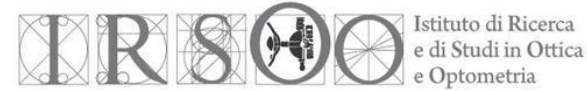




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e Optometria

The impact of smartphone luminance on reading abilities

Paolo A. Grasso, Massimo Gurioli & Laura Boccardo

*109° Congresso Nazionale della Società Italiana di Fisica
Salerno, 11-15 Settembre 2023*



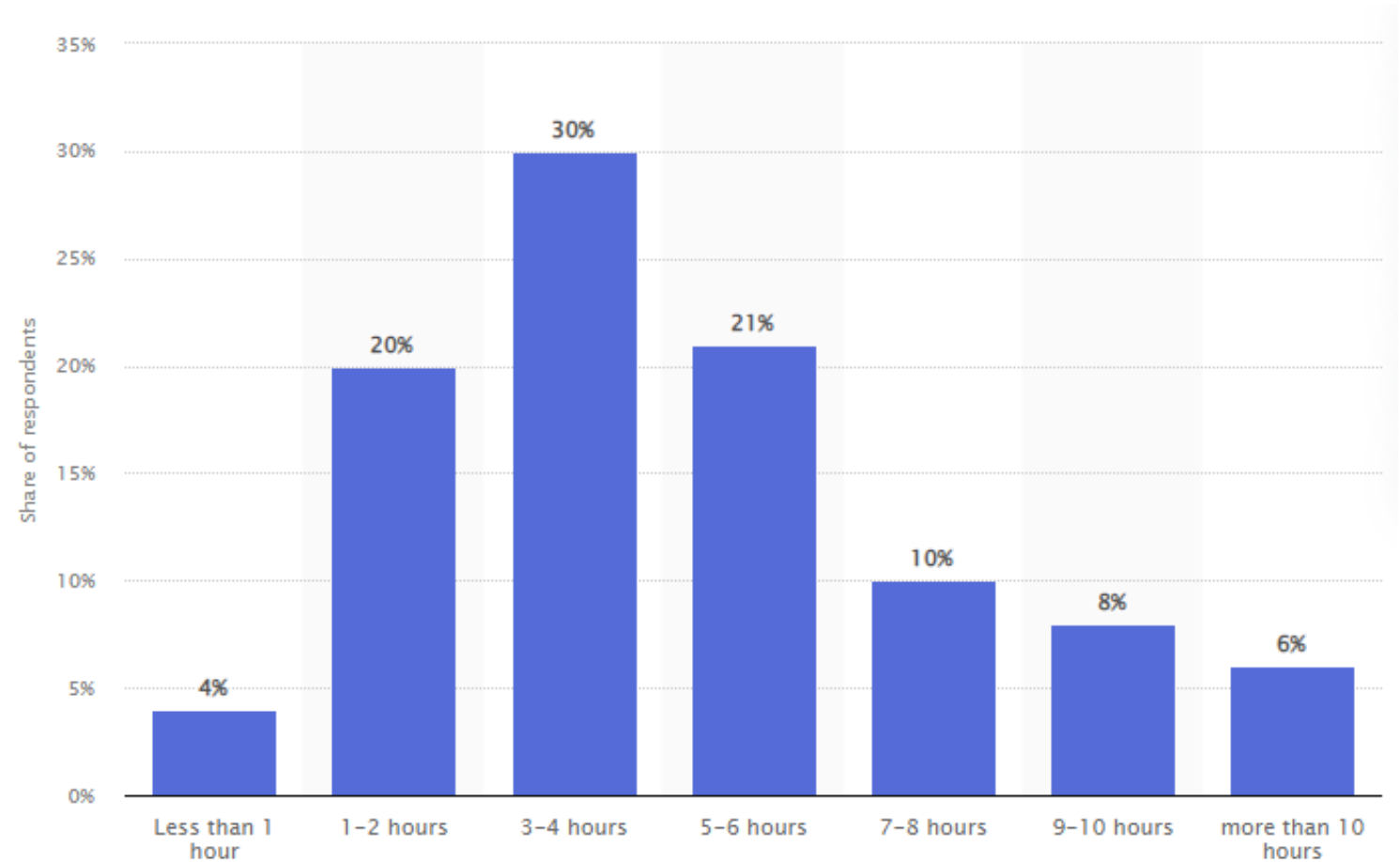
SOCIETÀ ITALIANA
DI FISICA



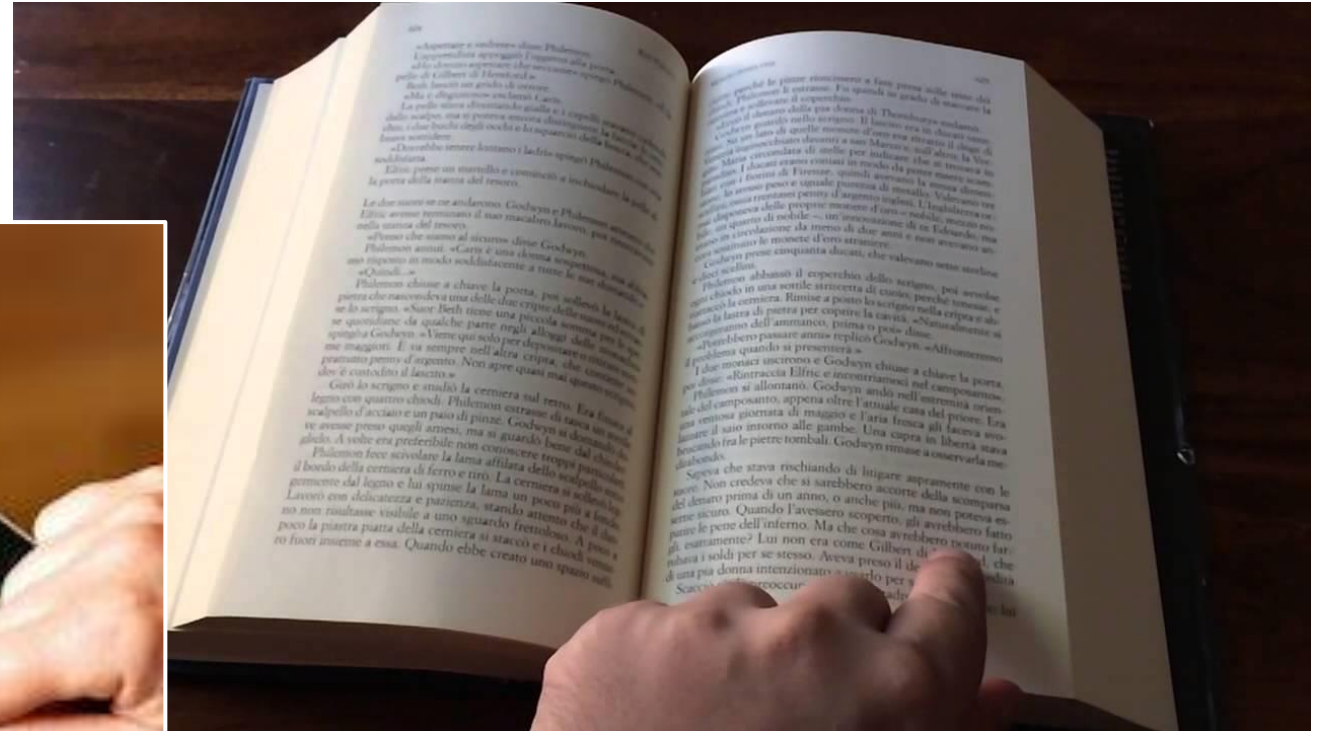
UNIVERSITÀ DEGLI STUDI DI SALERNO

INTRODUCTION

How much time have you spent using your smartphone in the last 24 hours?

