Result notes

Yuta Suzuki

4/23/2021

## Article information

Pupil response asymmetries of the periphery visual field in the glare illusion

Novera Istiqomah, Yuta Suzuki, Yuya Kinzuka, Minami Tetsuto, Shigeki Nakauchi

\*Corresponding author: Yuta Suzuki

##   
## [ sAB-Type Design ]  
##   
## This output was generated by anovakun 4.8.5 under R version 3.6.3.  
## It was executed on Tue Jul 20 00:58:36 2021.  
##   
##   
## << DESCRIPTIVE STATISTICS >>  
##   
## --------------------------------------  
## Locs Pattern n Mean S.D.   
## --------------------------------------  
## Upper Glare 17 0.2524 0.3913   
## Upper Control 17 0.3787 0.3337   
## Lower Glare 17 0.1114 0.3523   
## Lower Control 17 0.1440 0.3905   
## Left Glare 17 0.1889 0.3509   
## Left Control 17 0.2192 0.3640   
## Right Glare 17 0.1866 0.3756   
## Right Control 17 0.2292 0.3678   
## --------------------------------------  
##   
##   
## << SPHERICITY INDICES >>  
##   
## == Mendoza's Multisample Sphericity Test and Epsilons ==  
##   
## --------------------------------------------------------------------------------  
## Effect Lambda approx.Chi df p LB GG HF CM   
## --------------------------------------------------------------------------------  
## Global 0.0000 24.5774 27 0.6181 ns 0.1429 0.7035 1.0541 1.0077   
## Locs 0.0285 6.5490 5 0.2573 ns 0.3333 0.7722 0.9106 0.8705   
## Pattern 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Locs x Pattern 0.1150 3.9808 5 0.5529 ns 0.3333 0.8782 1.0672 1.0202   
## --------------------------------------------------------------------------------  
## LB = lower.bound, GG = Greenhouse-Geisser  
## HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller  
##   
##   
## << ANOVA TABLE >>  
##   
## == Adjusted by Greenhouse-Geisser's Epsilon ==  
##   
## -------------------------------------------------------------------------  
## Source SS df MS F-ratio p-value p.eta^2   
## -------------------------------------------------------------------------  
## s 14.4554 16 0.9035   
## -------------------------------------------------------------------------  
## Locs 0.6082 2.32 0.2626 9.8852 0.0002 \*\*\* 0.3819   
## s x Locs 0.9845 37.06 0.0266   
## -------------------------------------------------------------------------  
## Pattern 0.1141 1 0.1141 3.6796 0.0731 + 0.1870   
## s x Pattern 0.4961 16 0.0310   
## -------------------------------------------------------------------------  
## Locs x Pattern 0.0536 2.63 0.0204 0.6951 0.5424 ns 0.0416   
## s x Locs x Pattern 1.2346 42.15 0.0293   
## -------------------------------------------------------------------------  
## Total 17.9465 135 0.1329   
## +p < .10, \*p < .05, \*\*p < .01, \*\*\*p < .001  
##   
##   
## << POST ANALYSES >>  
##   
## < MULTIPLE COMPARISON for "Locs" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## -----------------------------  
## Locs n Mean S.D.   
## -----------------------------  
## Upper 34 0.3155 0.3638   
## Lower 34 0.1277 0.3666   
## Left 34 0.2041 0.3524   
## Right 34 0.2079 0.3667   
## -----------------------------  
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Lower 0.1878 4.2304 16 0.0006 0.0038 Upper > Lower \*   
