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Supplemental Information

Auditory Cortical Plasticity Dependent on Environmental Noise Statistics

Natsumi Y. Homma, Patrick W. Hullett, Craig A. Atencio, and Christoph E. Schreiner

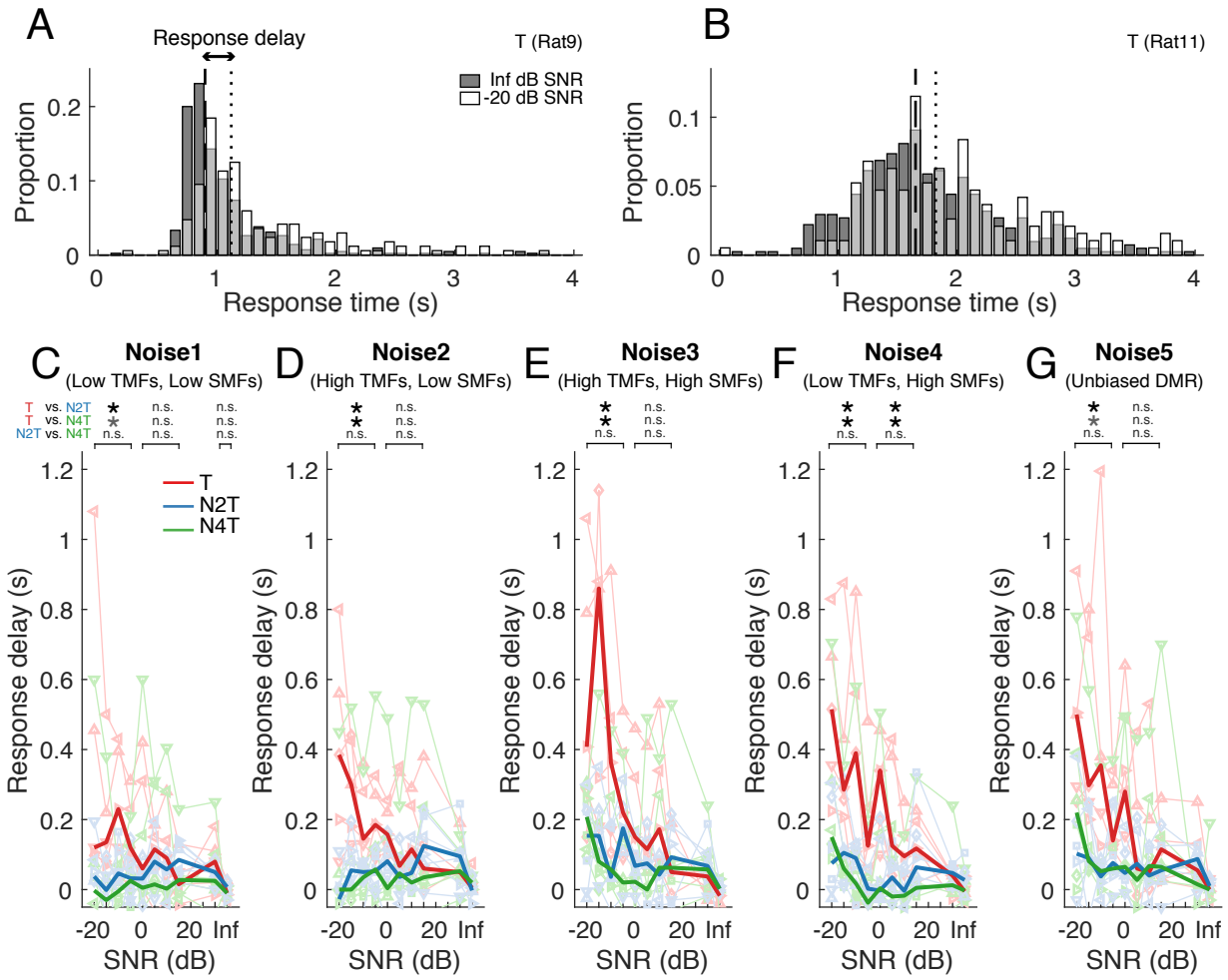

Figure S1. Noise-rearing improved behavioral response time delay, Related to Figure 3. (**A** and **B**) Histograms of response time for Inf dB SNR (gray) and -20 dB SNR (white) for two example trained animals. Black dashed and dotted lines depict median values of Inf and -20 dB SNR, respectively. Black horizontal arrow indicates response delay, the difference of median values between no