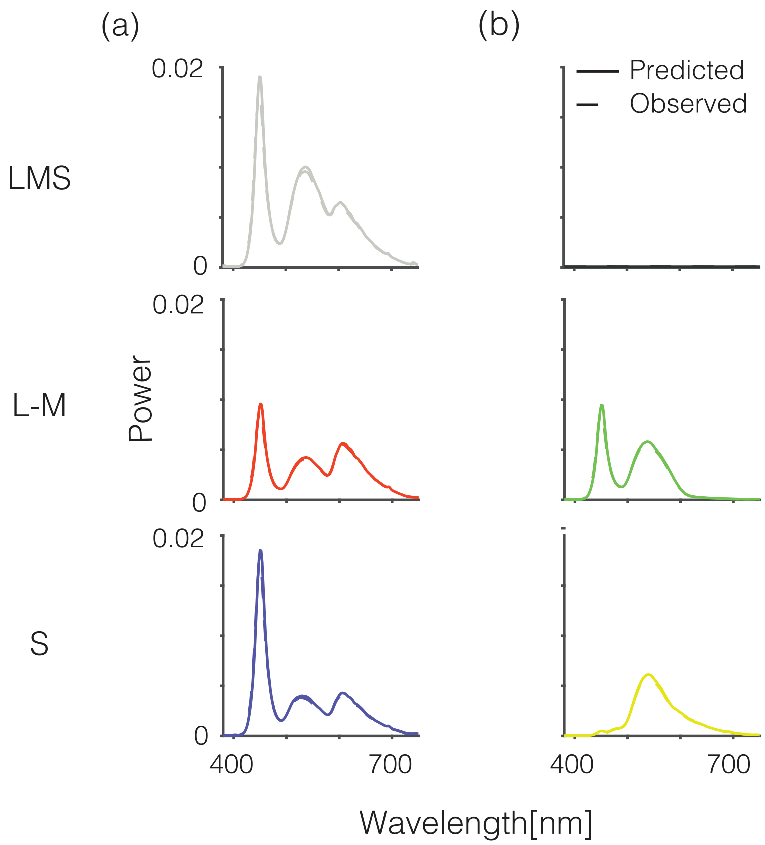

Figure S1: Power spectra for the nominal (solid line) and measured (dotted line) stimulus spectra for the positive (a) and negative (b) arms of the LMS (top), L-M (middle) and S (bottom) stimuli. The measured values are in close agreement with the predicted values.

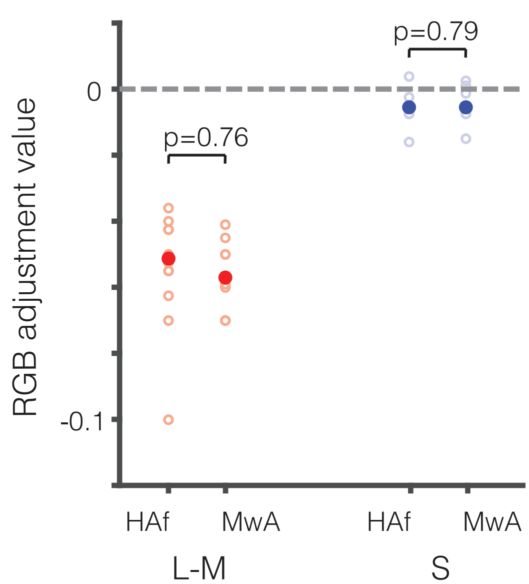

Figure S2: RGB nulling values for the L-M (red) and S (blue) stimuli for each subject (open circles). Median values for the HAf and MwA groups are shown (closed circles). P-values represent 2-way t-test.

