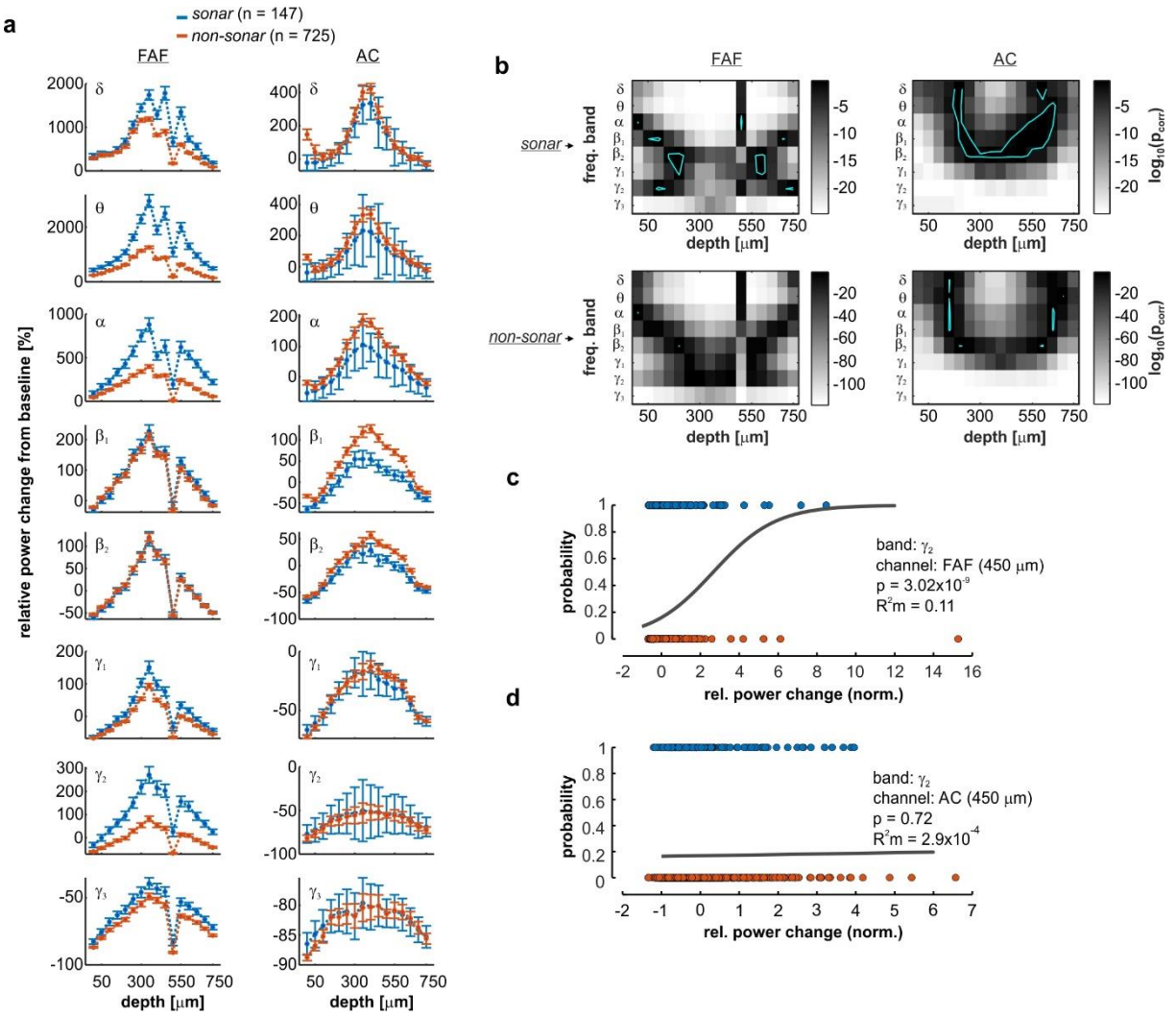

Fig. S1. Pre-vocal power changes associated with the production of sonar and non-sonar calls. (a) Percentage pre-vocal power change across LFP frequency bands (d, 1-4 Hz; q, 4-8 Hz; a, 8-12 Hz; b_1, 12-20 Hz; b_2, 20-30 Hz; g_1, 30-60 Hz; g_2, 60-120 Hz; g_3, 120-200 Hz), relative to a no-voc baseline, across all cortical depths in FAF (left) and AC (right). Pre-vocal power change values related to sonar utterances (n = 147) are depicted in blue; those related to non-sonar utterances (n = 725) are depicted in orange. Data shown as mean ± sem. (b) Significance matrices depicting p-values statistical tests to determine whether changes shown in panel a were significant (i.e. significantly different than 0% change for each channel and frequency band; FDR-corrected Wilcoxon signed rank tests). The colour scale in the figures indicates the log10 of the corrected p-values (significance when $p_{corr} < 0.05$). (c) Example GLM fitted with pre-vocal power change data from an FAF channel located at 450 mm from the cortical surface, in the g_2-band. Power changes in this band significantly predicted