

Implementing the MNREAD Reading Acuity Test on an iPad3

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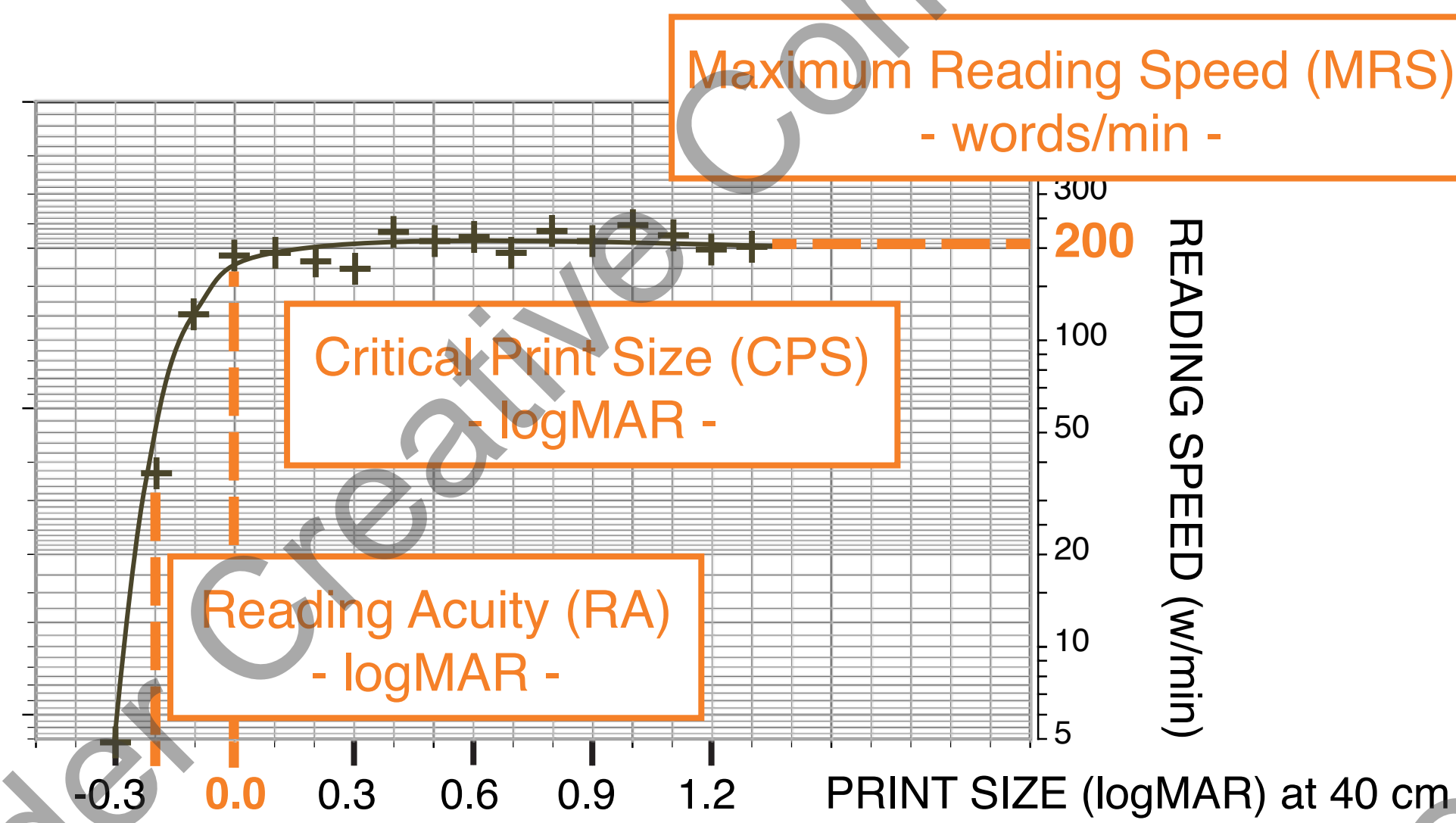
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Background

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



- Several versions available:
 - Normal & reversed contrasts
 - Five sentence sets in English
- Wide range of applications in research & low vision

