**Zebrafish (*Danio rerio)* Shoaling in Light and Dark Conditions Involves a Complex Interplay Between Vision and the Lateral Line**

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**Data and Statistics**

**Baseline**

**Distance Moved**

**Data:**

**Means +/-SEM**

**Group Mean (cm) +/-SEM**

A control+light 5868.0 264.594   
B control+dark 5987.9 352.779   
C cobalt+light 5650.0 324.900   
D cobalt+dark 5315.7 342.324

**Analysis:**

**Degrees of Freedom**

Anova(aov(Baseline.DM ~ cobalt\_control \* light\_dark))

Table 1.1. *Two-way Analysis of Variance of Distance Moved (cm) in Baseline Phase*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ANOVA table | SS (Type II) | DF | F (DFn, DFd) | | Pr(>F) | |
| Cobalt | 1478736 | 1 | F (1, 27) =1.8466 | | 0.1854 | |
| Light | 102274 | 1 | F (1, 27) =0.1277 | | 0.7236 | |
| Interaction | 398296 | 1 | F (1, 27) =0.4974 | | 0.4867 | |
| Residuals | 21621340 | 27 |  |  | |  |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. No interaction or main effects of cobalt and light treatments on distance moved (cm).

**Post-hoc**

Table 1.2*. Tukey Multiple Comparisons of Distance Moved (cm) in Baseline Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean Difference | 95% Confidence Interval | | P-value (adj) |
| Lower | Upper |
| Ctrl:dark-CoCl2:dark | 672.1923 | -595.2162 | 1939.601 | 0.4796794 |
| CoCl2:light- CoCl2:dark | 334.2498 | -890.1832 | 1558.683 | 0.8771133 |
| Ctrl:light- Ctrl:dark | -119.9095 | -1387.3180 | 1147.499 | 0.9937709 |
| Ctrl:light- CoCl2:light | 218.0330 | -1006.3999 | 1442.466 | 0.9612644 |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05.

**etaSquared**

etasquared(aov(Baseline.DM ~ cobalt\_control \* light\_dark))

eta.sq eta.sq.part

cobalt\_control 0.062583081 0.064014317

light\_dark 0.004328449 0.004707971

cobalt\_control:light\_dark 0.016856709 0.018088236

**Interindividual Distance**

**Data:**

**Means +/-SEM**

**Group Mean (cm) +/-SEM**

A control+light 8.5 0.532   
B control+dark 9.4 0.844   
C cobalt+light 10.8 0.564   
D cobalt+dark 10.4 0.584

**Statistics:**

**Degrees of Freedom**

Anova(aov(Baseline.IID ~ cobalt\_control \* light\_dark))

Table 2.1. *Two-way Analysis of Variance of Interindividual Distance (cm) in Baseline Phase*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ANOVA table | SS (Type II) | DF | F (DFn, DFd) | | Pr(>F) | |
| Cobalt | 20.867 | 1 | F (1, 27) = 6.8178 | | 0.01455\* | |
| Light | 0.545 | 1 | F (1, 27) = 0.1781 | | 0.67636 | |
| Interaction | 3.273 | 1 | F (1, 27) =1.0693 | | 0.31028 | |
| Residuals | 82.637 | 27 |  |  | |  |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. Main effect of cobalt on interindividual distance (cm), p=0.015.

**Post-hoc**

Table 2.2. *Tukey Multiple Comparisons of Interindividual Distance (cm) in Baseline Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean Difference | 95% Confidence Interval | | P-value (adj) |
| Lower | Upper |
| Ctrl:dark-CoCl2:dark | -0.9692833 | -3.447069 | 1.5085028 | 0.7100084 |
| CoCl2:light- CoCl2:dark | 0.3629807 | -2.030788 | 2.7567495 | 0.9754377 |
| Ctrl:light- Ctrl:dark | -0.9388546 | -3.416641 | 1.5389314 | 0.7295933 |
| Ctrl:light- CoCl2:light | -2.2711186 | -4.664887 | 0.1226501 | 0.0675753 |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05.