ensuing call type on a trial-by-trial basis ($p = 3.02 \times 10^{-9}$), with moderate effect size $R^2m = 0.11$. (d) Example GLM fitted with pre-vocal power change data from the AC, same electrode depth as in c, and also in the g_2 frequency band. Relative power changes in this frequency band and brain region did not significantly predict ensuing vocal type ($p = 0.72$).

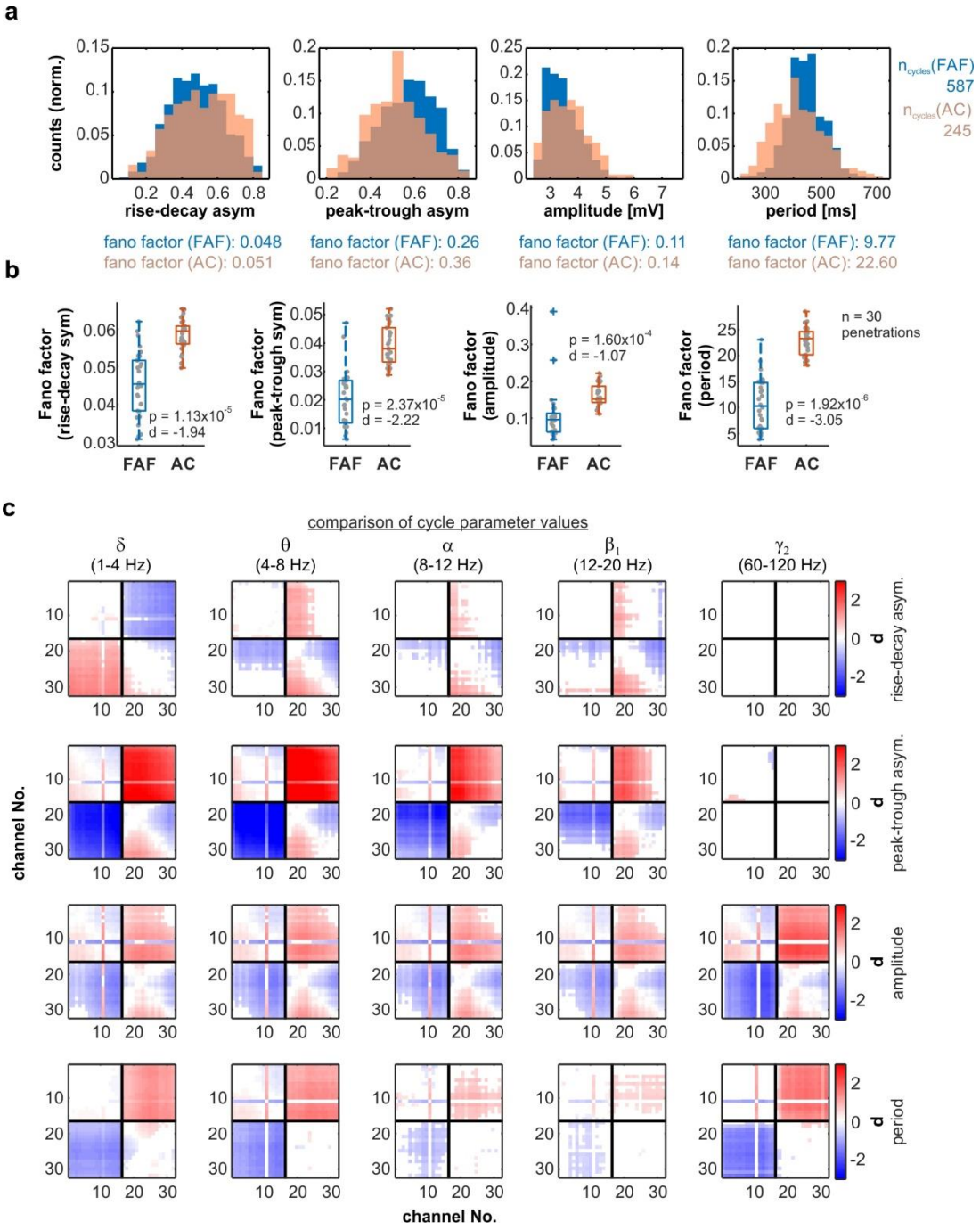

Fig. S2. Cycle parameters differ between frontal and auditory cortices. (**a**) Representative distribution of cycle parameters "rise-decay asymmetry", "peak-trough asymmetry", "amplitude", and "period" (left to right; period shown in **Fig. 2**) for d LFPs in simultaneously recorded FAF (blue) and AC (orange) channels (same penetration shown in **Fig. 2**; depth of 700 mm in FAF and AC). Fano factors of each distribution are indicated below the histograms. Note that Fano factors were always smaller in FAF. (**b**) Example comparison of d-band Fano factors across cycle parameters between the channels in FAF and AC whose parameter distributions are shown in **a** (i.e. 700 mm in both regions). Significance differences (Wilcoxon sign rank test, $p <= 1.60 \times 10^{-4}$) with large effect sizes ($|d| > 0.8$) were observed. Comparisons of all channel pairs, across frequency bands, are summarized in **Fig. 2f**. Similar comparisons

were performed for cycle parameter values (see Methods). (**b**) Effect sizes (Cohen's d) of the channel-by-channel pairwise comparisons between cycle parameters, across penetrations and frequency bands. Bands shown are those that were differentially modulated in terms of pre-vocal power between sonar and non-sonar utterances in FAF and AC (d, q, a, b_1, g_2). In each plot, a pixel with index (*i, j*) depicts the d obtained from comparing channels *i* and *j* (solid black lines in the plots divide channels from frontal and auditory regions). Channels with number 1-16 are located in FAF; channels with number 17-32 are in AC (see **Fig. 1e**). d values are only shown if the statistical comparisons for a given parameter are significant (FDR-corrected Wilcoxon signed rank tests, $p_{corr} < 0.05$); the value was set to 0 otherwise (pcorr >= 0.05). Large effect sizes occur for |d| > 0.8 (notably, blue and red regions in the plots).

