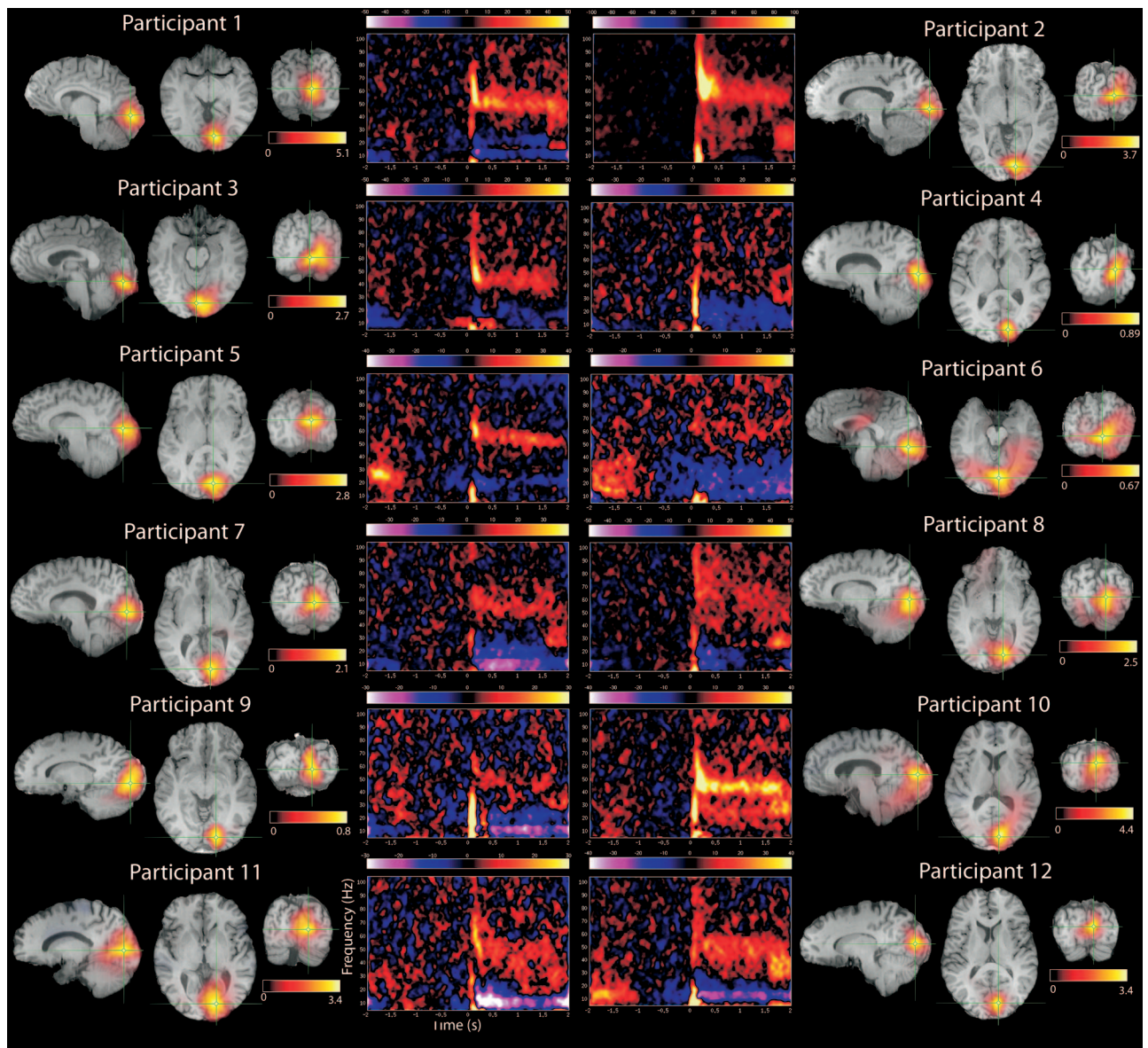
Fig. S2. SAM source localization results for all studied participants in the gamma (40–60 Hz) band shown in sagittal, axial, and coronal slice views. Units for the source localization maps are pseudoT statistics. The peak voxel location for gamma is indicated with the green crosshair. The corresponding time-frequency analysis for the virtual sensor at this location for each participant is plotted alongside. The units for the time-frequency analysis are percentage change from baseline.
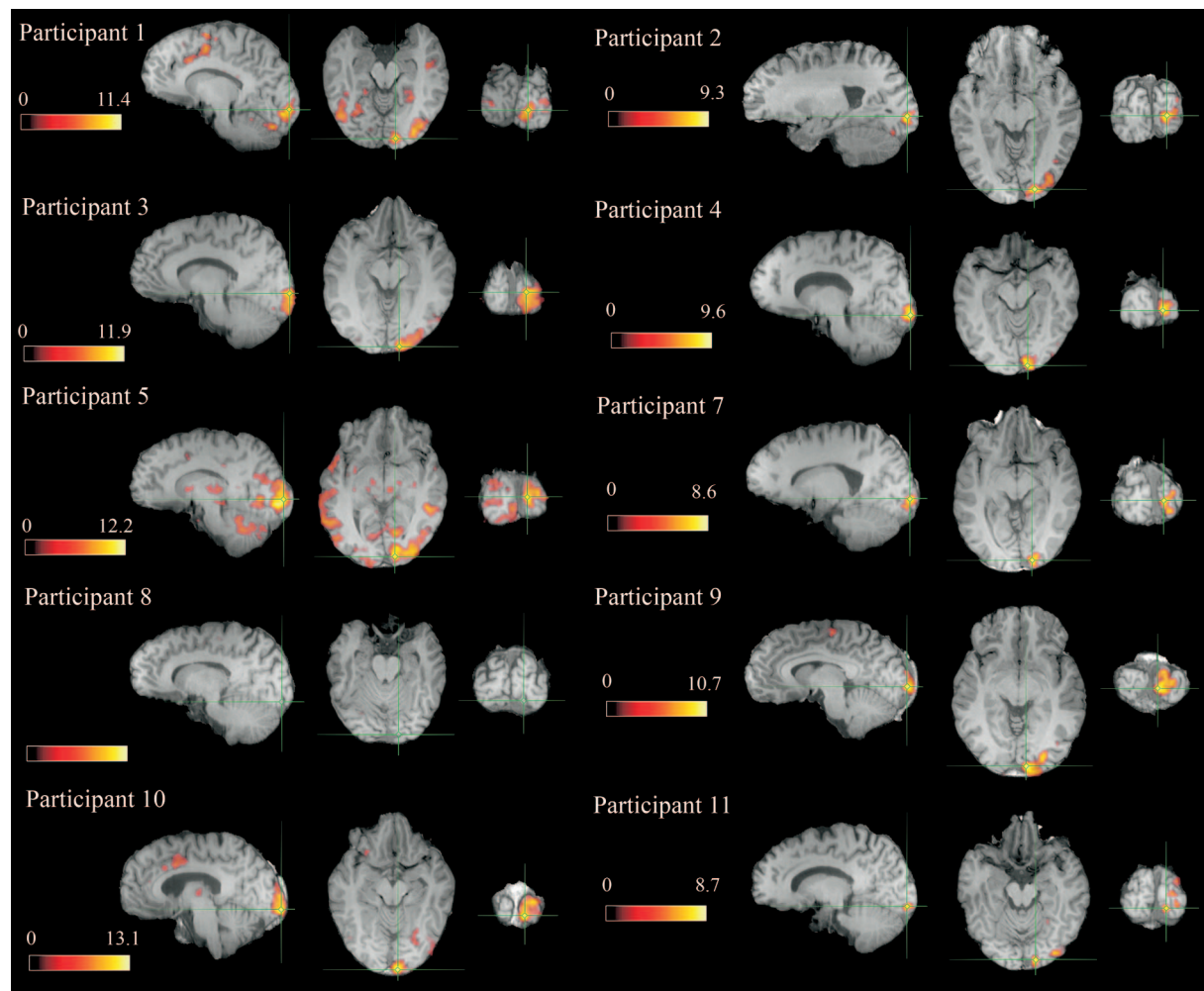
Fig. S3. fMRI data for all participants in the experiment. The *z*-score color maps display thresholded BOLD activation maps (*P* < 0.05, voxelwise-corrected over the whole brain) overlaid onto skull-stripped high resolution structural scans for each participant. The green cross hairs indicate the peak amplitude location for each participant. Only data for Participant 8 fell below this relatively harsh single-participant thresholding criterion. This participant had one of the higher gamma frequencies in our cohort (see Table S1). Participants 6 and 12 were unavailable for fMRI scanning.