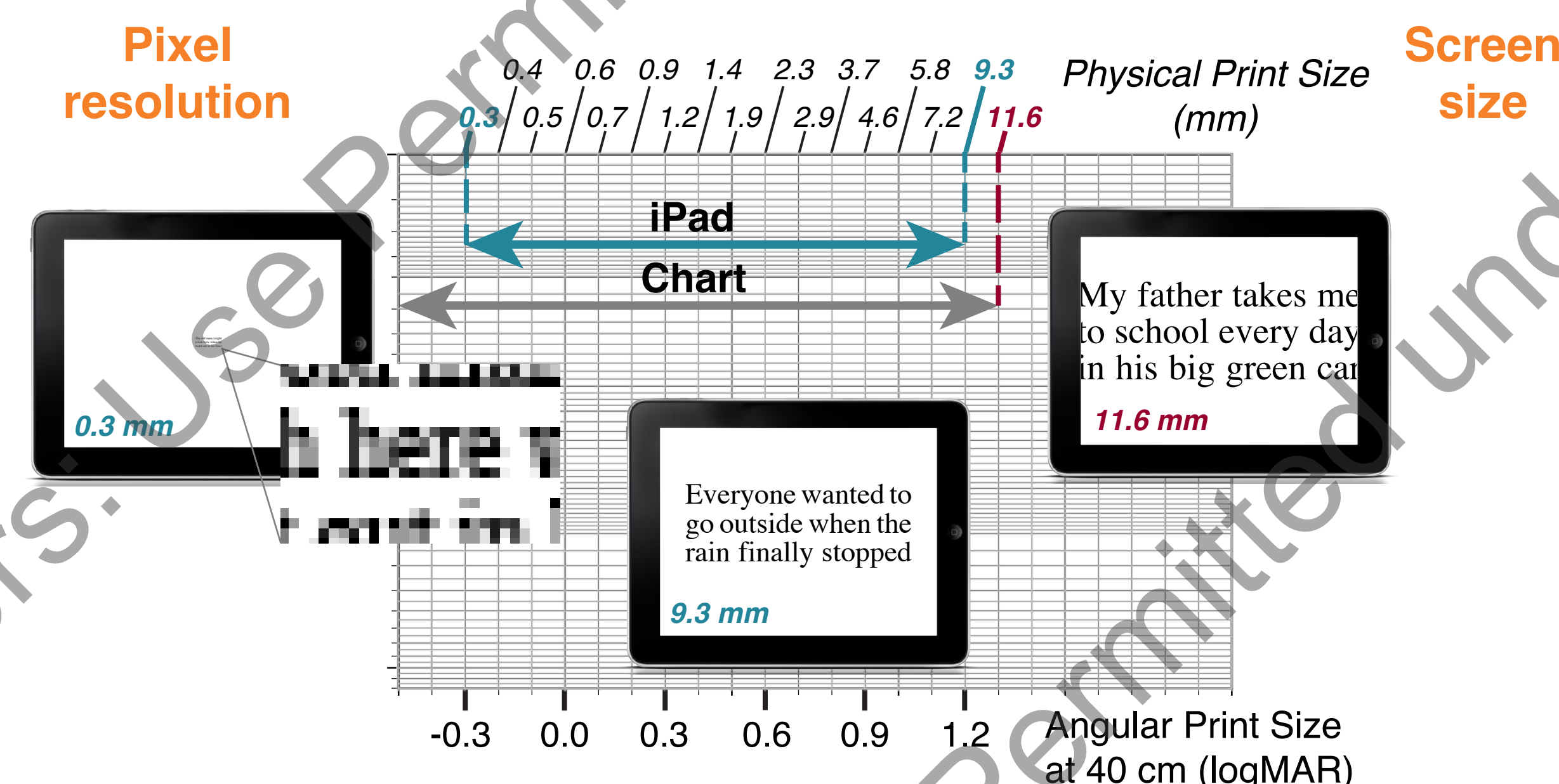
Our Goal To design & test a digital version of the MNREAD acuity chart on an iPad3

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?



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 and a low-vision population.

