

Supplementary Materials for

Integrating vision and echolocation for navigation and perception in bats

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Reference (40)

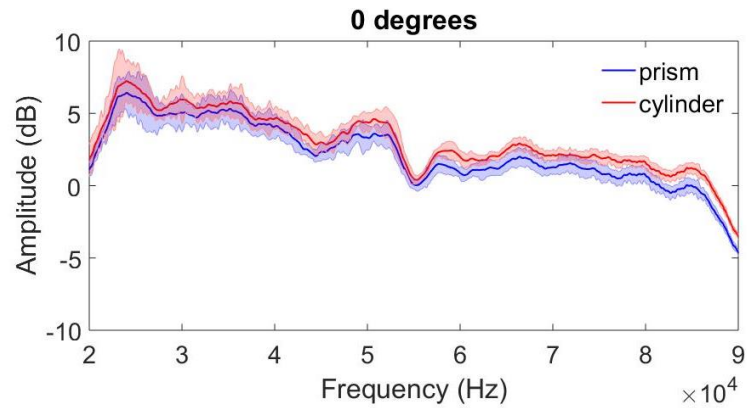


Fig. S1. Spectra of the targets in the bimodal learning experiment. The targets' spectra were recorded from 0 degrees demonstrating that the echoes of the targets' 2D cross-section were very similar. Discriminating the targets acoustically, thus, required the bats to scan their 3D shape, as they did (fig. S2).