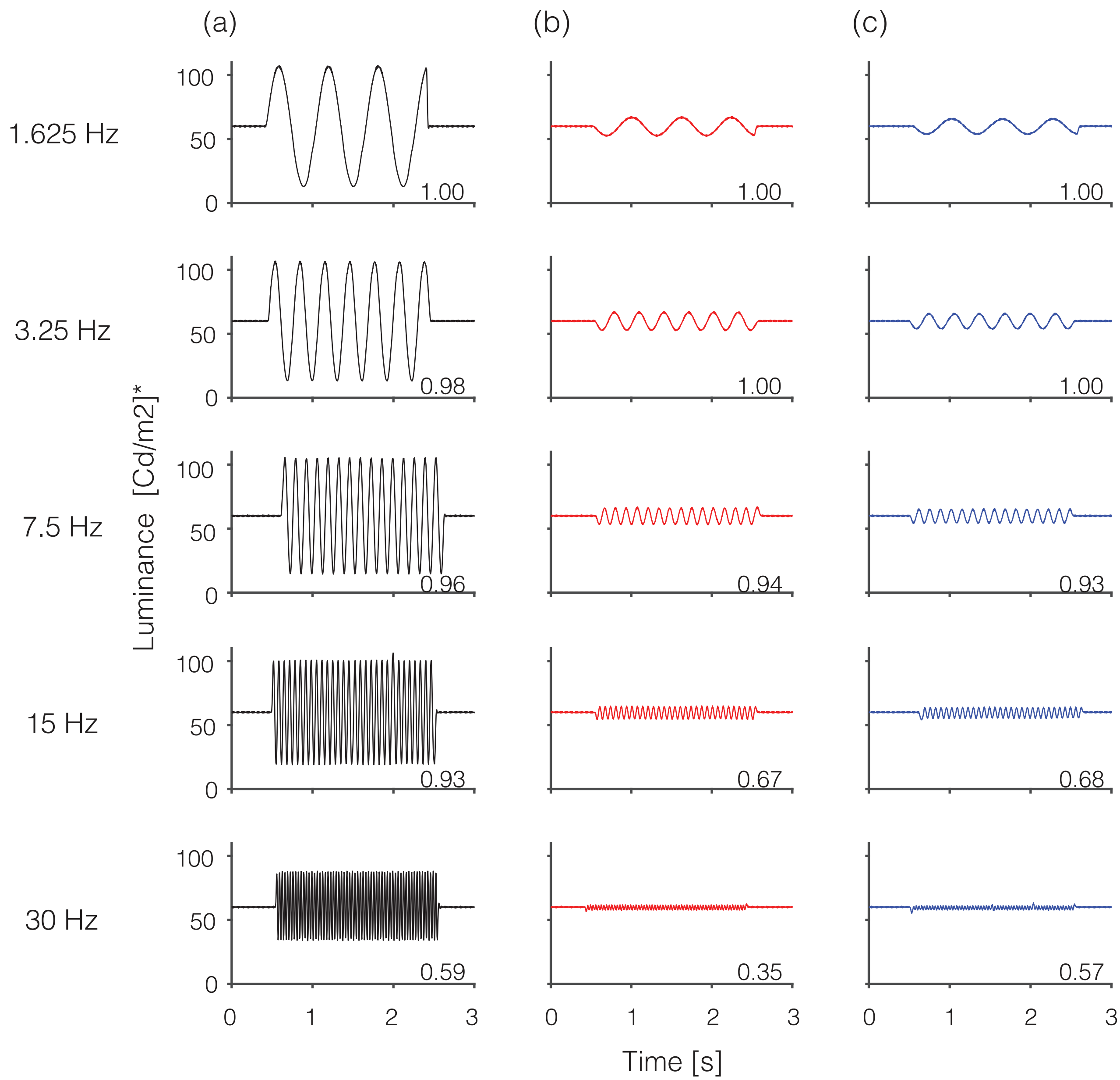

Figure S3: We measured the flickering stimuli in the center of our display using a photometer with a high temporal refresh rate (Klein 650, Klein Instruments Corporation). The photometer reports calculated "luminance" values in units of cd/m^2. We measured the photometer-reported luminance of the stimuli across a 2-second period of flicker for the LMS (a), L-M (b), and S (c) modulation directions across all temporal frequencies. It should be noted that the photopicluminosity function assumed by the device differs from the spectral sensitivity functions that we assumed for the purposes of generating our stimuli. As a consequence, our nominally iso-luminant stimuli (those that target the L-M and S pathways) are reported by the Klein device to have a small temporal modulation of "Klein luminance". We were able to use this modulation to confirm that 1) the stimuli retain their general sinusoidal form across temporal frequencies and modulation directions, however 2) there is a drop in the modulation amplitude with increasing stimulus frequency (proportional amplitude relative to the1.625 Hz stimulus is indicated). This later effect is comparable in size across the modulation directions, and likely represents the imperfect recreation of a high-frequency sinusoid at the 120 Hz refresh rate available for the monitor.