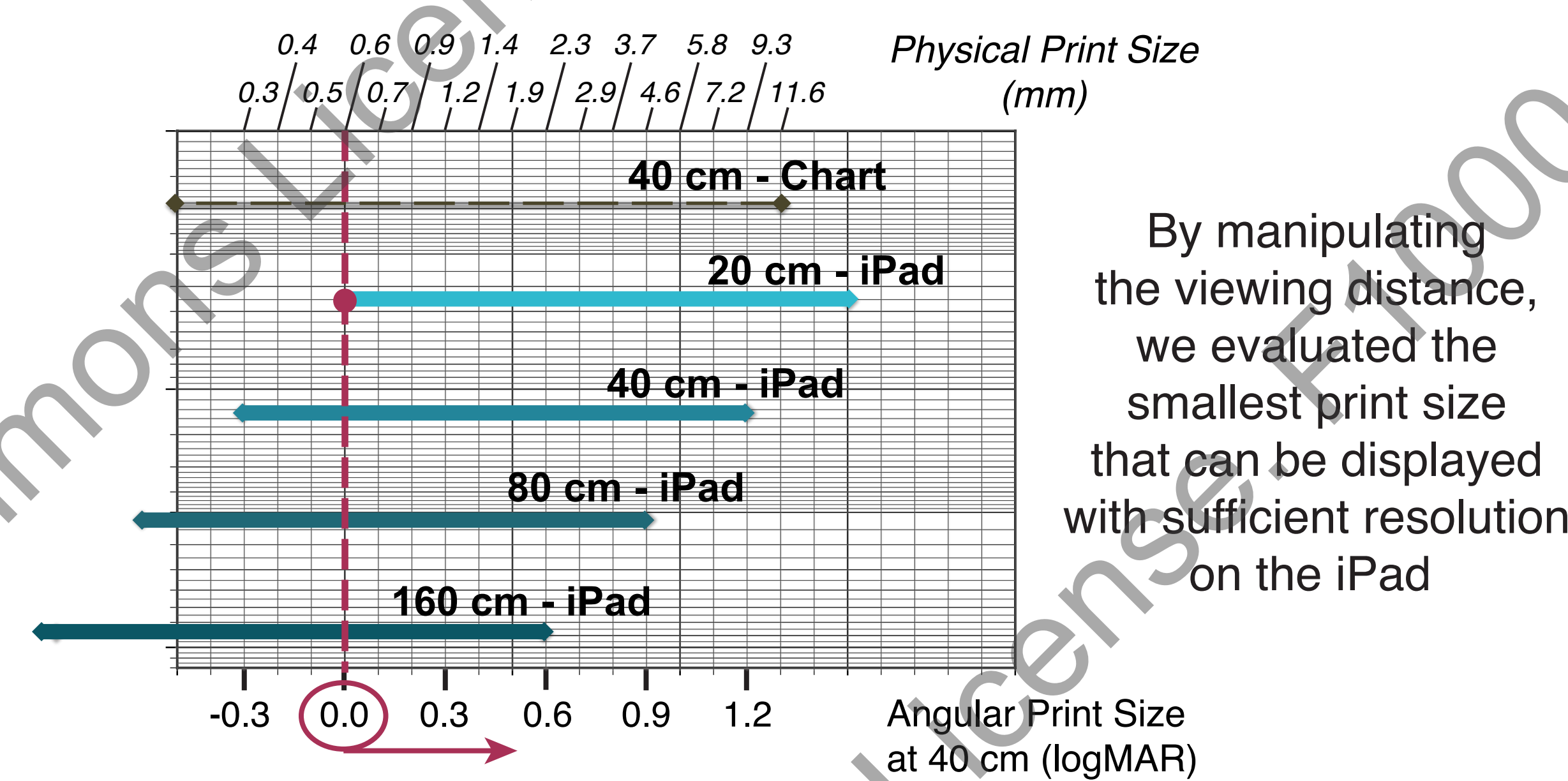
Experiment 1 - Normal Vision -

Goal

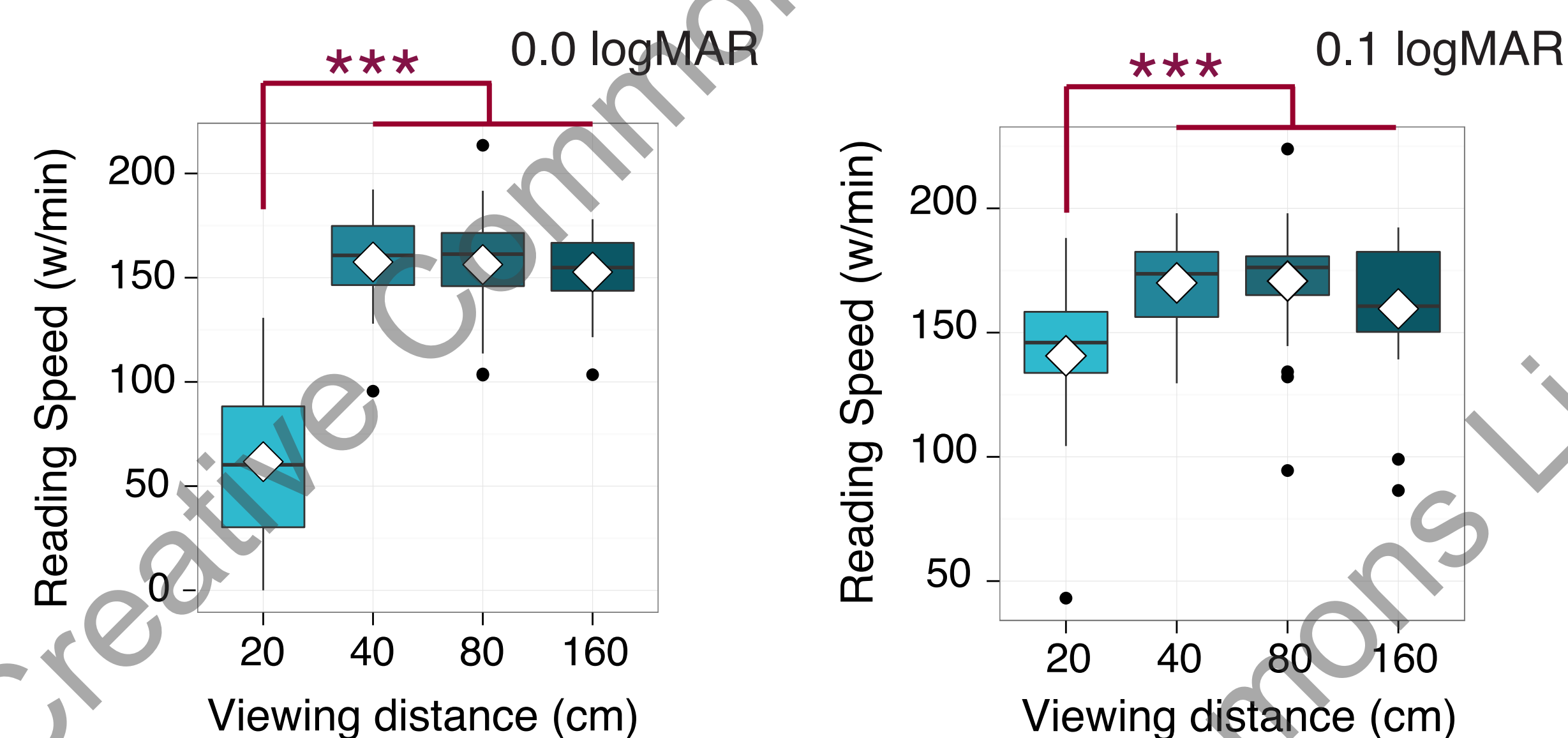
To determine the smallest usable print size on the iPad3

