The Significance of Preattentive Visual Search (PAVS) in Glaucoma

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Why Another Psychophysical Test for Glaucoma?

Objectives of investigating PAVS:

- to provide tests maximizing sensitivity to $M_y$ magno-fibres & to parvo-fibres
- to determine whether PAVS can discriminate between normals, hypertensives, & glaucomatous Pxs
- to determine whether PAVS (using 2-AFC reaction times) has practicality (e.g. consistency)
PAVS Targets: Orientation Task

- Px required to press switch to indicate whether target (N) is on L or RHS.
- Uses paradigm of Flitcroft et al. (1996)
Flicker & Oscillatory Targets

1 target flickers or oscillates vertically among stationary distractors
Target & Distractor Parameters

Include:

- # distractors
- Oscillation frequency
- Displacement frequency

[All 3 PAVS tests are 2-alternative forced-choice]
<table>
<thead>
<tr>
<th>Glaucoma</th>
<th>Glaucoma Susp.</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic ONH/RNFL damage</td>
<td>Suspicious ONH/RNFL structure</td>
<td>Normal ONH &amp; RNFL structure. C:D &lt; 0.7</td>
</tr>
<tr>
<td>Characteristic, repeatable, VF loss (Abnormal GHT &amp;/or corrected PSD &lt; 5%, &amp;/or cluster criteria defect)</td>
<td>No repeatable characteristic VF loss</td>
<td>Normal VF sensitivity</td>
</tr>
<tr>
<td>Classified based on IOP &amp; gonioscopy findings</td>
<td></td>
<td>Normal IOP &amp; anterior chamber angle</td>
</tr>
</tbody>
</table>
Flicker               Displacement         Orientation
Glaucoma           Suspect           Normal

Reaction Time
(sec)

Glaucoma         Suspect         Normal

Flicker             Displacement         Orientation

Dec 2010  Loughman & Davison UKEGS
<table>
<thead>
<tr>
<th></th>
<th>Flicker</th>
<th>Displacement</th>
<th>Orientation</th>
</tr>
</thead>
</table>
| **Glaucoma Vs Suspect** | $T = 7.43$  
                   | $P < 0.001$  
                   | $T = 6.25$  
                   | $P < 0.001$  
                   | $T = 9.34$  
                   | $P < 0.001$  |
| **Glaucoma Vs Normal**  | $T = 9.16$  
                   | $P < 0.001$  
                   | $T = 7.54$  
                   | $P < 0.001$  
                   | $T = 10.96$  
                   | $P < 0.001$  |
| **Suspect Vs Normal**  | $T = 1.76$  
                   | $P = 0.083$  
                   | $T = 2.18$  
                   | $P = 0.032$  
                   | $T = 1.39$  
                   | $P = 0.168$  |
Potential Problems with RTs

Choice RTs (CRTs) are:
- sensory status dependent

But also potentially influenced by
- motor status
- cortical factors – e.g. decision time
- age
Perceptual Search Index

- CRT paradigm: find square & press L or R button (only 1 distractor)
- PSI = PAVS RT / CRT
- PAVS RTs should not increase significantly above the CRT regardless of the number of distractors
PSI Results
## PSI: Glaucoma Suspects vs Normals

<table>
<thead>
<tr>
<th>Flicker PAVS/CRT</th>
<th>Displacement PAVS/CRT</th>
<th>Orientation PAVS/CRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>T = 3.19</td>
<td>T = 3.59</td>
<td>T = 2.60</td>
</tr>
<tr>
<td>P = 0.002</td>
<td>P = 0.001</td>
<td>P = 0.012</td>
</tr>
</tbody>
</table>

- PSI discriminates for all 3 PAVS tests, even between normals & glaucoma suspects.
Conclusions

- All 3 PAVS tests discriminate between glaucoma & suspect Pxs.
- Displacement PAVS discriminates between suspects & normals.
- Using CRT to generate PSI improves discriminability by reducing motor & decision time factors
- Test is rapid & Px-friendly (does not use thresholds)
- Only requires PC & software
Acknowledgements

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