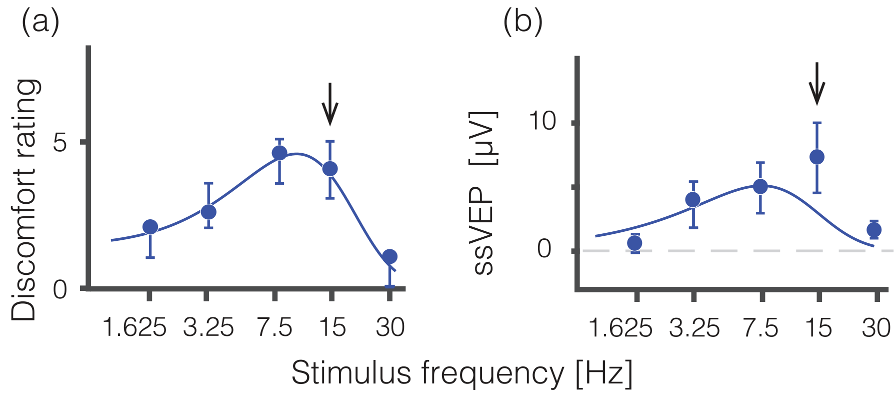

Figure S4: Data and fits from figure 2 plotted with the omitted visual discomfort and ssVEP values of the 15 Hz S stimulus (arrows).