noise and a SNR condition. (**C**, **D**, **E**, **F** and **G**) Median response delay values are computed for Noise1 (**C**), Noise2 (**D**), Noise3 (**E**), Noise4 (**F**) or Noise5 (**G**) and plotted against SNRs for T (red; n=5), N2T (blue; n=6) and N4T (green; n=6) groups with bold lines. Trained group showed larger delays compared to N2T and N4T groups. The asterisks indicate paired comparisons for the range of -20 to -5, 0 to 15, or Inf dB SNR. Asterisks: black, *P* <0.01, gray, *P* <0.05, n.s., Not significant.

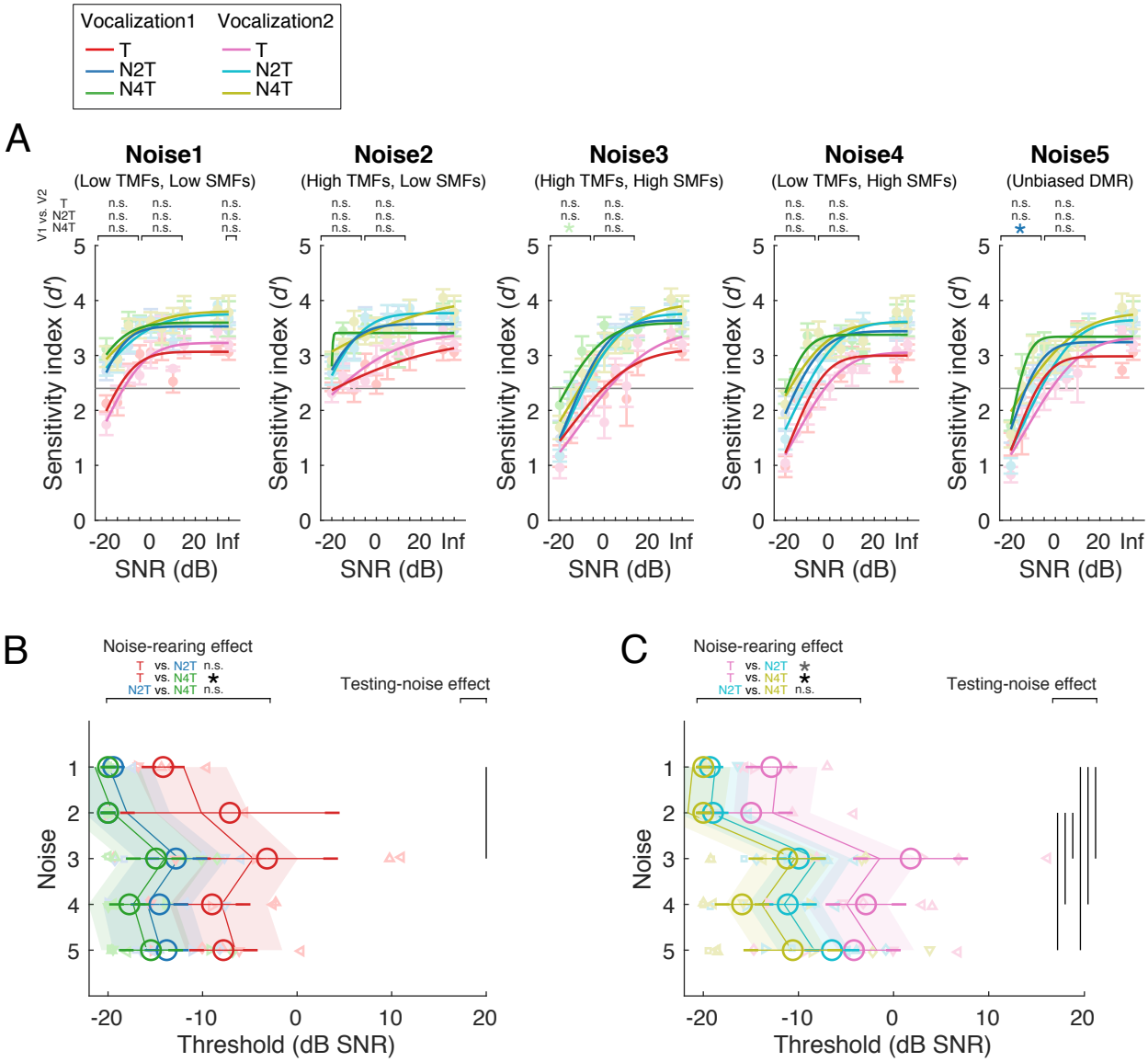

Figure S2. Improvement with noise-rearing was similar for different vocalizations, Related to Figure 3.

