Implementing the MNREAD Reading Acuity Test on an iPad3

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Background

What Is the MNREAD Acuity Chart?
- Continuous text reading acuity chart, available in multiple languages
- Assesses reading of normally-sighted & low vision individuals
- Estimates 3 measures of reading performance

What print size range can be displayed reliably on the iPad?
- Physical size
- Screen size
- Contrast

Our Goal
To design & test a digital version of the MNREAD acuity chart on an iPad

Advantages
- More portable
- Less expensive
- Easier test administration
- Multiple versions available on a single device (set, polarity, language)

Challenges
- What print size range can be rendered on the iPad?
- How do the MNREAD parameters (Maximum Reading Speed, Critical Print Size & Reading Acuity) work?

General Conclusion
The iPad version & the printed chart yield similar estimates of the MNREAD parameters (Maximum Reading Speed, Critical Print Size & Reading Acuity) when tested on both a normally-sighted population & low vision population.

Experiment 1

Goal
To determine the smallest usable print size on the iPad

Methods
- 20 normally-sighted subjects
- Each subject was tested with the iPad
- at 4 viewing distances

Results
- Reading speed is 60% slower at 20cm (95% CI [55.6, 64.1])

Conclusions
- Only 14 print sizes in 0.1 logMAR increments can be displayed reliably on the iPad (vs. 19 on the chart)
- This print size number can be overcome by changing the viewing distance in both normal & low vision

Experiment 2

Goal
To compare the Maximum Reading Speed, Critical Print Size & Reading Acuity assessed-
- with the printed chart & the iPad version
- at different viewing distances on the iPad

Methods
- 54 normally-sighted subjects
- 4 viewing distances

Results
- Maximum Reading Speed: 4% slower with the iPad (95% CI [0.2%, 14.5%])
- No significant effect of the viewing distance

Conclusions
- The small difference in Maximum Reading Speed (%) can be attributed to minor procedure differences
- The difference in Critical Print Size (0.04 logMAR) does not exceed the step unit of 0.1 logMAR (i.e., one sentence step) within the test-retest reliability on the chart
- The repeatability of the iPad version over a range of viewing distances is similar to the repeatability of the chart

Experiment 3

Goal
To compare the Maximum Reading Speed, Critical Print Size & Reading Acuity assessed-
- with the printed chart & the iPad version
- at different viewing distances & test-retest reliability

Methods
- 18 subjects blindfolded to test low vision
- Binocular visual acuity from 20/83 to 20/8000
- Optic neuropathy, optic neuritis, rod-cone dystrophy, MD, RP
- Repeated measures

Results
- Maximum Reading Speed is 7% slower with the iPad (95% CI [4.5%, 9.5%])
- No significant effect of the contrast (95% CI [0.04, 0.07])

Conclusions
- When tested on a wide variety of low vision conditions, the iPad version yields similar estimates of the three MNREAD parameters compared to the chart