Table S1. Data from all 12 participants in the study

Participant	Gamma frequency, Hz	Gamma amplitude, %	BOLD response, %	GABA concentration, i.u.	GLX concentration, i.u.	Age, years	Average lingual-cuneal grey matter thickness, mm	Total lingual-cuneal grey matter volume, mm³
1	51	21.89	1.83	1.17	1.03	29.8	2.2	25788
2	58	30.55	1.21	1.21	1.28	36.3	2.2	26656
3	43.5	12.54	2.50	1.15	1.03	42.9	2.1	18505
4	40	3.98	2.17	1.14	1.19	38.2	2.2	20793
5	54	11.24	1.91	1.22	1.06	34.3	2.2	22499
6	65.5	2.01	—	1.41	1.12	31.3	2.2	19531
7	55	6.22	1.36	1.31	1.12	30.3	2.2	22559
8	62.5	13.81	0.86	1.27	1.09	34.4	2.1	19537
9	46	4.01	1.94	1.07	1.07	29.4	2.4	23407
10	44.5	27.7	2.38	1.25	1.00	39.9	2.4	23202
11	53.5	6.83	1.01	1.39	1.09	40.8	1.9	13405
12	50.5	14.57	—	1.18	1.12	29.8	2.1	21861

Gamma frequency and amplitude are measured from the MEG data, BOLD response from the fMRI data, GABA and GLX concentrations from the MRS analyses and gray-matter thickness and volume measures from Freesurfer analyses of the anatomical MR scan; fMRI data were not collected from 2 participants. Participants 6 and 12 were unavailable for fMRI scanning

Table S2. Regression analyses demonstrating the dependence of measured BOLD and Gamma oscillation parameters on other measures for the 12 participants, using the Pearson correlation coefficient (R)

	Gamma frequency, Hz	Gamma amplitude, % change	GABA concentration, i.u.	GLX concentration, i.u.	Age, years	Average lingual-cuneal grey matter thickness, mm	Total lingual-cuneal grey matter volume, mm³
Gamma frequency, Hz	—	R = 0.03 P = 0.9	R = 0.68 P = 0.015 **	R = 0.26 P = 0.4	R = 0.37 P = 0.2	R = 0.18 P = 0.6	R = 0.06 P = 0.9
Gamma Amplitude, %	R = 0.03 P = 0.9	—	R = −0.17 P = 0.6	R = 0.003 P = 0.9	R = 0.19 P = 0.5	R = 0.10 P = 0.8	R = 0.56 P = 0.06 *
BOLD Response, %	R = −0.88 P = 0.0008 **	R = 0.02 P = 0.95	R = −0.64 P = 0.045 **	R = −0.42 P = 0.22	R = 0.25 P = 0.48	R = 0.38 P = 0.27	R = 0.20 P = 0.57

** = significant ($P < 0.05$); * = trend to significance. The strongest correlation was between Gamma frequency and BOLD. There was also a trend to significance in the relationship between the total amount of grey-matter in the lingual-cuneal region of the occipital lobe and Gamma oscillation magnitude