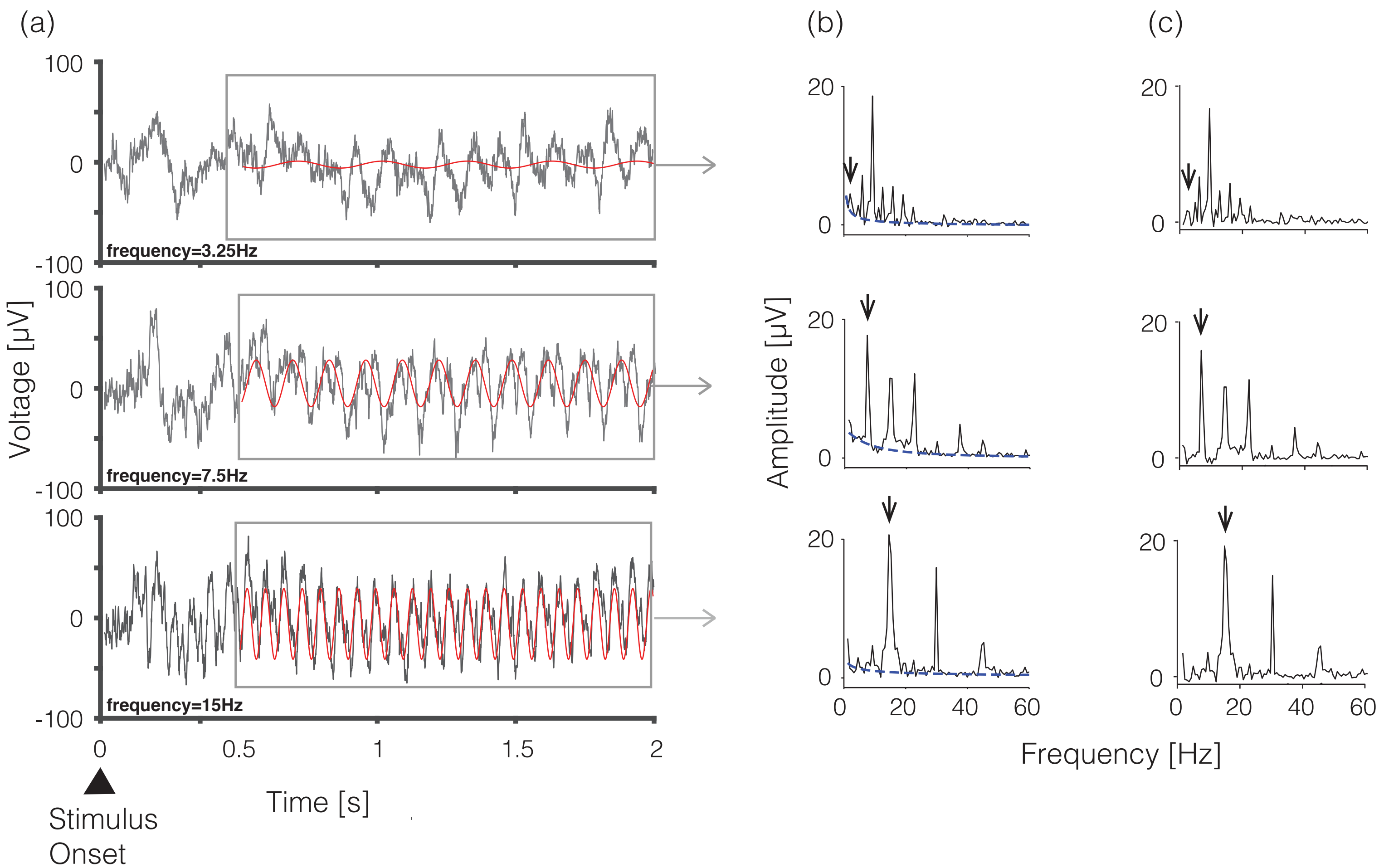

Figure S5: ssVEP analysis for an example subject. (A) median ssVEP response over the 2-second stimulus epoch for 1.625 Hz (top), 7.5 Hz (middle), and 15 Hz (bottom) LMS stimuli. Gray outline denotes the portion of the response epoch that was retained after discarding the response onset. The 1.625Hz window is shorter to center the fourier transform bins over the stimulus frequency. (B) ssVEP signal converted from the time domain to frequency domain through discrete Fourier transform. The original signal is shown (black) with the aperiodic component fit (dashed-blue)(Haller et al., 2018). (C) The periodic component of the ssVEP signal in the frequency domain (i.e., with the aperiodic signal subtracted from the original signal). Fundamental frequency peaks are denoted by arrows.

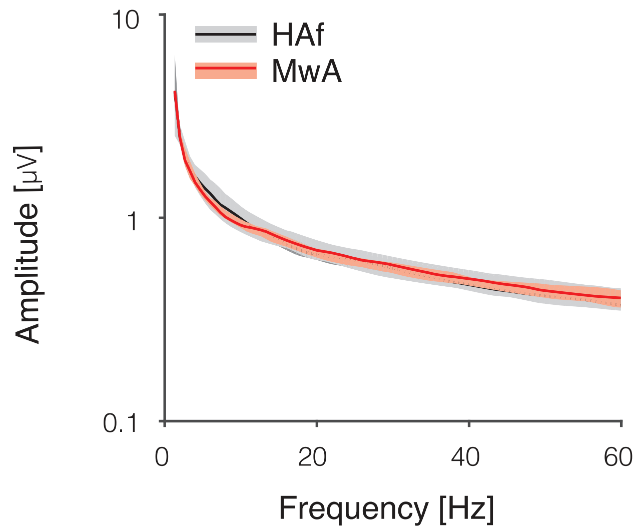

Figure S6: Median of the aperiodic fits across all stimuli for HAf (black) and MwA (red) subjects. Shaded area represents 95% confidence intervals.

