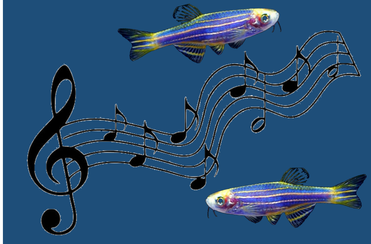


Effect of Vivaldi Music Enrichment on Anxiety and Memory in Wild-Type Striped And Leopard Zebrafish

Tilahun B., Le Z., Scheele I., Howard J., Jeppesen N., Loidolt K., Gikundiro, E., Umutoniwase Y., DeSilva Feelixge H.S., Strand K.

Neuroscience Program and Biology Department, Concordia College – Moorhead

URSCA undergraduate research | scholarship | creative activity

CONCORDIA COLLEGE MOORHEAD, MINNESOTA

RESEARCH QUESTION

Does Vivaldi music enrichment affect anxiety-like behavior and memory in wild-type zebrafish?

INTRODUCTION

- Vivaldi music enrichment has been shown to reduce anxiety in zebrafish using the novel tank and light-dark tank tests[1].
- We conducted a pilot experiment using male and female adult wild-type AB *Danio rerio* (zebrafish) and Vivaldi music as the environmental enrichment.
- We measured anxiety and memory using the novel tank and novel object recognition tasks, respectively.
- We tested the effectiveness of two different designs of novel objects made from Lego bricks.
- Elevated anxiety in zebrafish is correlated with spending more time in the lower portion of the novel tank.
- Zebrafish recognizing a new object as different from a familiar object are expected to spend more time with a familiar object than the novel object.

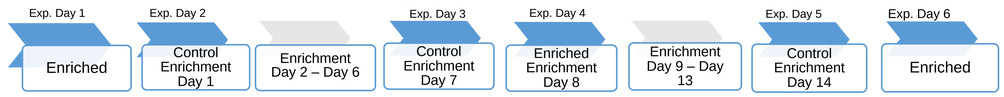
1. Barcellos et al. 2018: DOI 10.7717/peerj.5162

ACKNOWLEDGEMENTS

Thank you to Dr. Krys Strand, Harshana DeSilva Feelixge, and URSCA for your contributions to the development and continuation of this research.

EXPERIMENTAL DESIGN

Enrichment and Behavioral Testing Timeline



Novel Tank and Novel Object Recognition Measured by Ethovision XT14

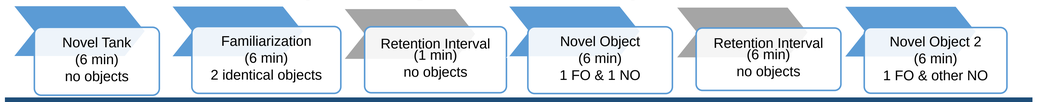
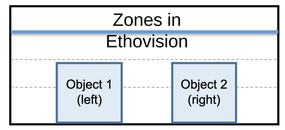


Figure 3. Lego objects designed for the novel object recognition task.



Enrichment Schedule:
0900 feed & water change
0930 – 1130 music
1630 feed & water change
1700 – 1900 music

RESULTS

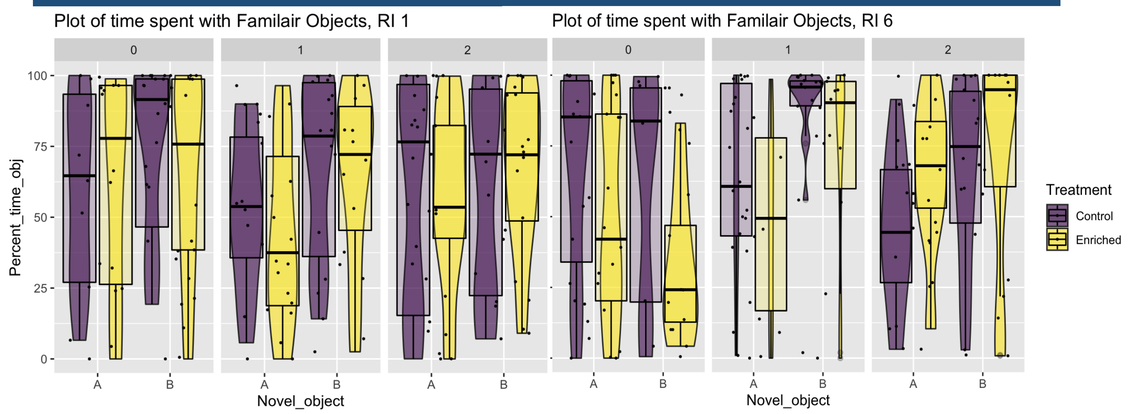


Figure 1. Percent time spent with novel objects compared to a familiar object after 1- and 6-minute retention interval following 0, 1, and 2 weeks of enrichment (n=30) compared to controls (n=28).