**etaSquared**

etaSquared(aov(Baseline.IID ~ cobalt\_control \* light\_dark))

eta.sq eta.sq.part

cobalt\_control 0.19398142 0.201602924

light\_dark 0.00506726 0.006552933

cobalt\_control:light\_dark 0.03042338 0.038094103

**Time in Thigmotaxis Zone**

**Data:**

**Means +/-SEM**

**Group Mean (cm) +/-SEM**

A control+light 502.5 9.244   
B control+dark 491.2 12.859   
C cobalt+light 434.0 19.602   
D cobalt+dark 417.7 30.817

**Statistics:**

**Degrees of Freedom**

Table 3.1. *Two-way Analysis of Variance of Time in Thigmotaxis (s) in Baseline Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ANOVA table | SS (Type II) | DF | F (DFn, DFd) | Pr(>F) |
| Cobalt | 38871 | 1 | F (1, 27) = 12.1429 | 0.001699\*\* |
| Light | 1503 | 1 | F (1, 27) = 0.4695 | 0.499065 |
| Interaction | 49 | 1 | F (1, 27) = 0.0153 | 0.902503 |
| Residuals | 86431 | 27 |  |  |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. Main effect of cobalt on time in thigmotaxis (s), p=0.002.

**Post-hoc**

Table 3.2. *Tukey Multiple Comparisons of Time in Thigmotaxis (s) in Baseline Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean Difference | 95% Confidence Interval | | P-value (adj) |
| Lower | Upper |
| Ctrl:dark-CoCl2:dark | 73.50164 | -6.63119 | 153.63448 | 0.0809002 |
| CoCl2:light- CoCl2:dark | 16.37112 | -61.044547 | 93.78680 | 0.9376158 |
| Ctrl:light- Ctrl:dark | 11.33641 | -68.796426 | 91.46924 | 0.9798712 |
| Ctrl:light- CoCl2:light | 68.46693 | -8.948747 | 145.88260 | 0.0971406 |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05.

**etaSquared**

etaSquared(aov(Baseline.TiT ~ cobalt\_control \* light\_dark))

eta.sq eta.sq.part

cobalt\_control 0.305089511 0.3102193669

light\_dark 0.011795785 0.0170911288

cobalt\_control:light\_dark 0.000384184 0.0005660099

**Test**

**Distance Moved**

**Data:**

**Means +/-SEM**

**Group Mean (cm) +/-SEM**

A control+light 4891.8 242.923   
B control+dark 5287.1 241.544  
C cobalt+light 4314.9 304.303   
D cobalt+dark 5880.8 273.561

**Statistics:**

**Degrees of Freedom**

Table 4.1. *Two-way Analysis of Variance of Distance Moved (cm) in Test Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ANOVA table | SS (Type II) | DF | F (DFn, DFd) | Pr(>F) |
| Cobalt | 1080 | 1 | F (1, 27) = 0.0019 | 0.9653026 |
| Light | 7745583 | 1 | F (1, 27) = 13.8209 | 0.0009295 \*\*\* |
| Interaction | 2646033 | 1 | F (1, 27) = 4.7215 | 0.0387339 \* |
| Residuals | 15131490 | 27 |  |  |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. Interaction of cobalt and light treatments, p=0.039 and main effect of light, p<0.0001 on distance moved (cm).

**Post-hoc**

Table 4.2. *Tukey Multiple Comparisons of Distance Moved (cm) in Test Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean Difference | 95% Confidence Interval | | P-value (adj) |
| Lower | Upper |
| Ctrl:dark-CoCl2:dark | -593.6550 | -1653.9242 | 466.61416 | 0.4330247 |
| CoCl2:light- CoCl2:dark | -1565.9012 | -2590.2186 | -541.58390 | 0.0014648\*\* |
| Ctrl:light- Ctrl:dark | -395.3172 | -1455.5864 | 664.95198 | 0.7391270 |
| Ctrl:light- CoCl2:light | 576.9290 | -447.3884 | 1601.24635 | 0.4278988 |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. Significant post-hoc comparison of group B and D, p=0.001.