(**A**) Psychometric functions for vocalization detection in Noise1(LL), Noise2(HL), Noise3(HH), Noise4(LH) or Noise5(full). Individual *d'* values derived for the T (red for Vocalization1, V1; pink for Vocalization2, V2; n=5), N2T (blue for V1; cyan for V2; n=6) and N4T (green for V1; olive for V2; n=6) groups are plotted against signal-to-noise ratio (SNR). A cumulative Gaussian distribution was used to fit the functions for each mean (lines). Dots represent mean (±SEM) for each group. The horizontal gray lines indicate the threshold criterion of *d'* = 2.4. The asterisks indicate paired comparisons between V1 and V2 for the range of -20 to -5, 0 to 15, or Inf dB SNR, for each group. (**B** and **C**) Large open circles represent mean (±SEM) of threshold values for V1 (**B**) or V2 (**C**) for each noise type and group. The shaded areas represent the 2.5%-97.5% confidence intervals of the linear mixed effects model. Vertical lines: testing-noise effects (P <0.05). Asterisks: differences for T vs. N2T and T vs. N4T for each noise type; black, P <0.01, gray, P <0.05; n.s., Not significant. See Table S1 for details of statistical analysis.

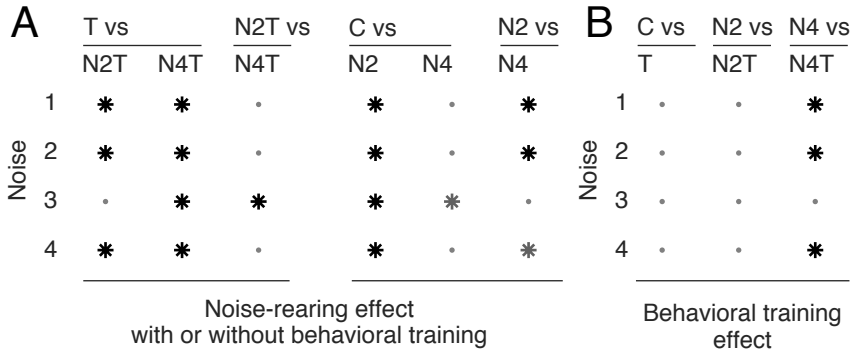

Figure S3. Post hoc comparisons for Figure 4L, Related to Figure 4. (**A**) Noise-rearing effects were found for N2T, N4T and N2 groups. (**B**) Behavioral training effects were observed in N4 group. Asterisks indicate significant post hoc multiple comparisons for groups at noise types; black, P <0.01, gray, P <0.05; gray dot, Not significant. See Table S1 for details of statistical analysis.