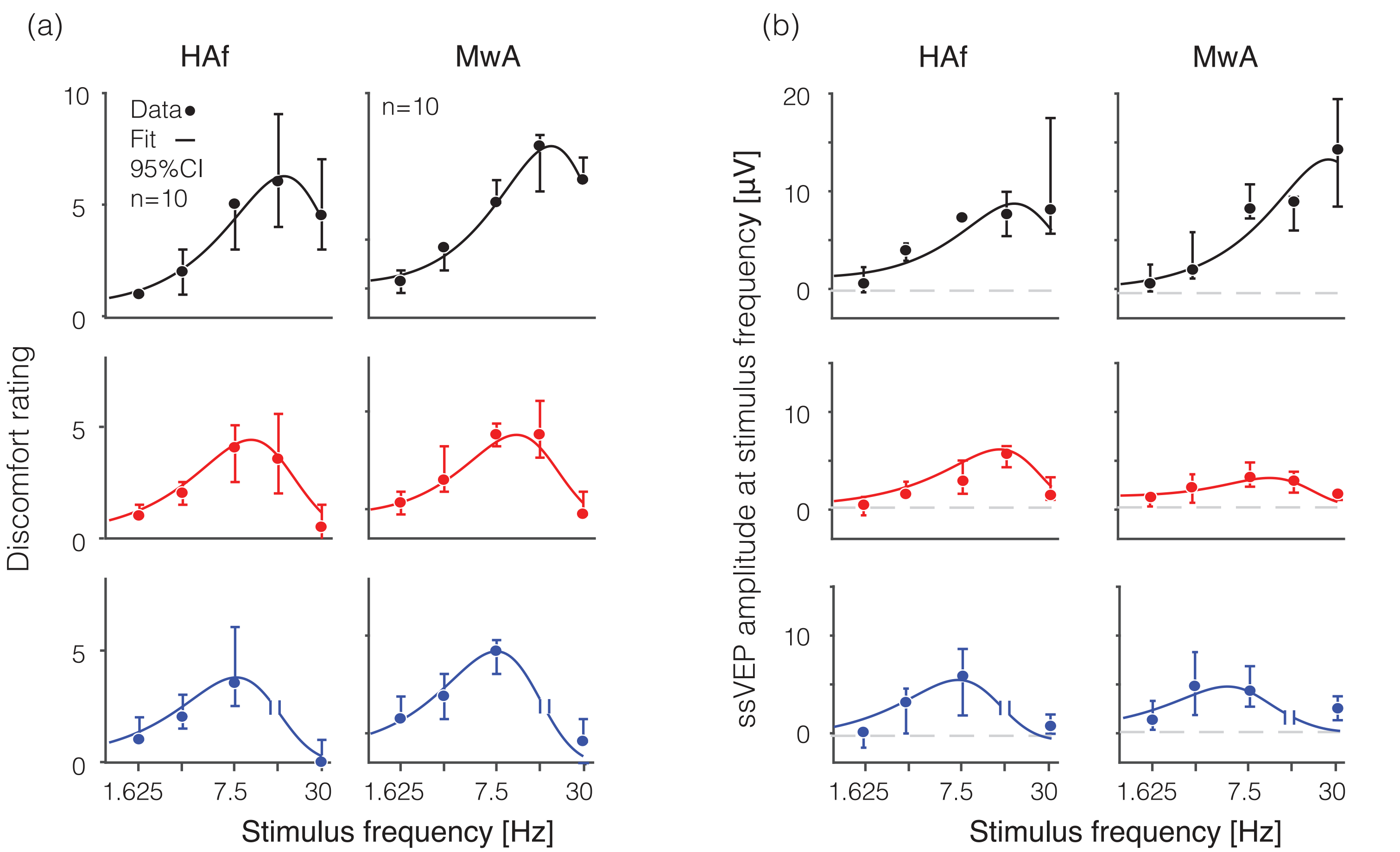

Figure S7: Visual discomfort ratings and visually evoked responses across temporal frequency and spectral modulations comparing HAf and MwA groups. Median visual discomfort ratings on a 0-10 scale (A) and visual evoked response at the fundamental stimulus frequency represented in mV (B) are shown as a function of temporal frequency (Hz) for LMS (black), L-M (red), and S (blue) flickering stimuli. Measurements from the S-cone directed stimulus flickering at 15 Hz were omitted (following our pre-registered protocol) as this stimulus was accompanied by a prominent, spatially structured luminance percept that we were unable to remove. Data are collapsed across HAf (n=10) and MwA (n=10) subjects. Error bars represent 95% confidence interval by bootstrap analysis. Fit line is derived from a difference-of-exponentials function.