Methods

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



Results



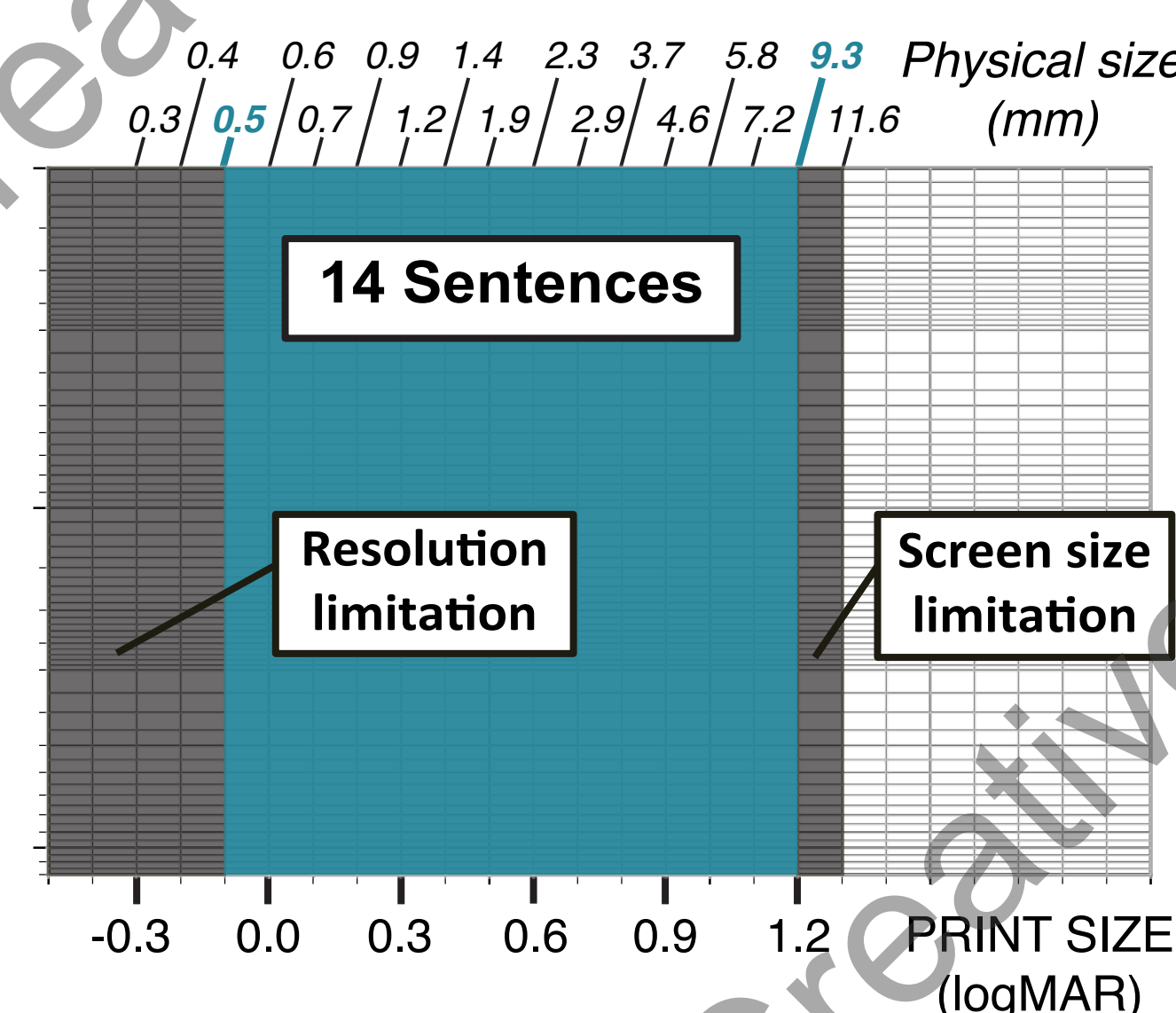
Reading speed is 60% slower at 20cm (95% CI [55,63])