**etaSquared**

etaSquared((aov(Test.DM ~ cobalt\_control \* light\_dark)))

eta.sq eta.sq.part

cobalt\_control 4.232215e-05 7.139203e-05

light\_dark 3.034307e-01 3.385741e-01

cobalt\_control:light\_dark 1.036575e-01 1.488415e-01

**Interindividual Distance**

**Data:**

**Means +/-SEM**

**Group Mean (cm) +/-SEM**

A control+light 7.0 0.609   
B control+dark 15.9 0.509   
C cobalt+light 8.8 0.298   
D cobalt+dark 14.4 0.722

**Statistics:**

**Degrees of Freedom**

Table 5.1. *Two-way Analysis of Variance of Interindividual Distance (cm) in Test Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ANOVA table | SS (Type II) | DF | F (DFn, DFd) | Pr(>F) |
| Cobalt | 0.38 | 1 | F (1, 27) = 0.1543 | 0.697581 |
| Light | 402.55 | 1 | F (1, 27) = 165.0836 | <0.0001\*\*\* |
| Interaction | 21.12 | 1 | F (1, 27) = 8.6613 | 0.006604\*\* |
| Residuals | 65.84 | 27 |  |  |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. Interaction effect of cobalt and light on, p=0.007 and main effect of light, p<0.0001 on interindividual distance (cm).

**Post-hoc**

Table 5.2. *Tukey Multiple Comparisons of Interindividual Distance (cm) in Test Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean Difference | 95% Confidence Interval | | P-value (adj) |
| Lower | Upper |
| Ctrl:dark-CoCl2:dark | 1.490053 | -0.7216002 | 3.7017056 | 0.2756921 |
| CoCl2:light- CoCl2:dark | -5.618308 | -7.7549681 | -3.4816487 | <0.0001\*\*\* |
| Ctrl:light- Ctrl:dark | -8.925469 | -11.1371221 | -6.7138163 | <0.0001\*\*\* |
| Ctrl:light- CoCl2:light | -1.817108 | -3.9537678 | 0.3195516 | 0.1167604 |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. Significant post-hoc comparison of groups A and C, p<0.0001 and groups B and D, p<0.0001.

**etaSquared**

etaSquared(aov(Test.IID ~ cobalt\_control \* light\_dark))

eta.sq eta.sq.part

cobalt\_control 0.0007658616 0.005680864

light\_dark 0.8196000233 0.859436233

cobalt\_control:light\_dark 0.0430010454 0.242875888

**Time in Thigmotaxis Zone**

**Data:**

**Means +/- SEM**

**Group Mean (cm) +/- SEM**

A control+light 466.0 18.991

B control+dark 505.4 14.648

C cobalt+light 382.1 18.817

D cobalt+dark 433.5 37.087

**Statistics:**

**Degrees of Freedom**

Table 6.1. *Two-way Analysis of Variance of Time in Thigmotaxis (s) in Test Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ANOVA table | SS (Type II) | DF | F (DFn, DFd) | Pr(>F) |
| Cobalt | 47131 | 1 | F (1, 27) = 10.0946 | 0.003705\*\* |
| Light | 16112 | 1 | F (1, 27) = 3.4509 | 0.074157 |
| Interaction | 281 | 1 | F (1, 27) = 0.0601 | 0.808169 |
| Residuals | 126062 | 27 |  |  |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05. Main effect of cobalt on time in thigmotaxis (s), p=0.004.

**Post-hoc**

Table 6.2. *Tukey Multiple Comparisons of Time in Thigmotaxis (s) in Test Phase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean Difference | 95% Confidence Interval | | P-value (adj) |
| Lower | Upper |
| Ctrl:dark-CoCl2:dark | 71.83190 | -24.943977 | 168.60778 | 0.2017665 |
| CoCl2:light- CoCl2:dark | -51.46492 | -144.959308 | 42.02946 | 0.4477436 |
| Ctrl:light- Ctrl:dark | -39.40890 | -136.184785 | 57.36698 | 0.6839782 |
| Ctrl:light- CoCl2:light | 83.88792 | -9.606458 | 177.38231 | 0.0904851 |

Note. ‘\*\*\*’p<0.001 ‘\*\*’p<0.01 ‘\*’p<0.05.

**etaSquared**

etaSquared(aov(Test.TiT ~ cobalt\_control \* light\_dark))

eta.sq eta.sq.part

cobalt\_control 0.250943105 0.272131863

light\_dark 0.085785486 0.113325920

cobalt\_control:light\_dark 0.001494387 0.002221511