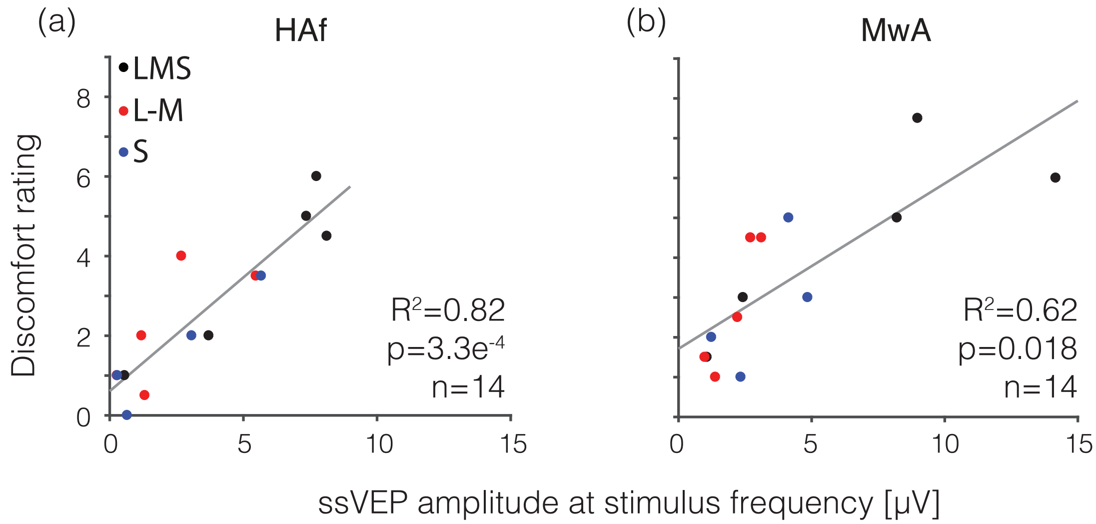

Figure S8: Visual discomfort strongly correlates with visual evoked response for both HAf and MwA groups. The median visual discomfort rating (0-10 scale) is plotted as a function of the median visually evoked response (in μV) for each of the 14 unique stimuli designed to stimulate the LMS (black), L-M (red), and S (blue) pathways.