## Upper-Left 0.1115 3.3258 16 0.0043 0.0128 Upper > Left \*   
## Upper-Right 0.1076 2.7098 16 0.0155 0.0464 Upper > Right \*   
## Lower-Right -0.0802 2.6521 16 0.0174 0.0522 Lower = Right   
## Lower-Left -0.0763 2.3855 16 0.0298 0.0595 Lower = Left   
## Left-Right -0.0038 0.1525 16 0.8807 0.8807 Left = Right   
## ----------------------------------------------------------------------  
##   
##   
## < SIMPLE EFFECTS for "Locs x Pattern" INTERACTION >  
##   
## -----------------------------------------------------------------------------------  
## Effect Lambda approx.Chi df p LB GG HF CM   
## -----------------------------------------------------------------------------------  
## Locs at Glare 0.0202 7.1784 5 0.2086 ns 0.3333 0.8030 0.9554 0.9134   
## Locs at Control 0.0861 4.5125 5 0.4791 ns 0.3333 0.8220 0.9832 0.9399   
## Pattern at Upper 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Lower 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Left 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Right 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## -----------------------------------------------------------------------------------  
## LB = lower.bound, GG = Greenhouse-Geisser  
## HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller  
##   
## --------------------------------------------------------------------------  
## Source SS df MS F-ratio p-value p.eta^2   
## --------------------------------------------------------------------------  
## Locs at Glare 0.1696 2.41 0.0704 2.7456 0.0673 + 0.1465   
## s x Locs at Glare 0.9883 38.55 0.0256   
## --------------------------------------------------------------------------  
## Locs at Control 0.4923 2.47 0.1996 6.3996 0.0022 \*\* 0.2857   
## s x Locs at Control 1.2308 39.45 0.0312   
## --------------------------------------------------------------------------  
## Pattern at Upper 0.1355 1 0.1355 4.6163 0.0473 \* 0.2239   
## s x Pattern at Upper 0.4696 16 0.0293   
## --------------------------------------------------------------------------  
## Pattern at Lower 0.0090 1 0.0090 0.3765 0.5481 ns 0.0230   
## s x Pattern at Lower 0.3838 16 0.0240   
## --------------------------------------------------------------------------  
## Pattern at Left 0.0078 1 0.0078 0.2913 0.5968 ns 0.0179   
## s x Pattern at Left 0.4272 16 0.0267   
## --------------------------------------------------------------------------  
## Pattern at Right 0.0154 1 0.0154 0.5485 0.4696 ns 0.0331   
## s x Pattern at Right 0.4501 16 0.0281   
## --------------------------------------------------------------------------  
## +p < .10, \*p < .05, \*\*p < .01, \*\*\*p < .001  
##   
##   
## < MULTIPLE COMPARISON for "Locs at Glare" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs at Glare > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Lower 0.1410 2.6938 16 0.0160 0.0958 Upper = Lower   
## Lower-Right -0.0752 2.0193 16 0.0605 0.1816 Lower = Right   
## Lower-Left -0.0775 1.9448 16 0.0696 0.2088 Lower = Left   
## Upper-Left 0.0635 1.3054 16 0.2102 0.6307 Upper = Left   
## Upper-Right 0.0658 1.1413 16 0.2706 0.6307 Upper = Right   
## Left-Right 0.0024 0.0421 16 0.9669 0.9669 Left = Right   
## ----------------------------------------------------------------------  
##   
##   
## < MULTIPLE COMPARISON for "Locs at Control" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs at Control > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Lower 0.2346 3.3568 16 0.0040 0.0241 Upper > Lower \*   
## Upper-Left 0.1595 2.7711 16 0.0136 0.0409 Upper > Left \*   
## Upper-Right 0.1495 2.7409 16 0.0145 0.0435 Upper > Right \*   
## Lower-Right -0.0852 1.6440 16 0.1197 0.3590 Lower = Right   
## Lower-Left -0.0752 1.5057 16 0.1516 0.3590 Lower = Left   
## Left-Right -0.0100 0.2390 16 0.8142 0.8142 Left = Right   
## ----------------------------------------------------------------------  
##   
## output is over --------------------///

