**Introduction**

A longstanding question about echolocating bats is how they are able to recognize their prey or obstacles by the sounds of echoes. Free-tailed bats emit frequency-modulated (FM) biosonar pulses and are able to reconstruct their auditory scene based on the timing, amplitude and fine acoustic features of the returning echoes. It is hypothesized that the shape or texture of a target can be inferred by the presence of spectrottemporal interference patterns that emerge in the echoes bouncing off of irregular shaped objects. The precise pattern of the notches in the bats’ echoes may be used to deduce target shape. To test this, we trained bats to discriminate between different types of sandpaper using their echolocation. The bats investigated targets by emitting pulses and evaluating the returning echoes, and were rewarded for approaching whichever sandpaper possessed the courser grit size. Sandpaper grit sizes differ by the average particle size, which allowed us to investigate how finely bats can discriminate differences in texture. We challenged bats with sandpaper grit sizes ranging from very coarse (40 grit, 425 microns) to very fine (240 grit, 65 microns) to determine what the smallest perceptible difference was.

**Methods and Materials**

In order to do the experiment the bats were trained to walk across a Y-maze, rather than fly. After the bats were comfortable crawling around the Y-maze, they were given the choice between two textures. The bats were rewarded with a treat when they approached the rougher choice of sandpaper.

**Results**

In order to test if bats can discriminate textures, we must first prove that echoes are changed by differences in textures. As we go down the grit sizes, the sand paper becomes rougher, and the power spectra shows a pattern of “rougher” peaks in their graphs. As evident when comparing the peaks of the of 60 grit vs the 120 grit, there are many more peaks and troughs in the 60 grit. In this experiment it is hypothesized the bats can make use of these differences in peaks to discriminate between two different sandpaper grits.

Next the bats were subjected various combinations of sandpaper to discriminate. Starting with the roughest and smoothest. The bats could easily discriminate between extremes. A full array of grits were tested to discover the limit of discrimination. As seen in figure B, the higher grit numbers have less of a particle diameter difference than lower grits which have a high difference in size between grits. At this point the discrimination is either based on relative difference or a discrete unit of difference.

**Conclusions**

The bats were found able to discriminate surfaces based on texture, due to the changes in echoes that the different particle sizes cause. The bats were able to distinguish a difference of 14 microns of sandpapers (180 grit vs 220), but were not able to do a difference of 77 microns (40 grit vs 50 grit). This inability suggests the bats’ discrimination follows a Weber-Fechner law with a threshold of approximately 20%. Overall this experiment was successful as a training model for providing evidence for this theory and as a model to train Mexican Free Tailed bats.

**References:**