Reading speed is 14% slower at 20cm (95% CI [4.5,20])

Conclusions

Only 14 print sizes in 0.1 logMAR increments can be displayed reliably on the iPad (vs. 19 on the chart)

This reduced number can be overcome by changing the viewing distance for both normal & low vision



Experiment 2 - Normal Vision -

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

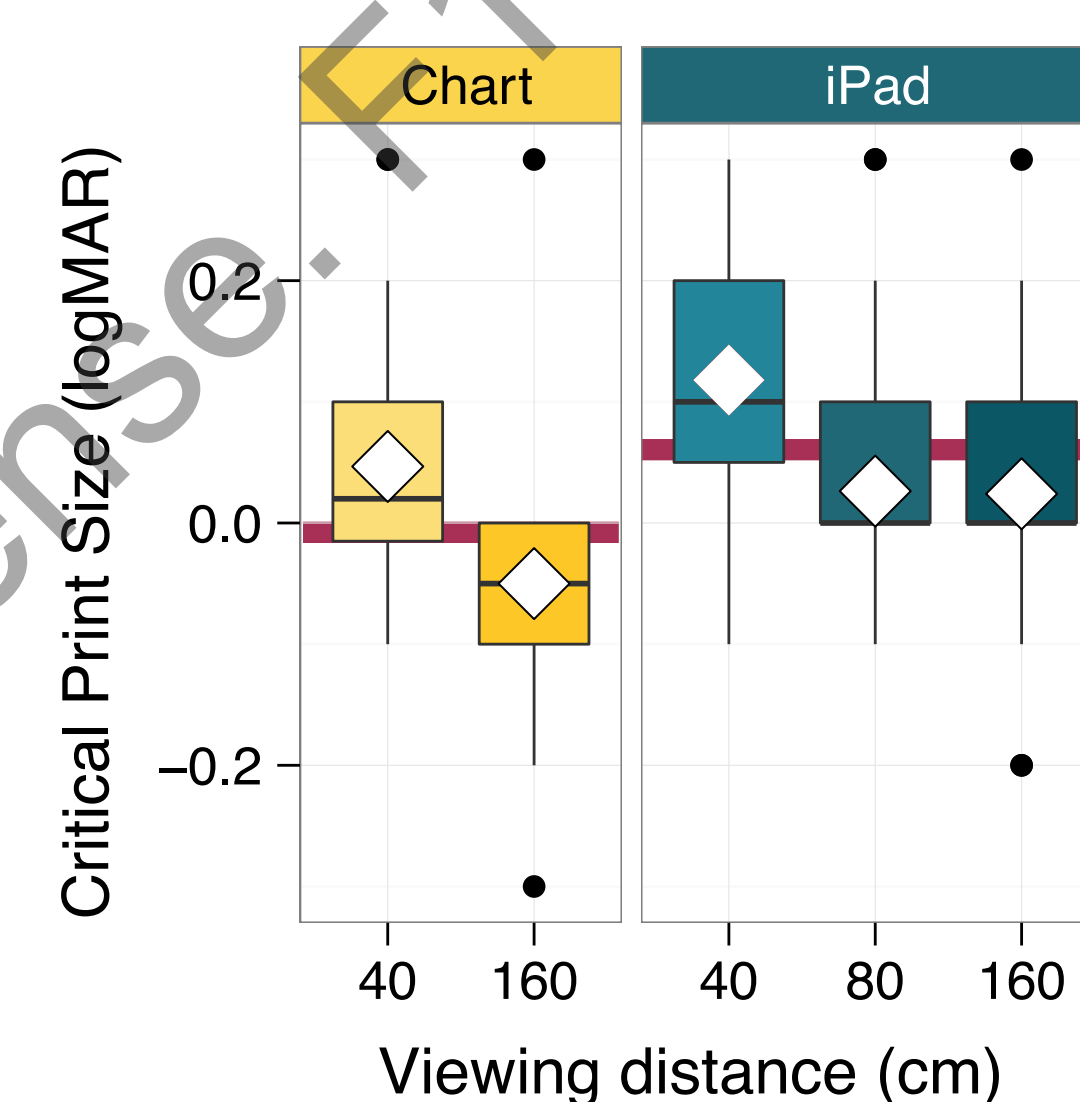
- 54 normally-sighted subjects
- Repeated measures