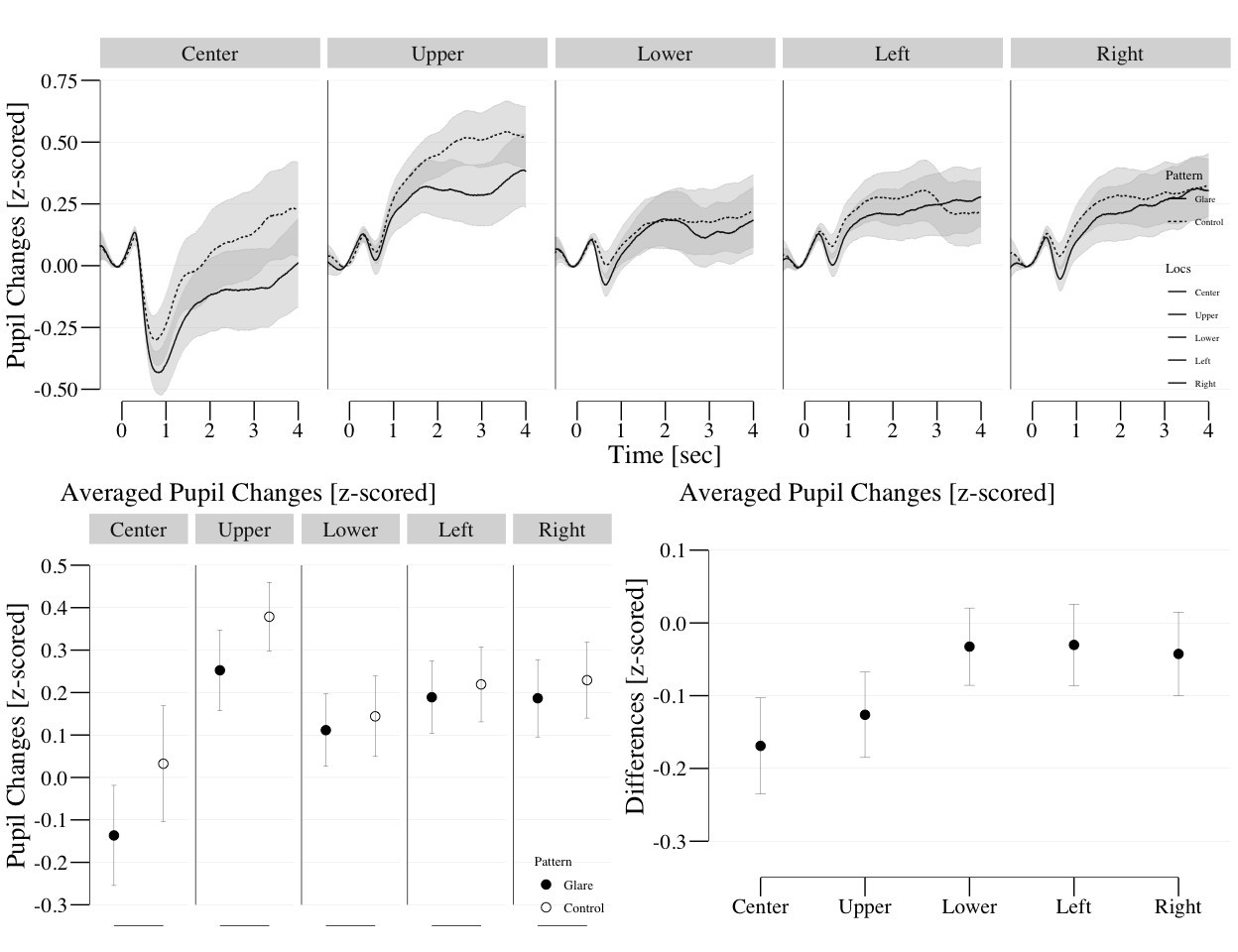
## Results

We presented a stimulus (glare or control stimuli) in four visual positions (i.e., upper, lower, left, and right). As shown in Fig.3, the pupillary trace demonstrated a prominent constriction approximately after 500 ms of stimulus onset (PLR), which was in response to the visual stimulus (glare illusion or control stimuli) presentation on the gray background **(Bombeke et al., 2016; Laeng et al., 2018; Laeng & Endestad, 2012; Zavagno et al., 2017)**. After reaching the PLR amplitude peak, the pupil gradually dilates, reflecting cognitive factors, including perceptual brightness of the stimuli. Fig. 3a portrays pupil size changes from stimulus onset to offset across all observers in each visual field.