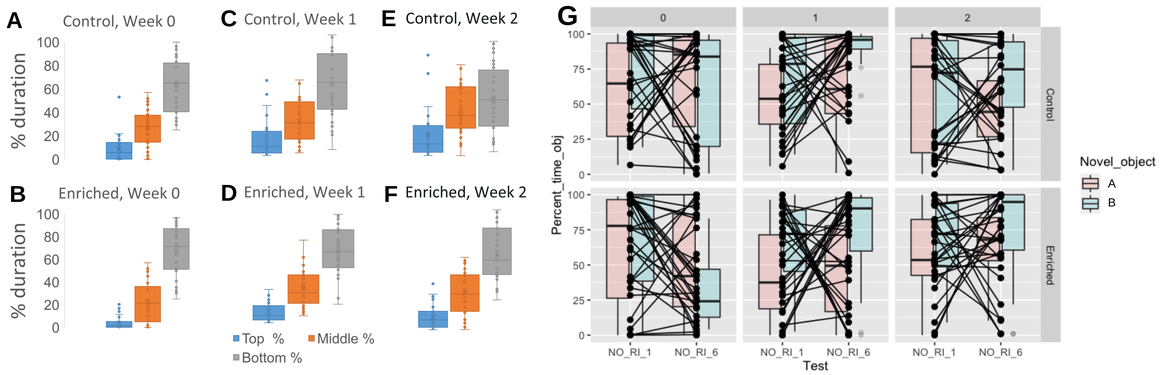


Figure 2 A-F. Percent time spent in bottom, middle, and top zones of the novel tank after 0, 1, and 2 weeks of enrichment (n=30) compared to controls (n=28). **Figure 2 G**. Paired boxplots for time spent with familiar object at week 0, 1 and 2 separated in treatment groups.

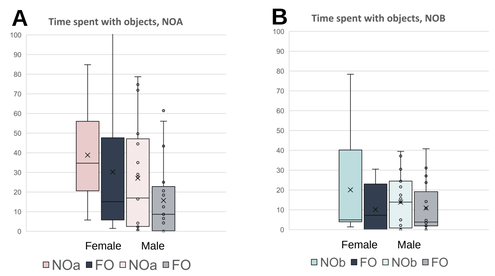


Figure 3 A-B. Percent time spent with objects used in NOR test.

	Week 1 / Week 0	Week 2 / Week 0
% time bottom, control	-1.08	-1.38
% time bottom, enriched	-1.12	-1.13
% time middle, control	1.05	1.37
% time middle, enriched	1.29	1.30
% time top, control	1.48	1.86
% time top, enriched	2.38	2.59

Table 1. Normalized means of percent time spent in NT zones.

CONCLUSIONS

NOVEL TANK TEST

- Enriched fish tended to spend more time in the top zone of the novel tank than controls, consistent with previous findings.[1]
- Compared to controls, enriched fish tended to spend an increased amount of time in the top and middle zones compared to week 0, prior to enrichment (Table 1).
- We will explore if a similar trend is observed in leopard *Danio*, which inherently exhibit increased baseline anxiety levels compared to striped *Danio.*

NOVEL OBJECT RECOGNITION TEST

- Both control and enriched fish recognized novel object b (Fig. 1) as novel more so than novel object a, evidenced by greater % time spent with the paired familiar object after a 1-minute retention (forgetting) interval.
- After a 6-minute retention interval compared to controls (Fig.1), several fish enriched for 2 weeks tended to spend more time with the familiar object compared to novel objects, however, this was not true for all fish. The Mann-Whitney U test returned values that were not significant.
- Fish displayed no tank side preference and no effect of enrichment on overall exploration.
- We need to further explore whether novel object b is inherently less preferred compared to the other designs.
- In future studies, we will use this novel tank and novel object recognition approach with an inducible transgenic zebrafish model of adult demyelination and remyelination to study the effect of enrichment on the myelin repair process and associated behavioral and molecular changes.