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Human Music Genre Recognition in Goldfish

By Sophia Hallam and Makali Haines

Hypothesis:
Goldfish will respond to sound cues and be able to distinguish between human made genres.

Intro

In our study goldfish will be trained to respond to sound cues and be able to distinguish between human made [music] genres. A study done by Richard Fay examined how different sound intensities were processed by goldfish and allowed us to gain further knowledge and understanding of sound memory in goldfish. Fay learned that in the saccular fibers in goldfish there is a detection of “increments and decrements in continuous tones may be determined by steep low-pass filtering in peripheral neural channels which enhance the effects of spectral “splatter” toward the lower frequencies,” (Fay 1985). Fay also found results that showed that at different sound pressure levels, different populations of peripheral fibers provide information used in intensity discrimination that goldfish display when sound is heard and processed into memory.

A study similar to Fay and the scientists at Israeli Technion Institute of Technology is one done by Kazutaka Shinozuka in 2013. Shinozuka looked into whether stimuli found in music had reinforcing and discriminative properties in goldfish. The results that were found by this study showed that “music has discriminative but not reinforcing stimulus properties in goldfish,” (Shinozuka 2013), and that goldfish did not show a preference for music but did show a specific and significant avoidance to some noise stimuli and thus was able to discriminate between pieces of classical music. This information allowed our study to focus on the cues found in separate genres and further compare whether the goldfish will respond to the correct sound cues found in the music.

Results:

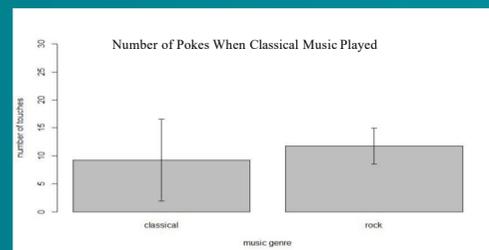


Figure 1. Figure one is a barplot that compares the number of classical pokes to the number of rock pokes during the classical music trial in goldfish. (p_value is 0.6954)

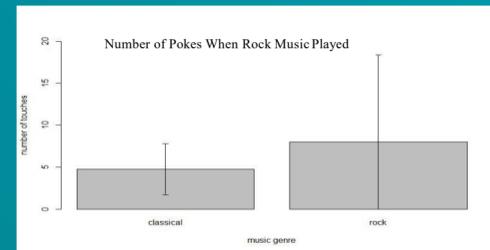


Figure 2. Figure two is a barplot that compares the number of rock pokes to the number of classical pokes during the rock music trial in goldfish. (P-value is 0.6813)

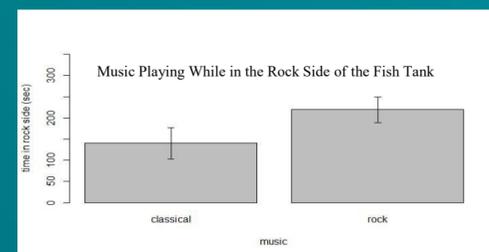


Figure 3: Figure three is a barplot that compares the duration of time the goldfish are in the correct side of the tank that correlates to the rock music being played. (P-value is 0.06103)

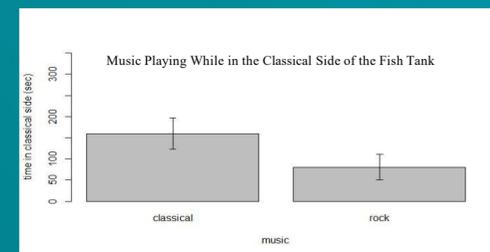


Figure 4. Figure four is a barplot that compares the duration of time the goldfish are in the correct side of the tank that correlates to the classical music being played (p-value is 0.06103)

Conclusions

The p-value for the time the fish were in the correct side of the tank was not significant, but it was close to being significant. This does not prove that goldfish can discriminate human made genres, but it suggests that it could be possible if the training was improved. The training could be improved by having a mechanism that releases the food quicker and closer to the fish when the fish touched the correct indicator. The fish might have also benefited from training for a longer period. The touch tests were also not significant and did not prove that goldfish can discriminate between human made genres.

Future Studies

A study could be done where they test a variety of animals looking for which one can learn our categorization of music, then compare what's happening in the brains of many species when hearing our music. Perhaps it's not a lack of ability but the lack that categorization of music is not a necessity that evolution has evolved for; or perhaps one could study the preferences of different genres of music or no music being played in their habitat.

Methods

We placed a one dram vial on one end of the tank and placed a blue pipe cleaner inside the vial, we repeated with a separate one dram vial and a yellow colored pipe cleaner on the opposite end of the tank. Each pipe cleaner was assigned a music genre, one color being classical and the other hard rock. A set of goldfish was separated into two groups, a control group and the group that would be trained (test group) to respond to the different musical genres.

We transferred the test group into the training ten-gallon tank and began playing the classical genre of music for fifteen minutes. During the fifteen minute training period the fish were only fed when they touched the corresponding pipe cleaner/vial for classical music. When the first training period was complete the fish were transferred into a separate, ten-gallon tank where they would rest for ten minutes between training periods. Once the rest period was completed, the fish were transferred back into the training tank and the fifteen minute test period was repeated but with the hard rock musical genre. The training was conducted four consecutive days a week for three weeks. The playlist for each genre was generated online from pieces that the public has deemed apart of that genre.

On the final day the goldfish were tested alone for five minutes per genre. We recorded the amount of times the goldfish touched the correct and incorrect pipe cleaner/vial during each trial and how long they stayed in the correct half of the tank. Once all goldfish were tested and the results recorded, the results were compared in R (Version 1.1.463) using a t-test.

Resources

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Laland, K. N., Brown, C., & Krause, J. (2003). Learning in fishes: from three-second memory to culture. *Fish and Fisheries*, 4(3), 199-202

Shinozuka, Kazutaka, Haruka Ono, and Shigeru Watanabe. "Reinforcing and discriminative stimulus properties of music in goldfish." *Behavioural processes* 99 (2013): 26-33.