### The stimulus-evoked pupillary responses in glare illusion and control pattern

We calculated the average pupil diameter change during the presentation of stimuli in each pattern and visual position, as displayed in Fig. 3B. Two-way repeated measures ANOVAs on the average pupil change performed in each pattern and visual position. There was a significant main effect of visual position ((2.316, 37.064) = 9.885, p = 0, = 0.382). Post-hoc comparisons demonstrated significant differences between upper-lower, -left, and -right positions (t(16) = 4.23,p = 0.004, Cohen’s = 0.538, = 55.921, t(16) = 3.326,p = 0.013, Cohen’s = 0.327, = 10.923, t(16) = 2.71,p = 0.046, Cohen’s = 0.31, = 3.757 respectively), indicating that the UVF produces larger pupil dilation than the other visual field regardless of the stimulus pattern, in line with the previous studies **(Hong et al., 2001; Sabeti et al., 2011; Tan et al., 2001; Wilhelm et al., 2000)**. The main effect of the pattern and the interaction between pattern and visual position were not significant ((1, 16) = 3.68, p = 0.073, = 0.187, (2.635, 42.154) = 0.695, p = 0.542, = 0.042, respectively). Following multiple comparisons showed that the differences of pupil response between glare and control stimuli in the upper position had significant effect with medium effect of Cohen’s d (t(16) = 4.616,p = 0.047, Cohen’s = 0.347, = 1.536). However, the differences between pattern in the lower, left, and right positions had no significant effects with small effects of Cohen’s d (t(16) = 0.377,p = 0.548, Cohen’s = 0.088, = 0.294, t(16) = 0.291,p = 0.597, Cohen’s = 0.085, = 0.283, t(16) = 0.549,p = 0.47, Cohen’s = 0.115, = 0.317, respectively).