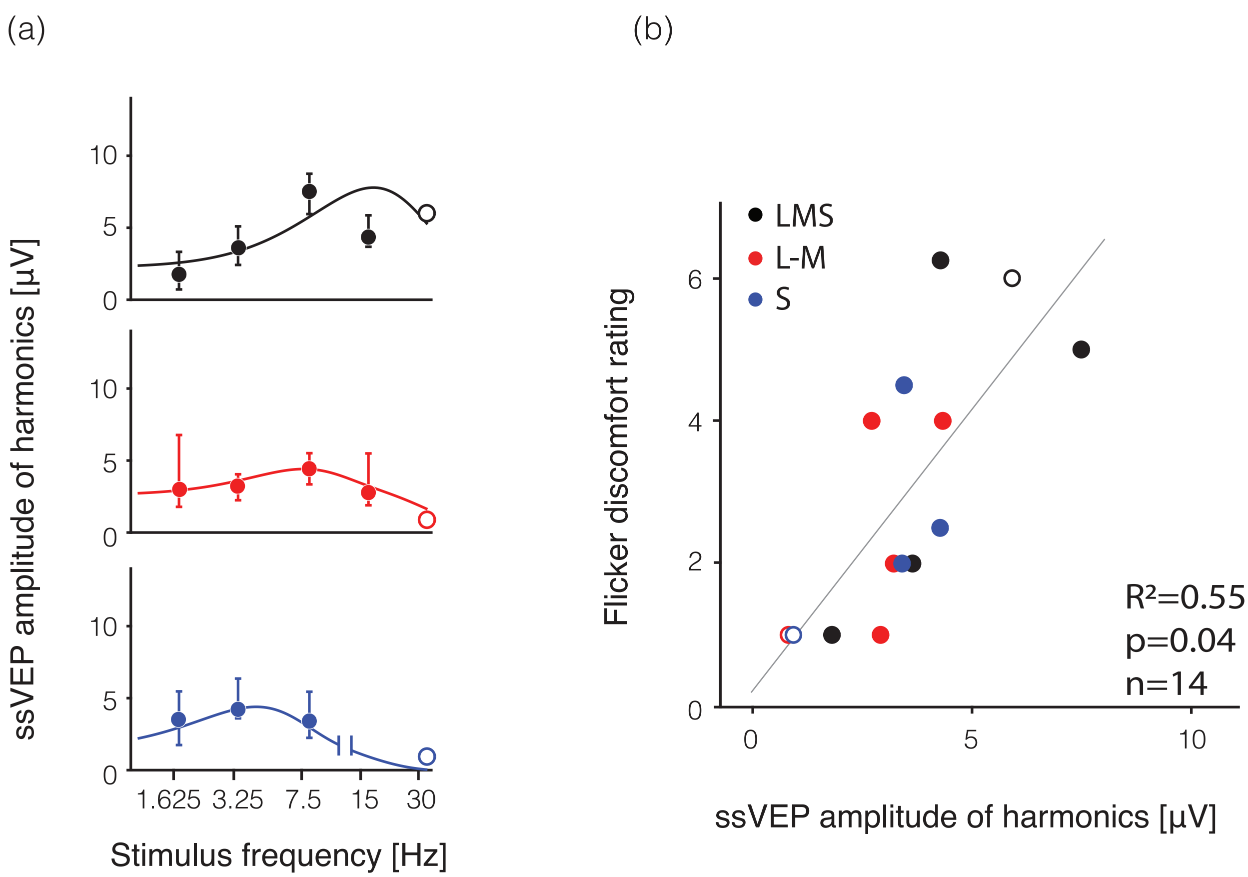

Figure S9: Stimulus frequency harmonics of the ssVEP signal. (A) shows the 2nd harmonic of the ssVEP signal for LMS (black), L-M (red), and S (blue) stimuli as a function of stimulus frequency. Open-circles identify imputed values. (B) shows the flicker discomfort rating as a function of the 2nd harmonic ssVEP for the 14 stimuli.