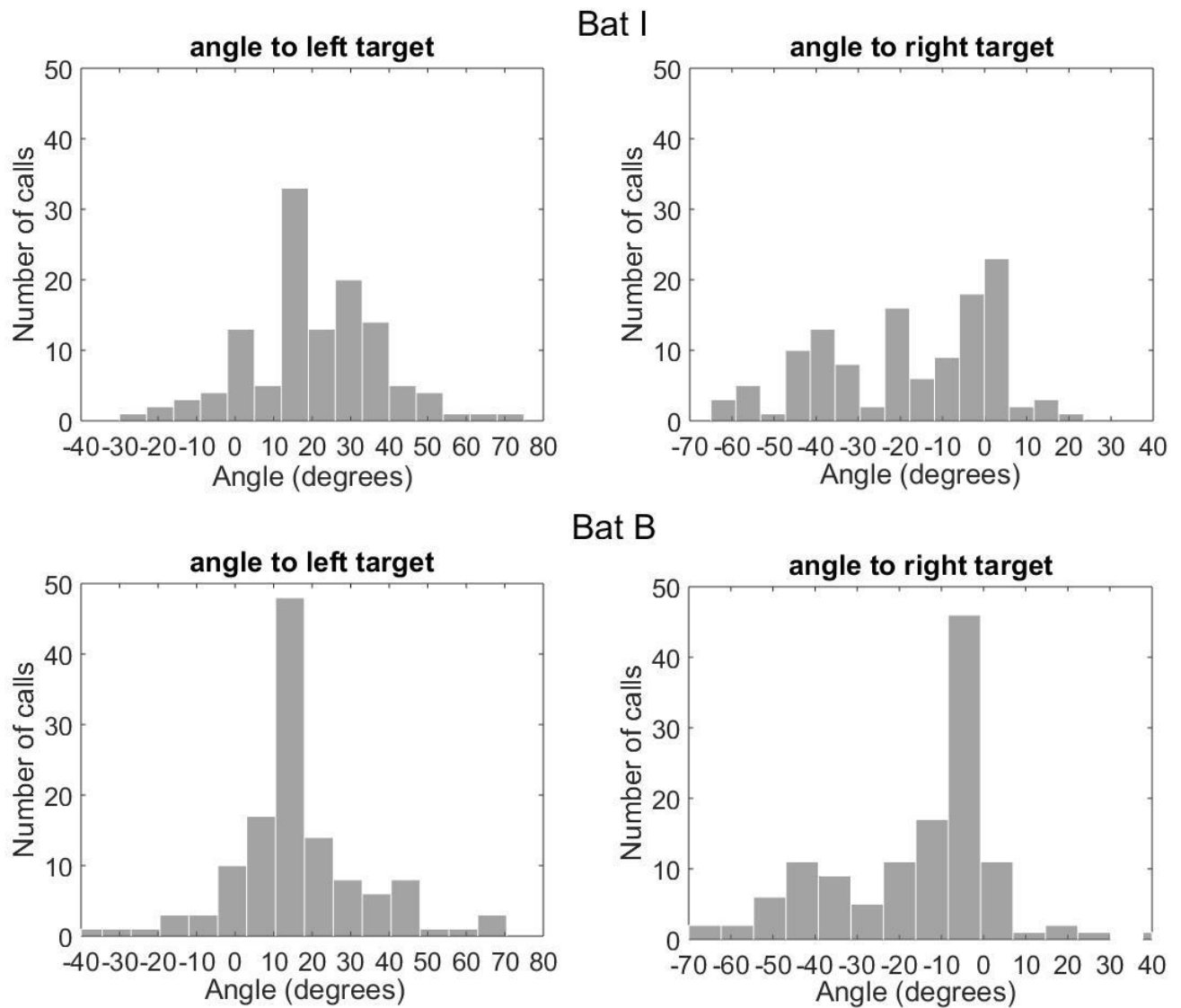


Fig. S2. The distribution of the bats' angles relative to the targets. The 3D location of the bat during every echolocation pulse emission along the flight was estimated based on the time of arrival of the sound to the different microphones (Materials and Methods). For each 3D location, the angle between the bat and the main axis of each of the targets was calculated. Previous studies show that these bats direct their beam towards the target at flight with a shift (40), so the actual angles of observation might be shifted, but the range should be the same. The distribution of all angles per bat and per target are shown, with 0 degrees indicating that the bat is facing the front face of the target. The data shown is for two bats I and B. For each bat, the data was calculated for 7 trials (4 with the rewarded target on the right and 3 to the left).

