Comparison of Spatial vs. Temporal Fundus Photo Evaluation Techniques with Novice Clinicians

Christopher Putnam, OD, FAAO, Alex Permann, BS, Tim Holmes, DSc, Carl Bassi, PhD

**Purpose**
The purpose of this study was to compare the speed and accuracy of detecting changes in serial fundus images using the traditional method of side-by-side comparison (spatial separation) vs. toggling superimposed images (temporal separation).

**Methods**
Twenty-five first and second year optometry students participated as subjects. A standard retinal photograph was manipulated with Adobe Photoshop to simulate fifteen different retinal pathologies including vascular (e.g.: dot hemorrhage, Hollenhorst plaque) and optic nerve head pathologies (e.g.: nerve fiber layer defects, optic nerve pallor). Each simulated pathology was displayed in a temporal and spatial presentation using Microsoft PowerPoint software. Temporal presentation rate (rate of toggling between superimposed images) was controlled by subjects. No time limit was given for image presentation. The sequence of image presentation was randomly determined to control for order effects. Catch trials (i.e. no difference between images) were also included. Both accuracy and timing were recorded.

**Results**
Subjects performed best with temporal presentation on accuracy of finding the simulated pathology (temporal: 95% correct vs. spatial: 79% correct) and were significantly faster at identification [ANOVA (2×15)] (by an average of 34.1 sec (2.7 sec std error)). Paired t-test analyses of spatial vs. temporal presentation found significant differences in speed of recognition across 12/15 (p<0.05) simulatedopathologies and marginal significance in 2/15 (p<0.10) simulatedpathologies.

<table>
<thead>
<tr>
<th>Simulated Pathologic Change</th>
<th>View</th>
<th>Mean</th>
<th>N</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectoral Pallor</td>
<td>Spatial</td>
<td>63.74</td>
<td>35</td>
<td>7.40</td>
</tr>
<tr>
<td>Tortuous Vessel</td>
<td>Temporal</td>
<td>3.35</td>
<td>35</td>
<td>0.32</td>
</tr>
<tr>
<td>Nerve Fiber Layer</td>
<td>Spatial</td>
<td>6.85</td>
<td>35</td>
<td>5.54</td>
</tr>
<tr>
<td>Indistinct Margins</td>
<td>Temporal</td>
<td>2.88</td>
<td>35</td>
<td>0.35</td>
</tr>
<tr>
<td>TOTAL</td>
<td>Spatial</td>
<td>63.75</td>
<td>375</td>
<td>2.58</td>
</tr>
<tr>
<td></td>
<td>Temporal</td>
<td>8.97</td>
<td>375</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Table 1: Comparison of speeds(s) of change detection in spatial vs. temporal presentations.

![Figure 1: Representation of superimposed images over time.](image)

**Conclusions**
Both accuracy and speed of recognition in simulated retinal pathology assessment were improved in a temporal presentation as opposed to a traditional spatial presentation. The improved efficacy and speed of detection in subtle retinal pathology changes could hold great promise in a primary care optometric practice.

**Future Directions**
Future studies will incorporate real fundus images of previously determined pathologic changes. Additionally, experienced clinicians will be asked to participate as subjects. LTVu software (Lickenbrock Technologies, St Louis, MO), which allows for both superimposition of serial fundus images and toggling between images, could be utilized in such a study.

**Acknowledgements**
We would like to offer special thanks to Lickenbrock Technologies for their innovative resources in the planning and development of this research.

**References**