## Figure 2



##   
## [ sAB-Type Design ]  
##   
## This output was generated by anovakun 4.8.5 under R version 3.6.3.  
## It was executed on Tue Jul 20 00:58:40 2021.  
##   
##   
## << DESCRIPTIVE STATISTICS >>  
##   
## ---------------------------------------  
## Locs Pattern n Mean S.D.   
## ---------------------------------------  
## Upper Glare 17 0.1105 0.2703   
## Upper Control 17 0.1523 0.2337   
## Lower Glare 17 -0.0247 0.2058   
## Lower Control 17 0.0359 0.2426   
## Left Glare 17 0.0663 0.2130   
## Left Control 17 0.1375 0.2266   
## Right Glare 17 0.0168 0.2277   
## Right Control 17 0.0959 0.2548   
## ---------------------------------------  
##   
##   
## << SPHERICITY INDICES >>  
##   
## == Mendoza's Multisample Sphericity Test and Epsilons ==  
##   
## --------------------------------------------------------------------------------  
## Effect Lambda approx.Chi df p LB GG HF CM   
## --------------------------------------------------------------------------------  
## Global 0.0000 21.4803 27 0.7776 ns 0.1429 0.6883 1.0209 0.9760   
## Locs 0.0522 5.4351 5 0.3660 ns 0.3333 0.8316 0.9975 0.9536   
## Pattern 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Locs x Pattern 0.3892 1.7366 5 0.8845 ns 0.3333 0.9368 1.1569 1.1060   
## --------------------------------------------------------------------------------  
## LB = lower.bound, GG = Greenhouse-Geisser  
## HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller  
##   
##   
## << ANOVA TABLE >>  
##   
## == Adjusted by Greenhouse-Geisser's Epsilon ==  
##   
## ------------------------------------------------------------------------  
## Source SS df MS F-ratio p-value p.eta^2   
## ------------------------------------------------------------------------  
## s 5.4273 16 0.3392   
## ------------------------------------------------------------------------  
## Locs 0.3080 2.49 0.1235 8.2726 0.0004 \*\*\* 0.3408   
## s x Locs 0.5958 39.92 0.0149   
## ------------------------------------------------------------------------  
## Pattern 0.1358 1 0.1358 6.8285 0.0188 \* 0.2991   
## s x Pattern 0.3182 16 0.0199   
## ------------------------------------------------------------------------  
## Locs x Pattern 0.0067 2.81 0.0024 0.1448 0.9234 ns 0.0090   
## s x Locs x Pattern 0.7364 44.97 0.0164   
## ------------------------------------------------------------------------  
## Total 7.5282 135 0.0558   
## +p < .10, \*p < .05, \*\*p < .01, \*\*\*p < .001  
##   
##   
## << POST ANALYSES >>  
##   
## < MULTIPLE COMPARISON for "Locs" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## -----------------------------  
## Locs n Mean S.D.   
## -----------------------------  
## Upper 34 0.1314 0.2497   
## Lower 34 0.0056 0.2237   
## Left 34 0.1019 0.2195   
## Right 34 0.0563 0.2413   
## -----------------------------  
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Lower 0.1258 3.8237 16 0.0015 0.0090 Upper > Lower \*   
## Lower-Left -0.0963 3.6468 16 0.0022 0.0090 Lower < Left \*   
## Upper-Right 0.0751 2.4866 16 0.0243 0.0730 Upper = Right   
## Left-Right 0.0456 2.4108 16 0.0283 0.0849 Left = Right   
## Lower-Right -0.0507 1.9549 16 0.0683 0.1366 Lower = Right   
## Upper-Left 0.0295 1.1470 16 0.2683 0.2683 Upper = Left   
## ----------------------------------------------------------------------  
##   
##   
## < SIMPLE EFFECTS for "Locs x Pattern" INTERACTION >  
##   
## -----------------------------------------------------------------------------------  
## Effect Lambda approx.Chi df p LB GG HF CM   
## -----------------------------------------------------------------------------------  
## Locs at Glare 0.2351 2.6641 5 0.7521 ns 0.3333 0.8943 1.0915 1.0435   
## Locs at Control 0.3504 1.9301 5 0.8590 ns 0.3333 0.9178 1.1276 1.0779   
## Pattern at Upper 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Lower 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Left 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Right 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## -----------------------------------------------------------------------------------  
## LB = lower.bound, GG = Greenhouse-Geisser  
## HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller  
##   
## --------------------------------------------------------------------------  
## Source SS df MS F-ratio p-value p.eta^2   
## --------------------------------------------------------------------------  
## Locs at Glare 0.1762 2.68 0.0657 4.0065 0.0162 \* 0.2003   
## s x Locs at Glare 0.7037 42.92 0.0164   
## --------------------------------------------------------------------------  
## Locs at Control 0.1385 2.75 0.0503 3.5260 0.0254 \* 0.1806   
## s x Locs at Control 0.6285 44.06 0.0143   
## --------------------------------------------------------------------------  
## Pattern at Upper 0.0148 1 0.0148 1.0657 0.3173 ns 0.0624   
## s x Pattern at Upper 0.2229 16 0.0139   
## --------------------------------------------------------------------------  
## Pattern at Lower 0.0312 1 0.0312 1.9591 0.1807 ns 0.1091   
## s x Pattern at Lower 0.2551 16 0.0159   
## --------------------------------------------------------------------------  
## Pattern at Left 0.0431 1 0.0431 2.8436 0.1111 ns 0.1509   
## s x Pattern at Left 0.2427 16 0.0152   
## --------------------------------------------------------------------------  
## Pattern at Right 0.0533 1 0.0533 2.5526 0.1297 ns 0.1376   
## s x Pattern at Right 0.3339 16 0.0209   
## --------------------------------------------------------------------------  
## +p < .10, \*p < .05, \*\*p < .01, \*\*\*p < .001  
##   
##   
## < MULTIPLE COMPARISON for "Locs at Glare" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs at Glare > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Lower 0.1352 2.8098 16 0.0126 0.0755 Upper = Lower   
## Lower-Left -0.0910 2.3441 16 0.0323 0.0969 Lower = Left   
## Upper-Right 0.0937 2.1199 16 0.0500 0.1500 Upper = Right   
## Left-Right 0.0495 1.1850 16 0.2533 0.7600 Left = Right   
## Lower-Right -0.0414 1.1521 16 0.2662 0.7600 Lower = Right   
## Upper-Left 0.0442 1.1295 16 0.2753 0.7600 Upper = Left   
## ----------------------------------------------------------------------  
##   
##   
## < MULTIPLE COMPARISON for "Locs at Control" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs at Control > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Lower 0.1164 2.8494 16 0.0116 0.0696 Upper = Lower   
## Lower-Left -0.1016 2.7402 16 0.0145 0.0696 Lower = Left   
## Lower-Right -0.0600 1.6226 16 0.1242 0.3727 Lower = Right   
## Upper-Right 0.0564 1.3303 16 0.2021 0.6062 Upper = Right   
## Left-Right 0.0416 1.2724 16 0.2214 0.6062 Left = Right   
## Upper-Left 0.0147 0.3325 16 0.7438 0.7438 Upper = Left   
## ----------------------------------------------------------------------  
##   
## output is over --------------------///