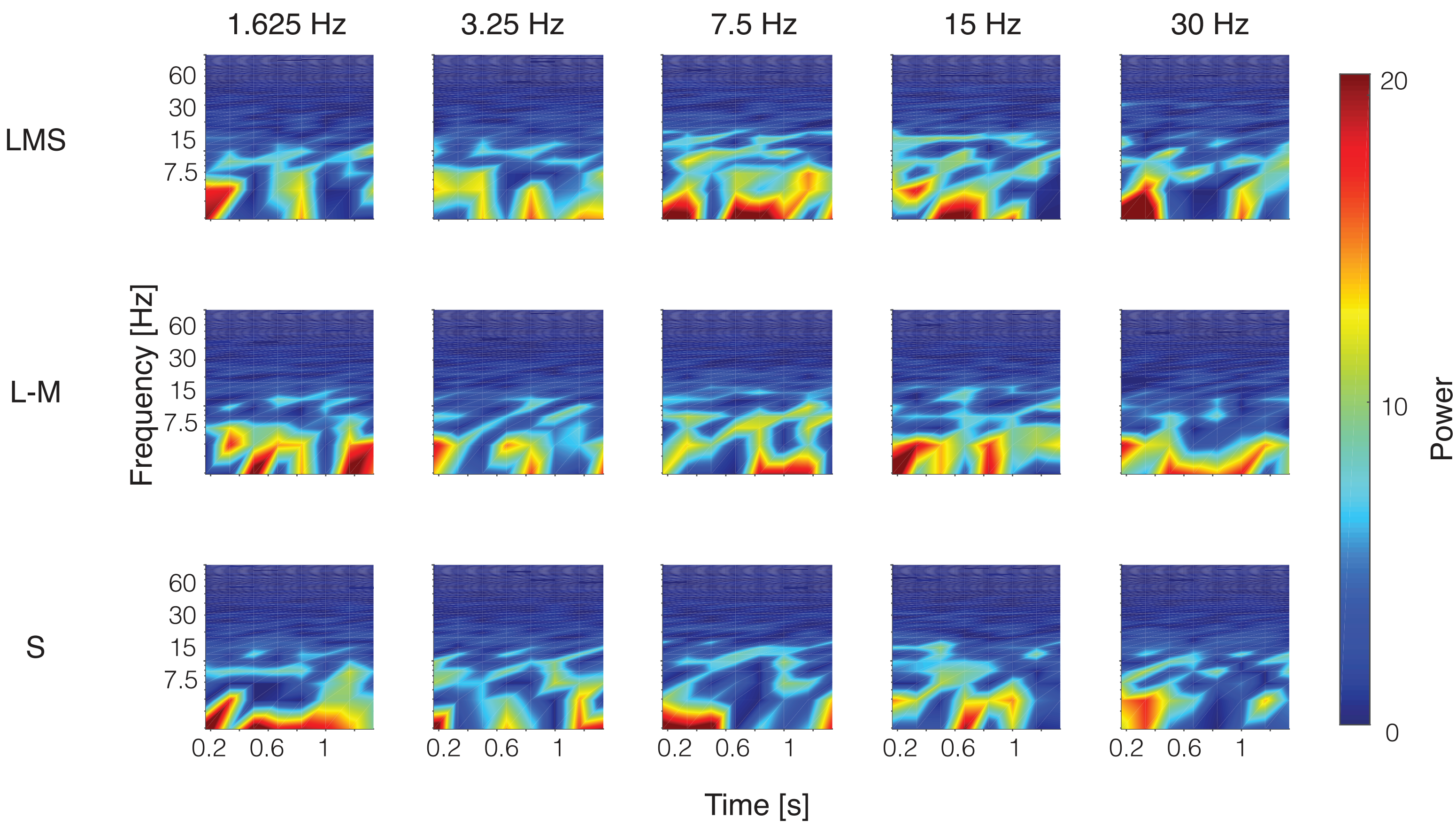

Figure S10: Narrowband gamma oscillations. Thomson's multitaper power spectral density (PSD) calculated across all subjects for the LMS (top), L-M (middle), and S (bottom) stimuli across 5 temporal frequencies. PSD was calculated from 200ms after stimulus onset to 1500ms after stimulus onset to focus on the steady state signal.

	Peak Frequency [Hz] Median [95% CI]		Peak Amplitude [μV] Median [95% CI]	
	MwA	HaF	MwA	HaF
Flicker discomfort	LMS 31.0 Hz [16.6-44.9] L-M 12.5 Hz [10.6-14.1] S 9.3 Hz [7.6-14.1]	LMS16.7 Hz [14.1-18.5] L-M 9.7 Hz [7.9-11.5] S 8.5 Hz [7.6-9.7]	LMS 7.5 [6.0-8.0] L-M 4.5 [4.0-6.0] S 5.0 [4.0-5.5]	LMS 6.0 [4.0-9.0] L-M 4.0 [2.0-5.0] S 3.5 [2.5-5.0]
ssVEP	LMS 31.1 Hz [15.9-44.4] L-M 12.5 Hz [10.3-14.1] S 5.7 Hz [4.9-9.5]	LMS 19.4 Hz [10.7-39.4] L-M 15.3 Hz [13.0-18.6] S 9.5 Hz [6.7-9.5]	LMS 14.2 μV [8.9-19.3] L-M 3.2 μV [2.5-5.2] S 5.7 μV [4.1-8.5]	LMS 8.9 μV [7.2-17.5] L-M 5.5 μV [4.2-6.3] S 5.5 μV [1.5-8.4]

Table Si: Peak frequency and peak amplitude from temporal transfer function difference of exponentials fit with median value and 95% confience interval by bootstrap analysis with replacement for HAf vs. MwA for the three spectral directions (LMS, L-M, and S).