	20 cm	40 cm	80 cm	160 cm
Chart				
iPad				

Results

Maximum Reading Speed is 4% slower with the iPad (95% CI [2.6%,5.6%])

No significant effect of the viewing distance



Critical Print Size is 0.04 logMAR larger with the iPad (95% CI [0.02, 0.07])

Critical Print Size is decreased by 0.07 logMAR for each 1m increase on both displays (95% CI [0.05,0.09])

Reading Acuity is the same with both displays (95% CI [-0.009,0.003])

Reading Acuity is decreased by 0.03 logMAR for each 1m increase on both displays (95% CI [0.007,0.05])

Conclusions

- The small difference in Maximum Reading Speed (4%) 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 (*ie.* one sentence) and lies 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 - Low Vision -

Goal

To compare the Maximum Reading Speed, Critical Print Size & Reading Acuity assessed with the printed chart & the iPad version

Methods

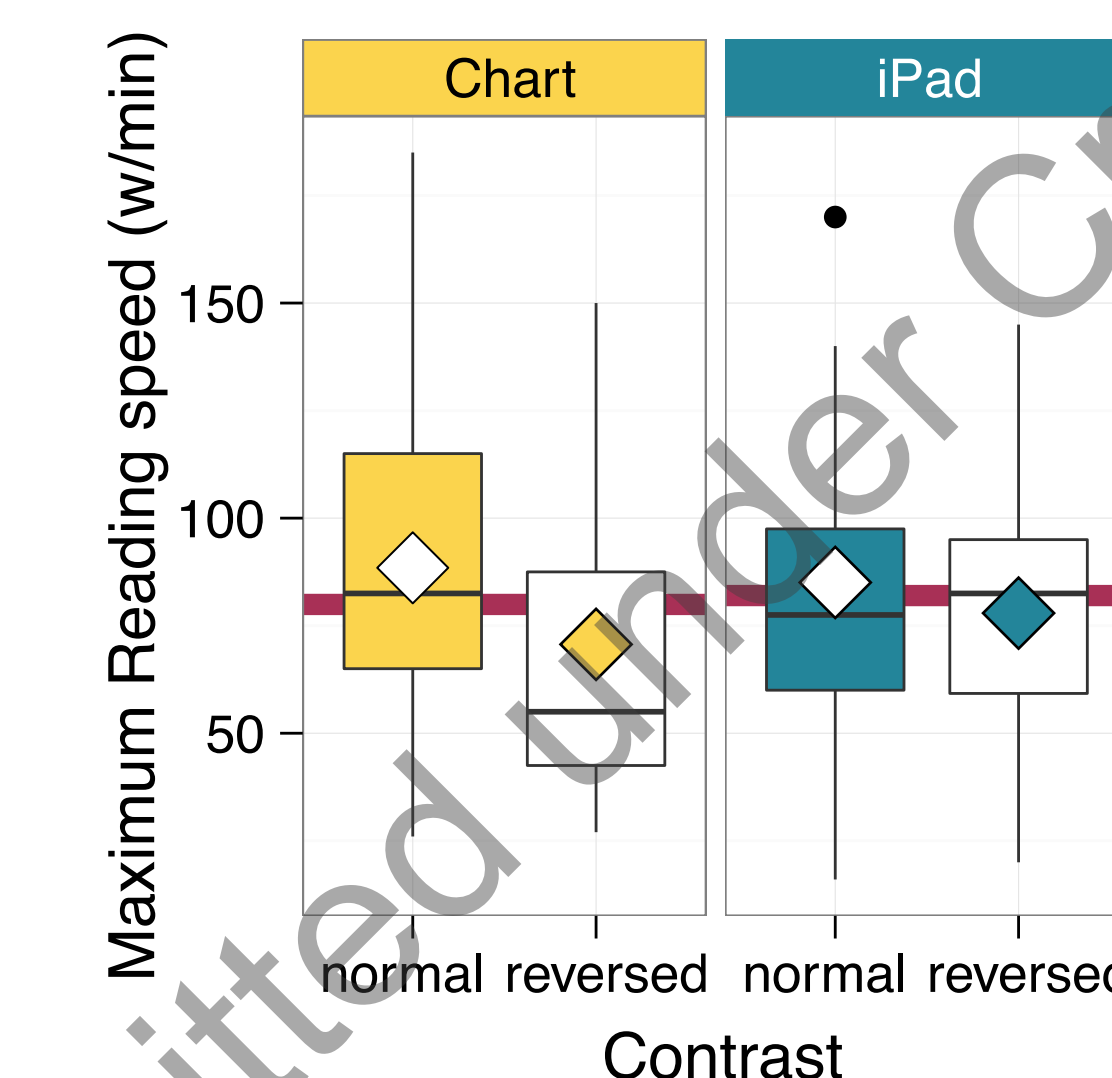
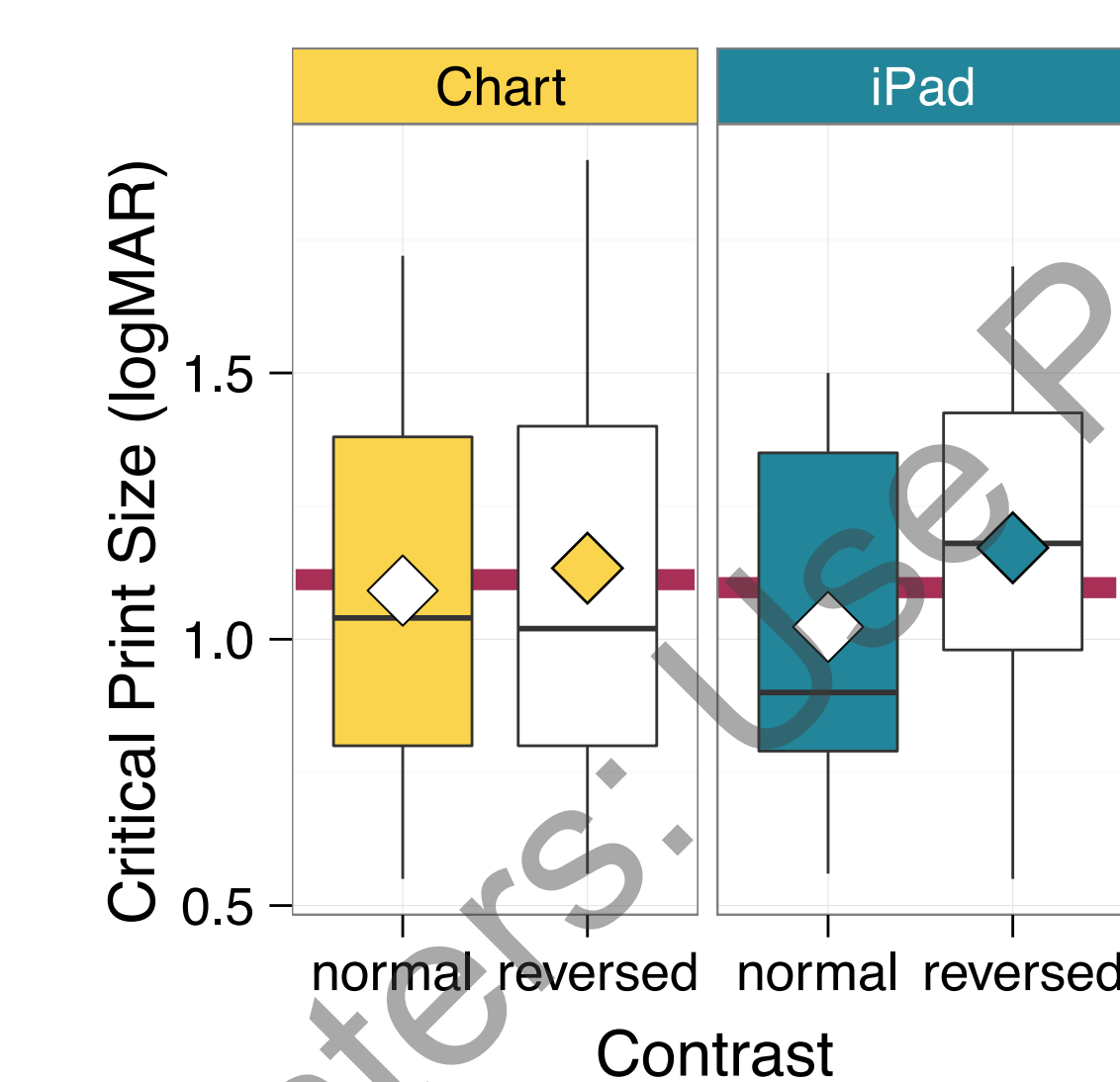
- 18 subjects with mild to severe low vision
 - Binocular visual acuity from 20/63 to 20/800
 - Optic neuropathy, rod-cone dystrophy, MD, RP
- Repeated measures