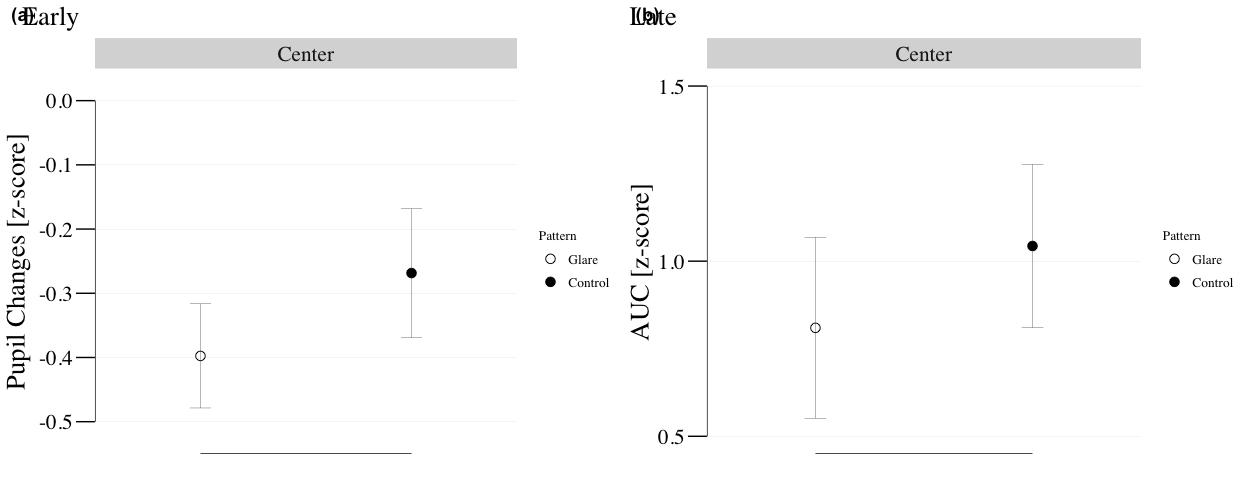
##   
## [ sAB-Type Design ]  
##   
## This output was generated by anovakun 4.8.5 under R version 3.6.3.  
## It was executed on Tue Jul 20 00:58:40 2021.  
##   
##   
## << DESCRIPTIVE STATISTICS >>  
##   
## --------------------------------------  
## Locs Pattern n Mean S.D.   
## --------------------------------------  
## Upper Glare 17 0.5968 0.8208   
## Upper Control 17 0.9623 0.6954   
## Lower Glare 17 0.5124 0.8953   
## Lower Control 17 0.4211 0.9152   
## Left Glare 17 0.4939 0.8422   
## Left Control 17 0.3590 0.7800   
## Right Glare 17 0.6684 0.8519   
## Right Control 17 0.5508 0.8194   
## --------------------------------------  
##   
##   
## << SPHERICITY INDICES >>  
##   
## == Mendoza's Multisample Sphericity Test and Epsilons ==  
##   
## --------------------------------------------------------------------------------  
## Effect Lambda approx.Chi df p LB GG HF CM   
## --------------------------------------------------------------------------------  
## Global 0.0000 27.9128 27 0.4378 ns 0.1429 0.6477 0.9355 0.8943   
## Locs 0.0028 10.8164 5 0.0556 + 0.3333 0.6566 0.7480 0.7151   
## Pattern 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Locs x Pattern 0.7577 0.5106 5 0.9917 ns 0.3333 0.9789 1.2229 1.1691   
## --------------------------------------------------------------------------------  
## LB = lower.bound, GG = Greenhouse-Geisser  
## HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller  
##   
##   
## << ANOVA TABLE >>  
##   
## == Adjusted by Greenhouse-Geisser's Epsilon ==  
##   
## -------------------------------------------------------------------------  
## Source SS df MS F-ratio p-value p.eta^2   
## -------------------------------------------------------------------------  
## s 71.1361 16 4.4460   
## -------------------------------------------------------------------------  
## Locs 2.6089 1.97 1.3245 5.4201 0.0098 \*\* 0.2530   
## s x Locs 7.7014 31.51 0.2444   
## -------------------------------------------------------------------------  
## Pattern 0.0010 1 0.0010 0.0074 0.9326 ns 0.0005   
## s x Pattern 2.2096 16 0.1381   
## -------------------------------------------------------------------------  
## Locs x Pattern 1.4777 2.94 0.5032 3.3147 0.0286 \* 0.1716   
## s x Locs x Pattern 7.1327 46.99 0.1518   
## -------------------------------------------------------------------------  
## Total 92.2674 135 0.6835   
## +p < .10, \*p < .05, \*\*p < .01, \*\*\*p < .001  
##   
##   
## << POST ANALYSES >>  
##   
## < MULTIPLE COMPARISON for "Locs" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## -----------------------------  
## Locs n Mean S.D.   
## -----------------------------  
## Upper 34 0.7795 0.7717   
## Lower 34 0.4668 0.8927   
## Left 34 0.4265 0.8022   
## Right 34 0.6096 0.8252   
## -----------------------------  
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Left 0.3531 4.2751 16 0.0006 0.0035 Upper > Left \*   