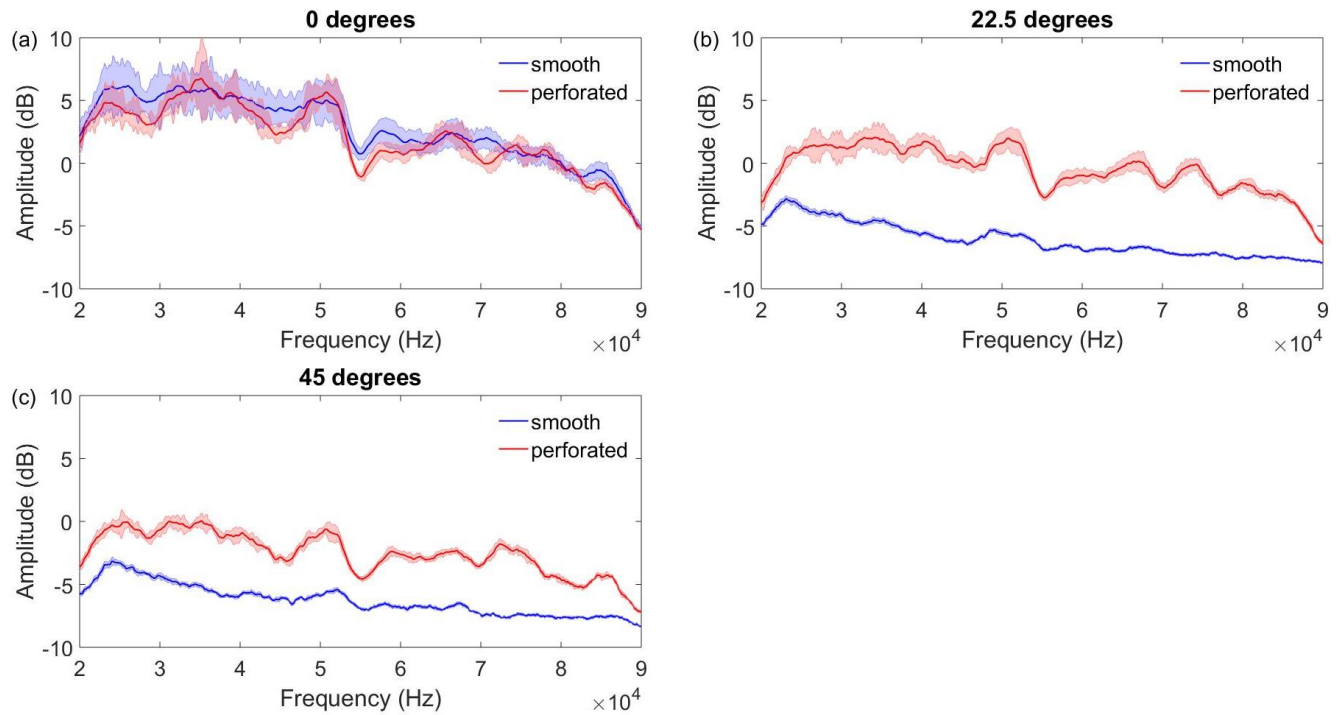


Fig. S3. Spectra of the targets in the cross-modal recognition experiment—round 1. The targets' spectra are presented for three azimuths: 0 degrees (a) 22.5 degrees (b) and 45 degrees (c). In addition to being louder, the echoes of the perforated target (red) show spectral modulations that become more salient when 'viewed' from the side.

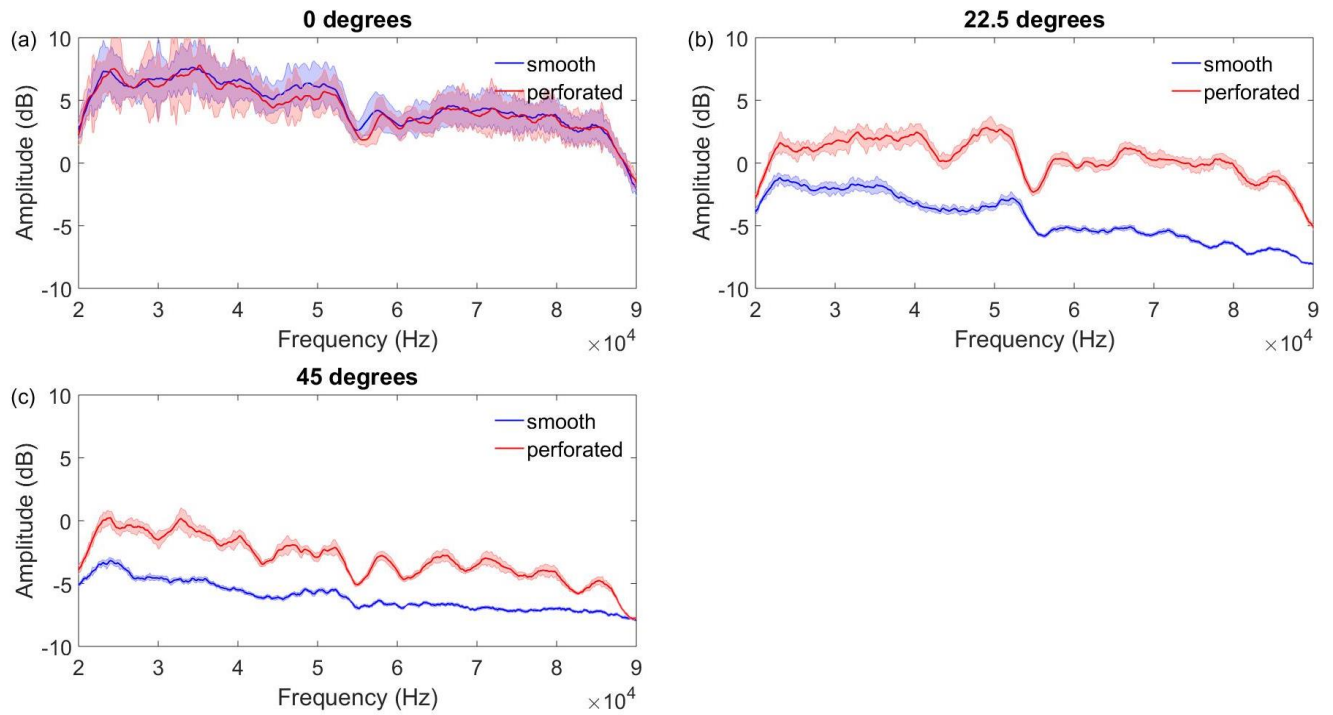


Fig. S4. Spectra of the targets in the cross-modal recognition experiment—round 2. The targets' spectra are presented for three azimuths: 0 degrees (a) 22.5 degrees (b) and 45 degrees (c). In addition to being louder, the echoes of the perforated target (red) show spectral modulations that become more salient when 'viewed' from the side.