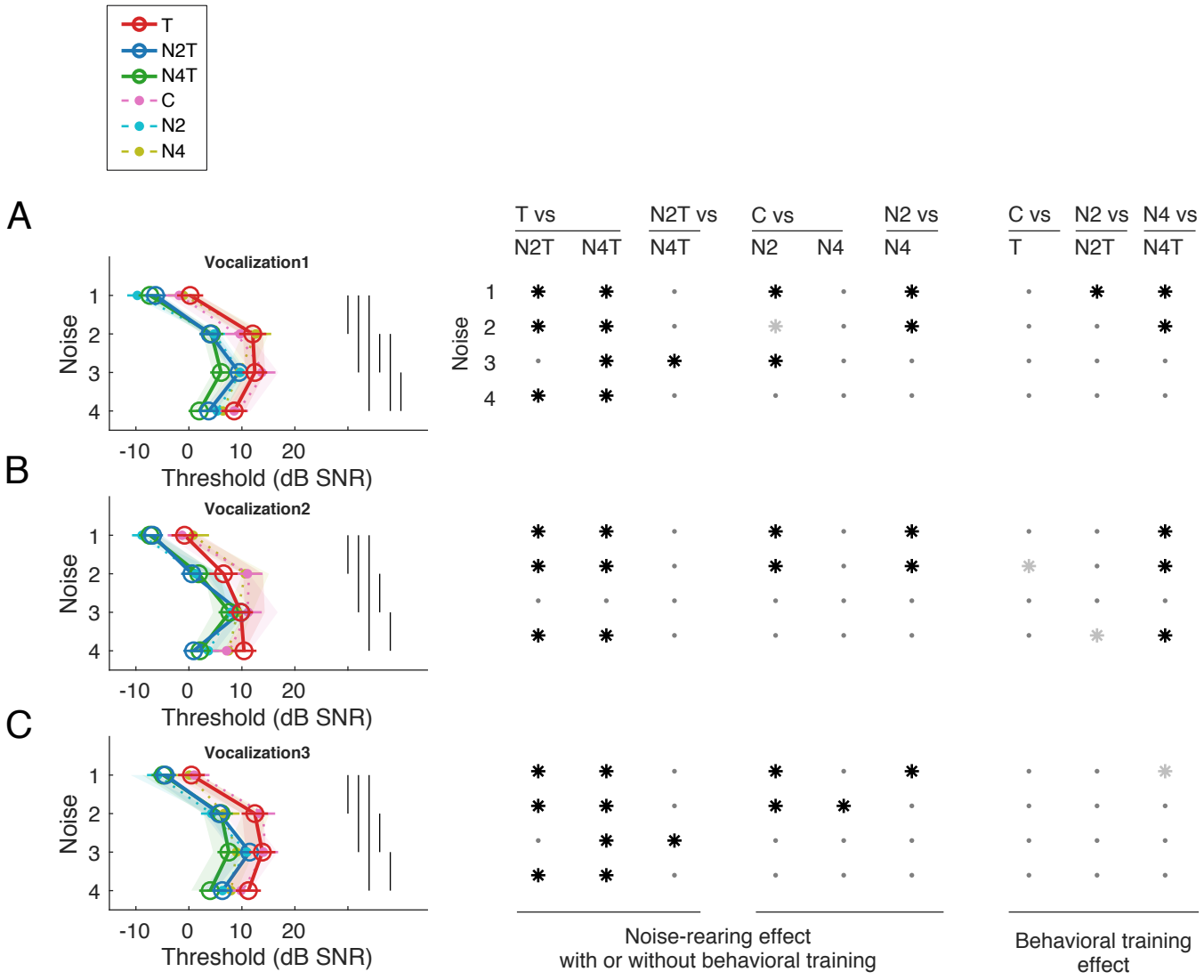

Figure S4. Cortical vocalization-in-DMR decoding to each noise type was consistent to different vocalizations, Related to Figure 4. Decoding thresholds were obtained as the first point to cross the criterion, and the mean (±SEM) value is plotted for each combination of groups and testing-noise types with open or filled circle for T (red; 254 MUs), N2T (blue; 652), N4T (green; 428), C (pink; 170), N2 (cyan; 587), and N4 (olive; 148) groups, for Vocalization1 (V1, **A**), Vocalization2 (V2, **B**) or Vocalization3 (V3, **C**). The shaded areas represent the 2.5%-97.5% confidence intervals of the linear mixed effects model. The vertical lines indicate significant post hoc multiple comparisons for noise type (P <0.05). Noise-rearing effects were found for N2T, N4T, N2 and N4 groups. Behavioral training effects were observed in V1 and V2, which were used in the task, and that was weaker for V3, which was only used for physiological testing. Asterisks indicate significant post hoc multiple comparisons for groups at noise types; black, P <0.01, gray, P <0.05; gray dot, Not significant. See Table S1 for details of statistical analysis.