	Normal contrast	Reversed contrast
Chart		
iPad		

Results

Maximum Reading Speed is the same with both displays (95% CI [-8%,5%])

Maximum Reading Speed is 7% slower with the reversed contrast (95% CI [0.2%,14.5%])

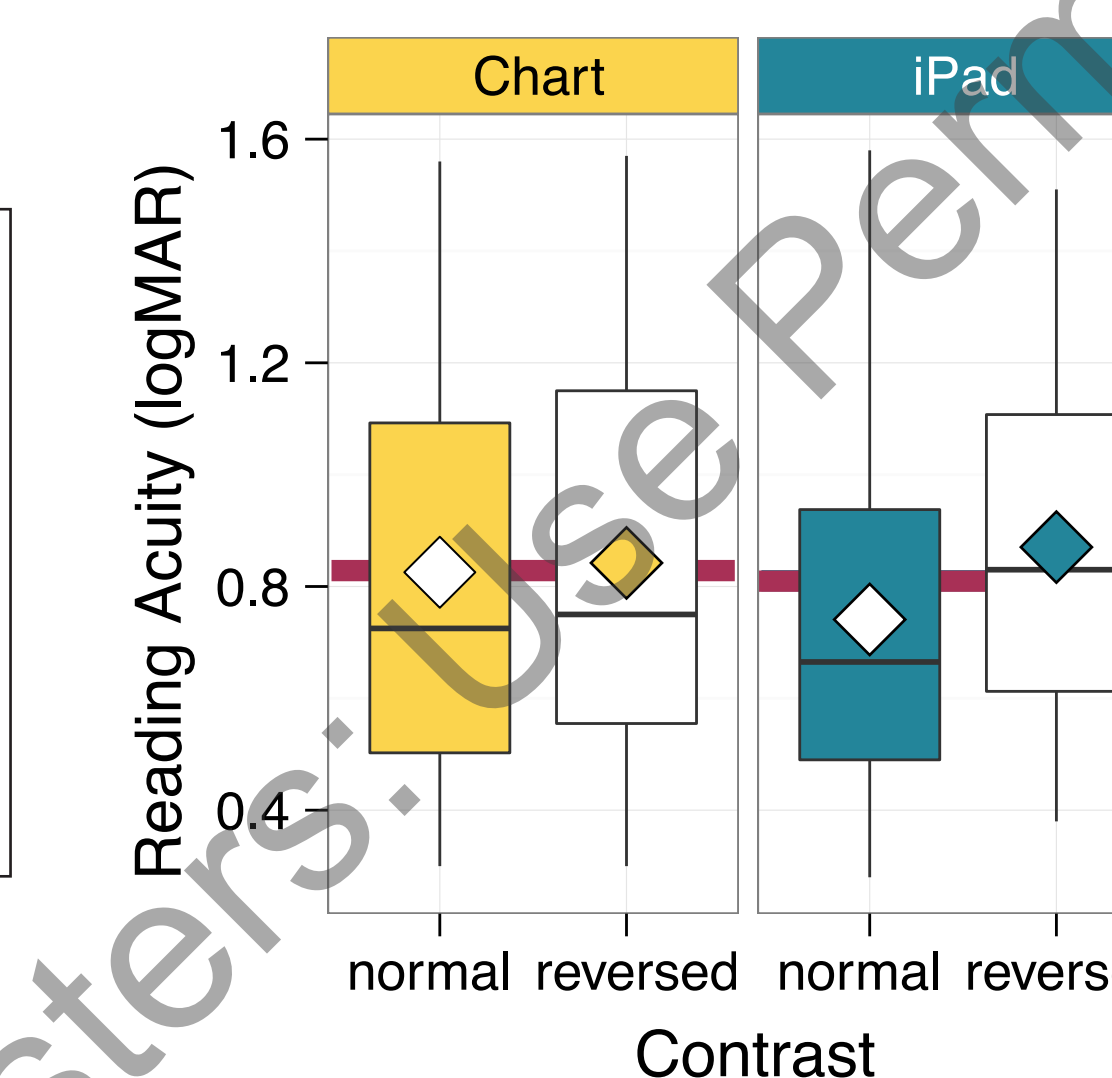


Critical Print Size is 0.04 logMAR larger with the iPad (95% CI [0.02, 0.07])

Critical Print Size is decreased by 0.07 logMAR for each 1m increase on both displays (95% CI [0.05,0.09])

Reading Acuity is the same with both displays (95% CI [-0.07,0.06])

No significant effect of the contrast (95% CI [-0.04,0.04])



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.