

Fig. S1: Boxplots of absolute phase lags ϕ in degrees between LW and RW for 11 *Gryllus bimaculatus* males (M1-M11) and four wing regions. Whiskers denote 1 IQR, outliers are marked as red +. For each animal, each wing region was simultaneously recorded with 2 LDV and ϕ was calculated as the difference in instantaneous phase between LW and RW at the positive and negative displacement peaks of the RW recordings. $n=18-28$ for each animal and wing region. Chord regions could only be recorded successfully from 7 animals. The last panel shows mean $\phi \pm \text{std}$ per wing region over all 11 specimens (7 for the chord region); see also Fig. S2 and S3.

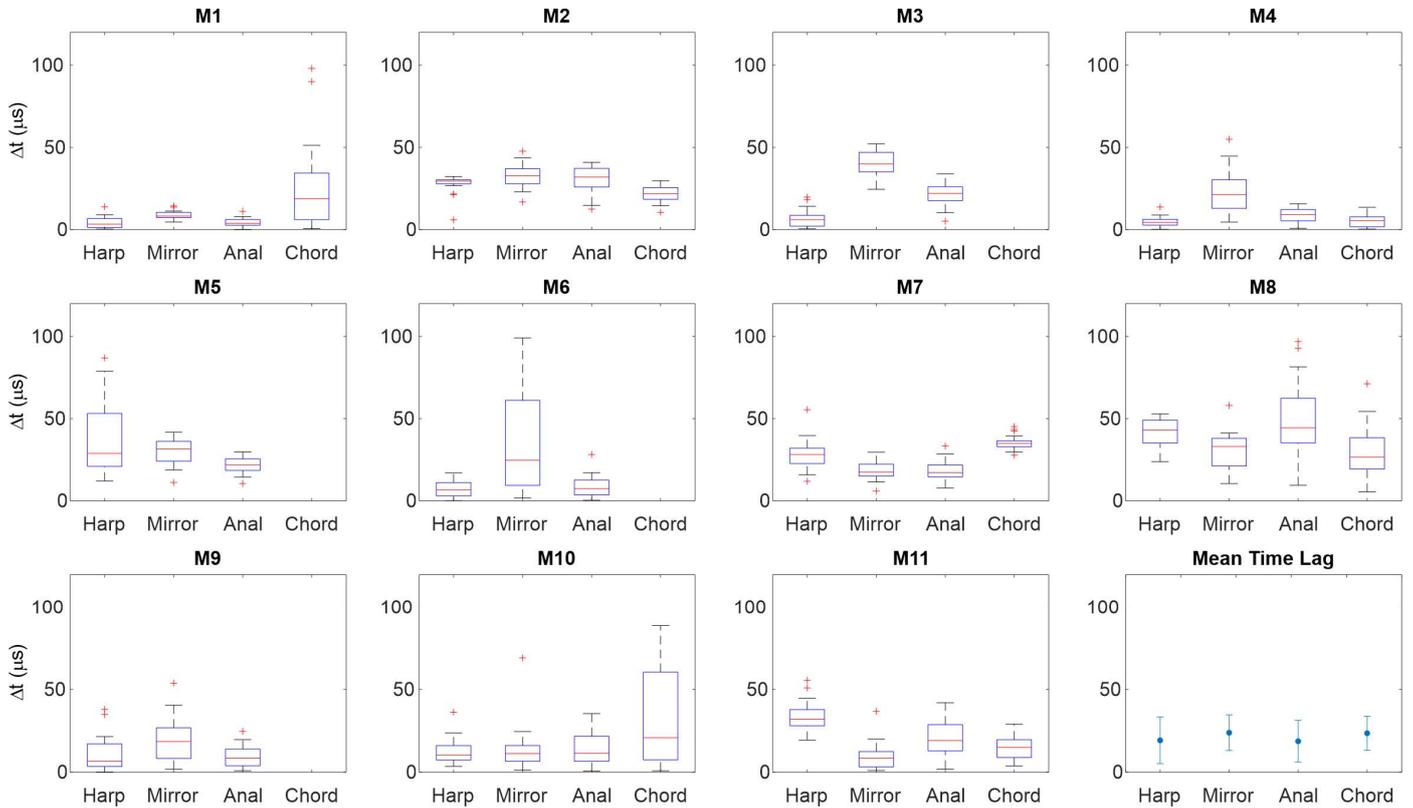


Fig. S2: Boxplots of absolute time lags Δt in μs between LW and RW for 11 *G. bimaculatus* males (M1-M11) and four wing regions. Whiskers denote 1 IQR, outliers are marked as red +. For each animal, each wing region was simultaneously recorded with 2 LDV and Δt was calculated using phase lags φ (see Fig. S1) and the corresponding carrier frequencies f_c . $n=18-28$ for each animal and wing region. Chord regions could only be recorded successfully from 7 animals. The last panel shows mean $\Delta t \pm \text{std}$ per wing region over all 11 specimens (7 for the chord region); see also Fig. S3.

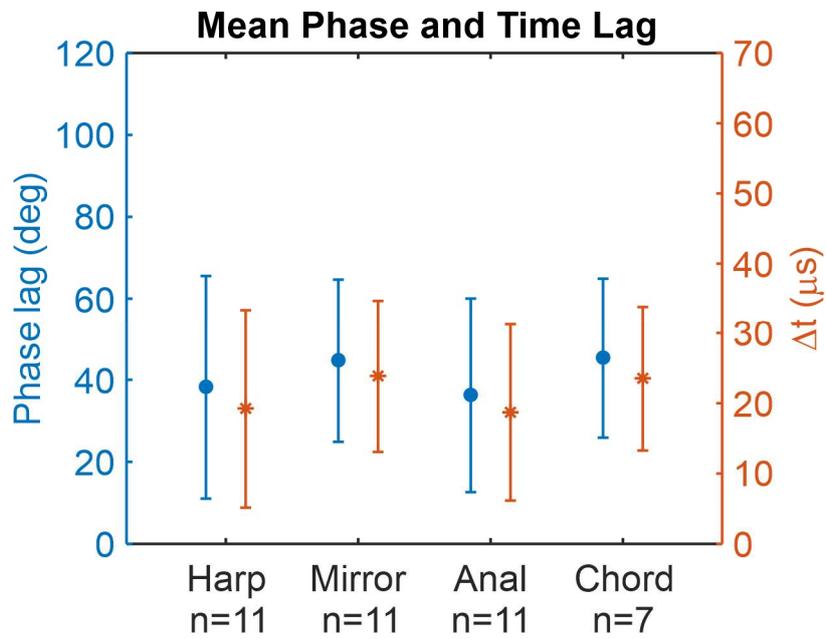


Fig. S3: Mean phase lag ϕ (blue circles, left y-axis) and time lag Δt (red stars, right y-axis) \pm std between left and right wings in 11 *G. bimaculatus* males for four wing regions. Chord regions could only be recorded successfully from 7 animals. Δt has been calculated from individual ϕ values and corresponding carrier frequencies for each specimen and recording.

Video 1: A male *Gryllus bimaculatus* producing calling song in the experimental setup after pharmacological injection of Eserine (10^{-2} mol/l) into the brain. The cricket is mounted and fixed on a holder in front of the LDV. The LDV's laser dot is visible on the harp area of the right wing.

Video 2: Animation of the vibration map of unengaged left and right wing of a male *Gryllus bimaculatus* as derived from LDV recordings. The wings are elevated upwards from the animal's body at a similar angle to the natural singing position, spaced apart and imaged from the front; the reference microphone is visible between and slightly behind the wings. The overlaid vibration map shows the colour-coded relative displacement ($\mu\text{m}/\text{Pa}$; red = max. positive displacement; blue = max. negative displacement) of the wing surface as a response to acoustic stimulation at the wings' overall resonance frequency (4.62 kHz). Here, the LW displacement amplitude is higher than the RW's.