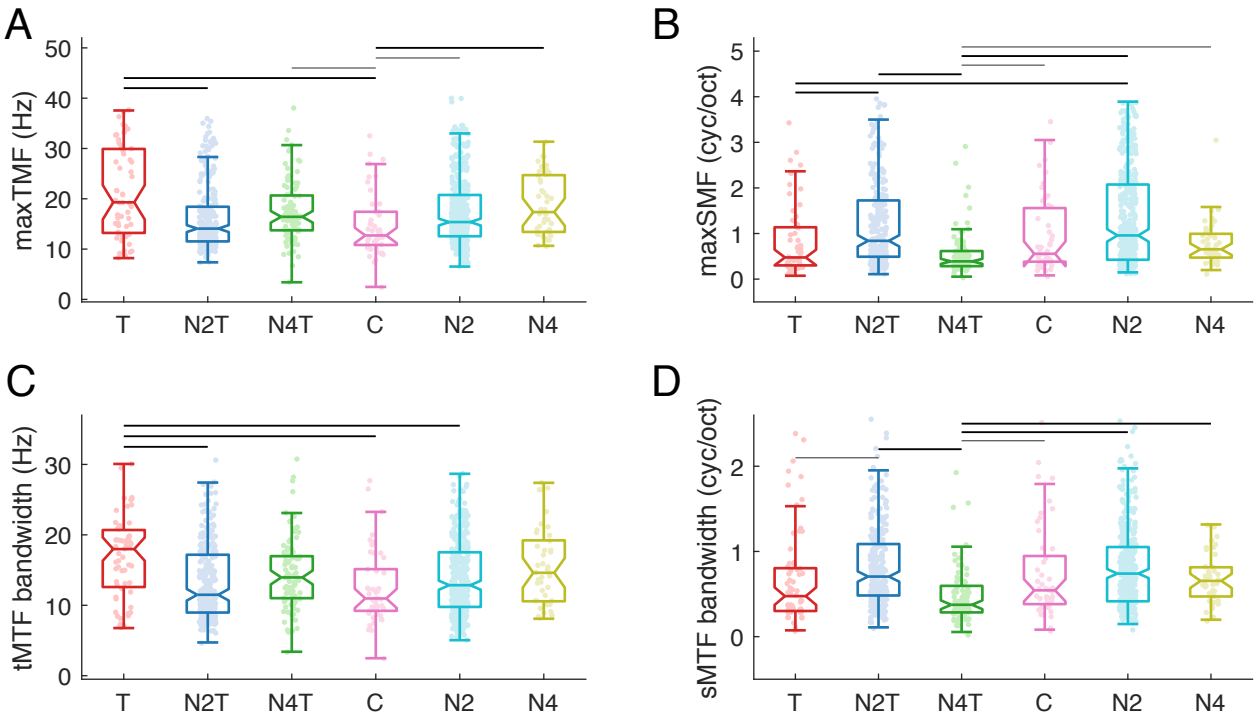

Figure S5. Noise-rearing and behavior training altered temporal and spectral modulation parameter values, Related to Figure 5.
tMTFs and sMTFs were obtained by summing a RTF along the spectral modulation axis for tMTF and along the temporal modulation axis for sMTF, respectively. maxTMF (**A**) and maxSMF (**B**) were computed as a maximum frequency above 70% of power of tMTFs and sMTFs. tMTF (**C**) and sMTF (**D**) bandwidths were computed as a cumulative distance above the 70%. For each box, the central marks represent the median values with the bottom and top of them indicating 25th-75th percentiles. (**A** and **C**) Noise-rearing and behavioral training slightly increased maxTMF with an expansion of tMTF bandwidth for Trained group. (**B** and **D**) Noise2-rearing increased maxSMF and sMTF bandwidth values while Noise4-rearing decreased them. The presentation scheme is the same as Figure 5.