## Left-Right -0.1831 2.3776 16 0.0302 0.0907 Left = Right   
## Upper-Lower 0.3128 2.3295 16 0.0333 0.0998 Upper = Lower   
## Lower-Right -0.1428 1.8444 16 0.0837 0.2512 Lower = Right   
## Upper-Right 0.1699 1.6126 16 0.1264 0.2528 Upper = Right   
## Lower-Left 0.0403 0.4310 16 0.6722 0.6722 Lower = Left   
## ----------------------------------------------------------------------  
##   
##   
## < SIMPLE EFFECTS for "Locs x Pattern" INTERACTION >  
##   
## -----------------------------------------------------------------------------------  
## Effect Lambda approx.Chi df p LB GG HF CM   
## -----------------------------------------------------------------------------------  
## Locs at Glare 0.0014 12.0393 5 0.0346 \* 0.3333 0.6526 0.7426 0.7099   
## Locs at Control 0.1040 4.1652 5 0.5267 ns 0.3333 0.8283 0.9926 0.9489   
## Pattern at Upper 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Lower 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Left 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## Pattern at Right 1.0000 -0.0000 0 1.0000 1.0000 1.0000 1.0000   
## -----------------------------------------------------------------------------------  
## LB = lower.bound, GG = Greenhouse-Geisser  
## HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller  
##   
## --------------------------------------------------------------------------  
## Source SS df MS F-ratio p-value p.eta^2   
## --------------------------------------------------------------------------  
## Locs at Glare 0.3312 1.96 0.1692 0.8059 0.4534 ns 0.0480   
## s x Locs at Glare 6.5748 31.32 0.2099   
## --------------------------------------------------------------------------  
## Locs at Control 3.7554 2.48 1.5112 7.2750 0.0010 \*\* 0.3126   
## s x Locs at Control 8.2593 39.76 0.2077   
## --------------------------------------------------------------------------  
## Pattern at Upper 1.1359 1 1.1359 6.1603 0.0245 \* 0.2780   
## s x Pattern at Upper 2.9502 16 0.1844   
## --------------------------------------------------------------------------  
## Pattern at Lower 0.0708 1 0.0708 0.4721 0.5019 ns 0.0287   
## s x Pattern at Lower 2.3986 16 0.1499   
## --------------------------------------------------------------------------  
## Pattern at Left 0.1546 1 0.1546 0.9945 0.3335 ns 0.0585   
## s x Pattern at Left 2.4877 16 0.1555   
## --------------------------------------------------------------------------  
## Pattern at Right 0.1174 1 0.1174 1.2475 0.2805 ns 0.0723   
## s x Pattern at Right 1.5059 16 0.0941   
## --------------------------------------------------------------------------  
## +p < .10, \*p < .05, \*\*p < .01, \*\*\*p < .001  
##   
##   
## < MULTIPLE COMPARISON for "Locs at Control" >  
##   
## == Shaffer's Modified Sequentially Rejective Bonferroni Procedure ==  
## == The factor < Locs at Control > is analysed as dependent means. ==   
## == Alpha level is 0.05. ==   
##   
## ----------------------------------------------------------------------  
## Pair Diff t-value df p adj.p   
## ----------------------------------------------------------------------  
## Upper-Left 0.6033 4.2909 16 0.0006 0.0034 Upper > Left \*   
## Upper-Right 0.4115 3.2617 16 0.0049 0.0147 Upper > Right \*   
## Upper-Lower 0.5412 3.0137 16 0.0082 0.0247 Upper > Lower \*   
## Left-Right -0.1918 1.6422 16 0.1201 0.3602 Left = Right   
## Lower-Right -0.1297 0.8722 16 0.3960 0.7920 Lower = Right   
## Lower-Left 0.0621 0.4658 16 0.6476 0.7920 Lower = Left   
## ----------------------------------------------------------------------  
##   
## output is over --------------------///

