Dyops, a new vision assessment – Properties and precision

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A research consortium supporting “Quality Sustainable Vision”
Visual Acuity is...

- The spatial resolving capacity of the visual system; or
- **The ability of the eye to see fine detail**
Visual Acuity is...

- Determined by...
  - Diffraction, aberrations, & photoreceptor density in the eye → **sharpness of the retinal focus**
Visual Acuity is...

- Determined by...
  - Diffraction, aberrations, and photoreceptor density in the eye \(\rightarrow\) sharpness of the retinal focus
  - Sensitivity of the interpretative faculty of the brain
VA reflects the visual system’s sensitivity to...

- Spatial resolution
- Temporal resolution

Visual acuity in Snellen notation and its conversion to spatial frequency.
Dyops

0.2 0.3 0.4 0.5 0.6
Questions

• What does Dyop measure?
• How precise is Dyop?
• How sensitive is Dyop to changes of blur?
Study Design

- N=60
  - Current n=49 (35 F, 14 M; avg. age 24.6)
  - Snellen VA: 20/20+

- Exp 1: Dyops vs. Landolt C
  - Threshold precision
  - Sensitivity to changes in blur
    - No lens, +1, +2, +3, +4 diopter lens

- Exp 2: Importance of luminance
Displays of stimuli in Exp 1

* All in black & white

- Standard LC
- LC – orientation Odd Out
- LC – Spinning
- Dyops - Spinning

Images of stimuli:
- Pink LC spinning.exe
- 1 in 4 dyop motion.exe
Results
Results

• Slopes:
  • Dyops (32.1±3.7) was steeper than all LC (23.1±3.5) tasks → better precision for Dyops™ threshold VA estimation.

• Threshold size (P50 at logMAR scale):
  • LC (-.16) < LCOO (-.1), LCS (-.06) < DP (.2)
  • Bigger threshold size is needed for tasks involving comparison of multiple targets
  • Bigger threshold size is needed for Dyops™
  • Form detection (LCOO) is easier than motion detection (LCS)

• Sensitivity to changes in blur
  • LC (-1.86 logMAR/Diopter) was twice as sensitive to blur changes as Dyops™ (-0.88 logMAR/Diopter)
Experiment 2: Effect of luminance change

4 tasks

- Black on Gray LC
- Isoluminant LC
- Black on Gray Dyops movie
  
- Isoluminant Dyops movie

30 trials each; Same viewing distance

Threshold size by optotype*
Results

- **Accuracy:** better with B/G (good luminance contrast) stimuli
Results

- RT:
  - Faster with B/G stimuli
  - Faster with Static (LC) stimuli
Conclusions

- Dyops...
  - More sensitive to threshold size than LC
  - Need bigger threshold size
  - Less sensitive to changes in Blur
  - More sensitive to luminance changes (motion, luminance contrast...) → usually processed by Magnocellular pathway
  - However... correct Isoluminant Dyops & LC responses →
    - Parvocellular pathway also react to motion... through color contrast
    - Slower than M-pathway
    - Even slower in Dyops than LC (the gain in temporal resolution does not fully compensate for spatial resolution)
  - Possible use in diagnose functions in different pathways...
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