Echolocation Flexibility of Tri-Colored Bats (*Perimyotis subflavus*)

Elle Lim and Amanda M. Adams
Department of Biology, Texas A&M University, College Station, TX

Introduction

The echolocation emitted by bats change accordingly to accommodate the environment in which they are in. In environments where other acoustic interferences are present, bats alter their location through mutual suppression or jamming avoidance response mechanisms.

Our research compares the echolocation calls of tri-colored bat (*Perimyotis subflavus*), fig. 1, a mostly solitary species of bats, under different flight settings to detect echolocation behaviour differences.

Figure 1. *Perimyotis subflavus* Photo credit: Joel Sartore

Hypothesis

Tri-colored bats flying in different environments will adjust and change their echolocation behaviour. We predict that bats will increase their emission rates in a cluttered "maze" environment, showing shorter interpulse intervals (IPI).

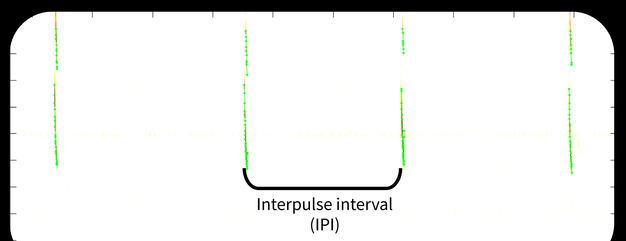

Figure 2. Call signals were analyzed in 500 msec windows with interpulse intervals labelled.

Methods

We analyzed the echolocation calls of tri-colored bats (n = 4 bats, 5 flights/bat) flying through two-room conditions:

a. In an open room (Fig. 3a,c)
b. In a room with a 6x5 rope "maze" (Fig. 3b,d)

And two acoustic treatments:

c. In silence (no playback, Fig. 3a,b)
d. A simulated pair with one bat flying in the flight room and playback, mimicking a second bat calling at a rate of 40 Hz (Fig. 3c,d)

Steps of Call Analysis (Fig. 2, 4)

a) In a program called callViewer, five flights were observed for a call recording belonging to one tri-colored bat.
b) Per flight, call signals were analyzed in 500-millisecond intervals
c) If needed, signals were re-analyzed for accuracy in order to collect the right frequency and call information.

Acoustic Analysis

We measured echolocation call variables of each flight per bat in all conditions

- Interpulse interval (IPI), the time between the emission of each call.
- Maximum frequency (Fmax), the peak frequency of the call.
- Minimum frequency (Fmin), the lowest frequency of the call.
- Frequency of most energy (FME), the frequency with the greatest amplitude (loudness) of the call.

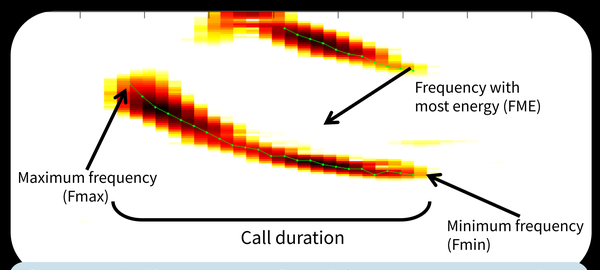

Figure 4. Calls were analyzed for accuracy to collect data on Fmax, Fmin, and FME.