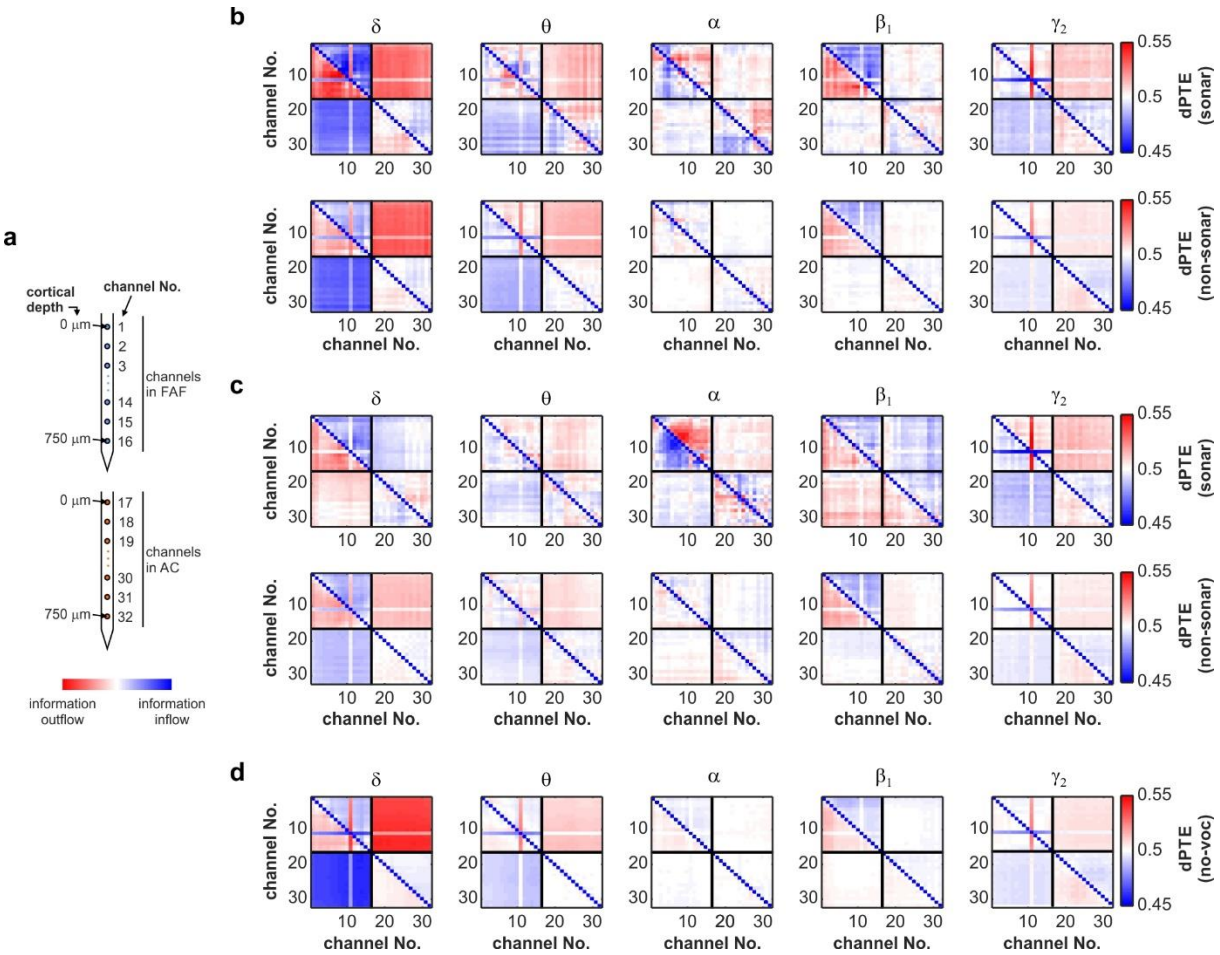

Fig. S3. Average dPTE matrices during pre-vocal, post-vocal, and no-voc periods. (**a**) Schematic representation of channel depth and cortical region associated with channel numbers in the panel. (**b**) Mean pre-vocal directed phase transfer entropy (dPTE) across LFP frequency bands (d, q, a, b_1, g_2) and conditions (sonar utterance, top; non-sonar utterance, bottom); 500 repetitions each). (**c**) Same as in **b**, with dPTE data corresponding to post-vocal periods. (**d**) Similar to **b** and **c**, illustrating average dPTE matrices corresponding to no-voc periods. Each matrix in the figure (i.e. panels **b-d**) illustrates the average dPTE across 500 repetitions calculated using 50 trials corresponding to sonar, non-sonar (both pre- and post-vocal), or no-voc related LFP segments. A cell (*i, j*) in a matrix shows the average dPTE value related to the information flow between channels *i* and *j*, which occurs in the $i \rightarrow j$ direction for dPTE values > 0.5 (red colours), and in the $j \rightarrow i$ direction for dPTE values < 0.5 (blue colours).