## Early and late compornents

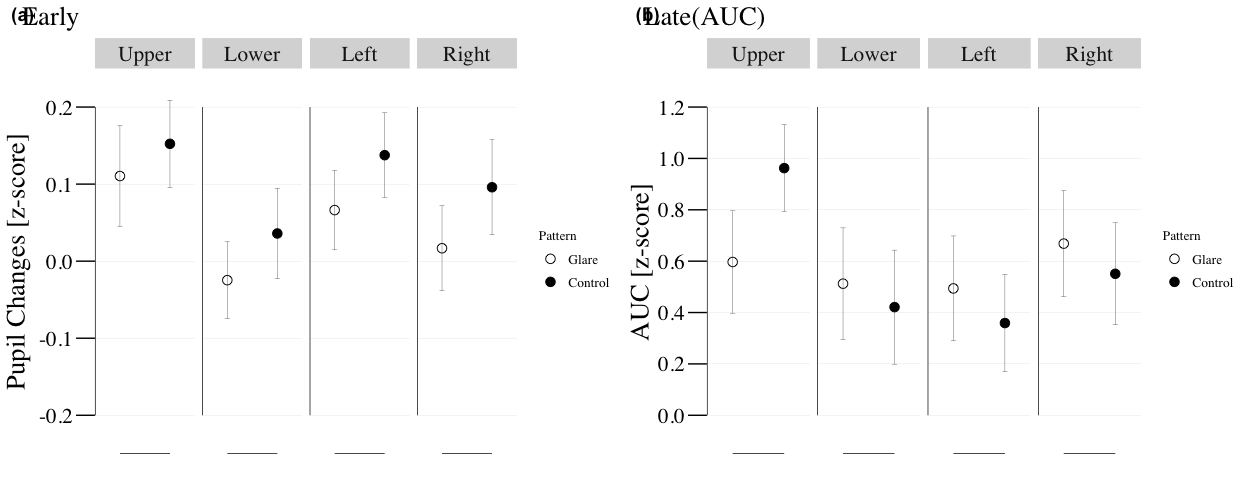
To assess temporal component of papillary response, the early component corresponded to peak pupil constriction after stimulus onset and the late comportment which was defined by are under the curve (AUC) were calculated (see Method). In early component (Fig 3B), pupil constriction to the glare illusion was larger than control pattern as the previous analysis ((1, 16) = 6.829, p = 0.019, = 0.299). The UVF produces larger pupil dilation than the other visual field regardless of the stimulus pattern ((2.495, 39.918) = 8.273, p = 0, = 0.341) in line with the previous studies **(Hong et al., 2001; Sabeti et al., 2011; Tan et al., 2001; Wilhelm et al., 2000)**. There was no significant interaction between visual field and stimulus pattern ((2.81, 44.967) = 0.145, p = 0.923, = 0.009).

In late component, there was a significant interaction between visual field and stimulus pattern ((2.937, 46.989) = 3.315, p = 0.029, = 0.172). Crucial, the significant differences of pupil response between glare and control stimuli was seen only in the UVF (F(1,16) = 6.16,p = 0.025, = 0.278).

## Figure 3



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## 2



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