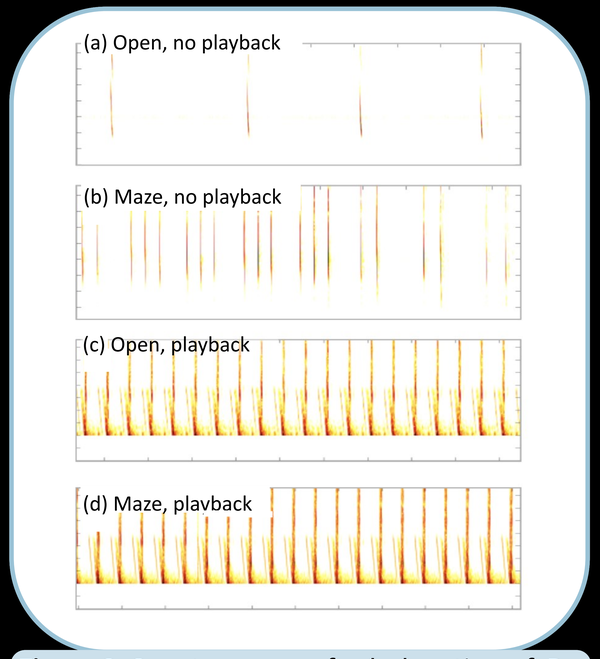

Figure 3. Spectrograms of echolocation of *P. subflavus* under different conditions

Results

There were significant differences found in the IPI and duration for the call parameters between the maze and open room conditions. However, analysis showed no significant differences in any of the frequency parameters for the echolocation calls. (t = 5.3, df = 6, p = 0.002)

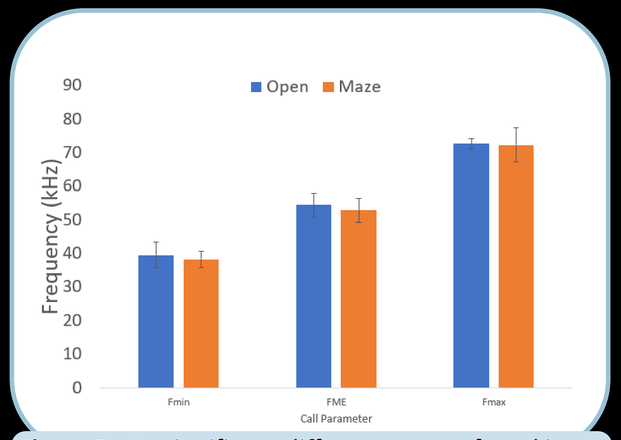

Figure 5. No significant differences were found in call frequency between the two room conditions.

Discussion

Our findings expand upon bat behaviour as we can quantify how bats modify their echolocation to match their environment. Our analysis of the echolocation calls emitted by *P. subflavus*, can further encompass what we know of echolocation flexibility by including potential jamming avoidance and mutual suppression as a response mechanism.

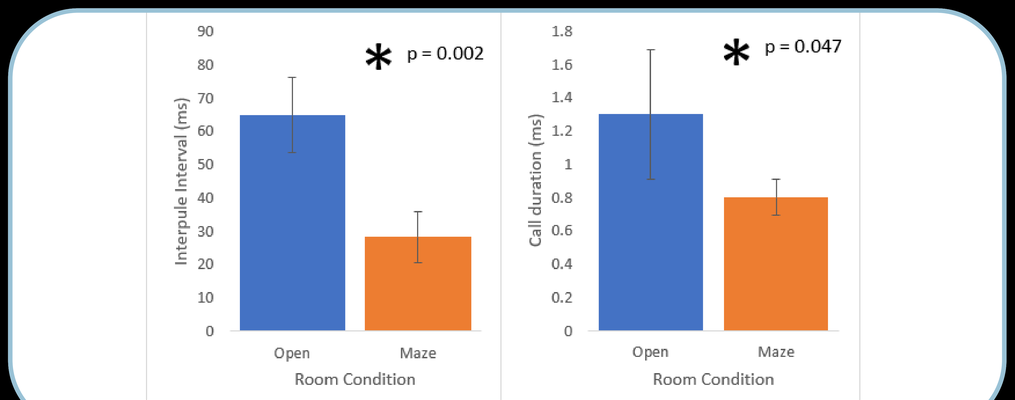

Figure 6. (t = 5.3, df = 6, p = 0.002)
Significant differences were found in IPI and call duration between the maze and open room conditions.