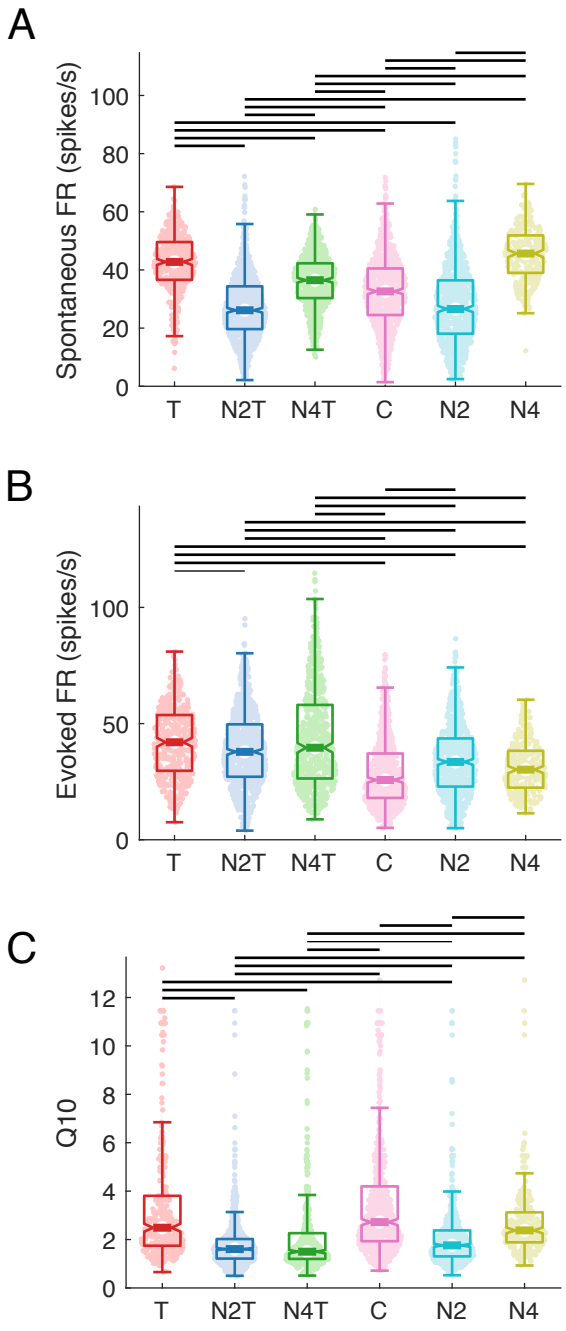

Figure S6. Effects of noise-rearing and behavioral training on frequency response area (FRA) properties, Related to Figure 5. (**A**) Noise specific effect was observed for spontaneous firing rate (FR) (*Kruskal-Wallis*, χ^2 = 815.87, P < 0.0001, *post hoc* test shown with horizontal lines or see Table S1 for P values). It decreased for the Noise2-reared animals (N2T and N2). (**B**) Evoked FR was obtained by subtracting preceding spontaneous FR from the FR during tone presentation. It tended to be larger for the animals with behavioral training (χ^2 = 326.01, P < 0.0001. (**C**) Q values were estimated as characteristic frequency divided by bandwidth. It was larger for Control and Trained groups (χ^2 = 668.40, P < 0.0001, supporting narrower tuning for the animals with no noise-rearing. This is consistent to the previous studies showing broader tuning for noise-reared animals (Insanally et al., 2009; de Villers-Sidani et al., 2007, 2008; Zhang et al., 2002; Zhou and Merzenich, 2008).

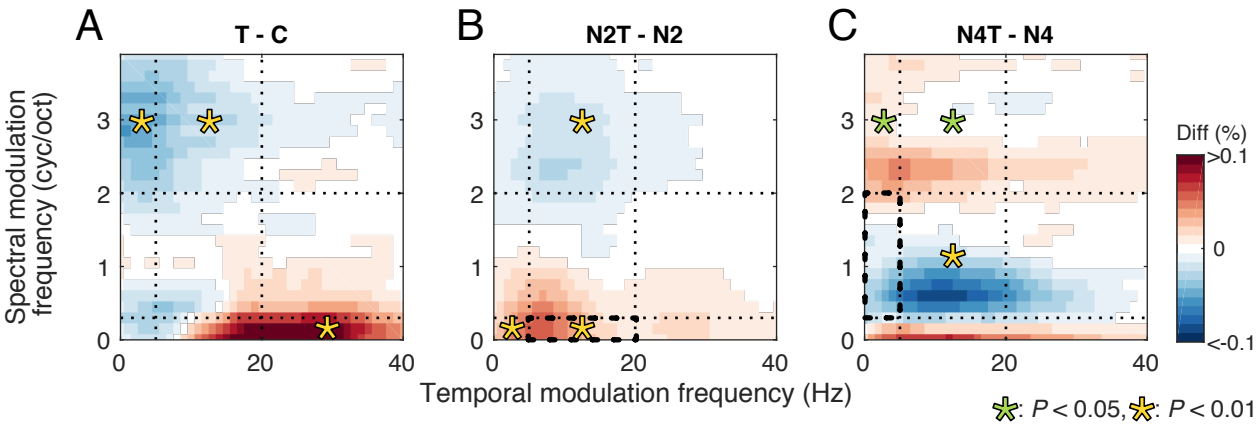

Figure S7. Behavioral training shifted spectral modulations toward the vocalization range, Related to Figures 6 and 7.
Effects of behavioral training were evaluated by contrasting pRTFs of trained versus untrained groups of matching exposure history. Differences of pRTFs were obtained between T and C (**A**), between N2T and N2 (**B**), and between N4T and N4 groups (**C**). The presentation scheme is the same as Figure 6D-F.