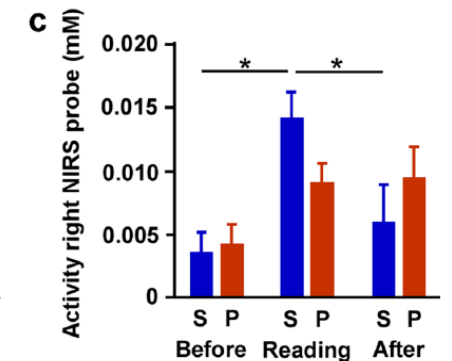
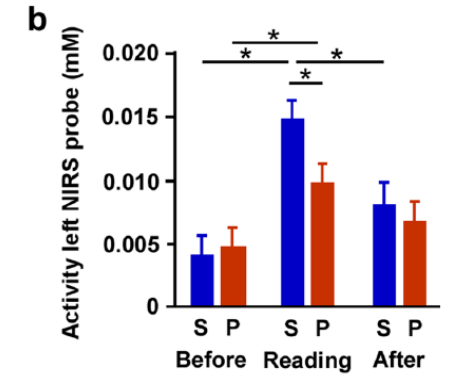
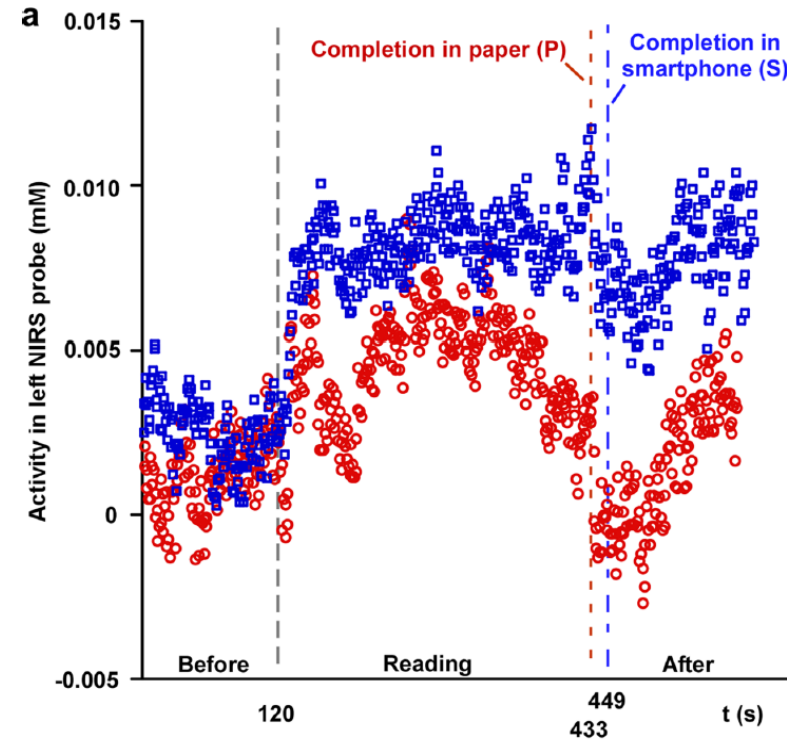
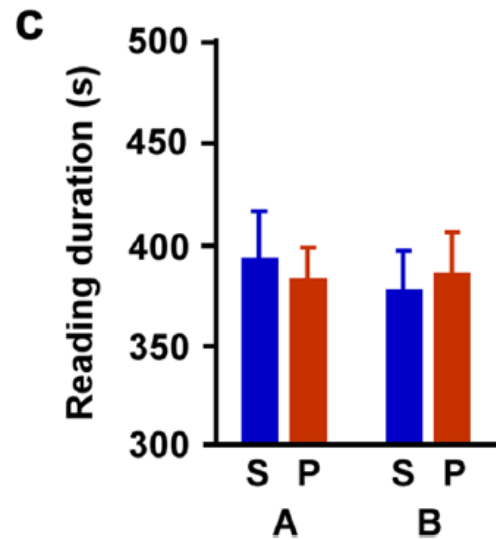
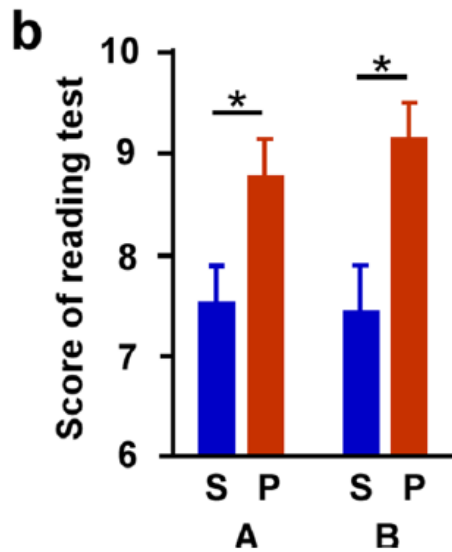


INTRODUCTION



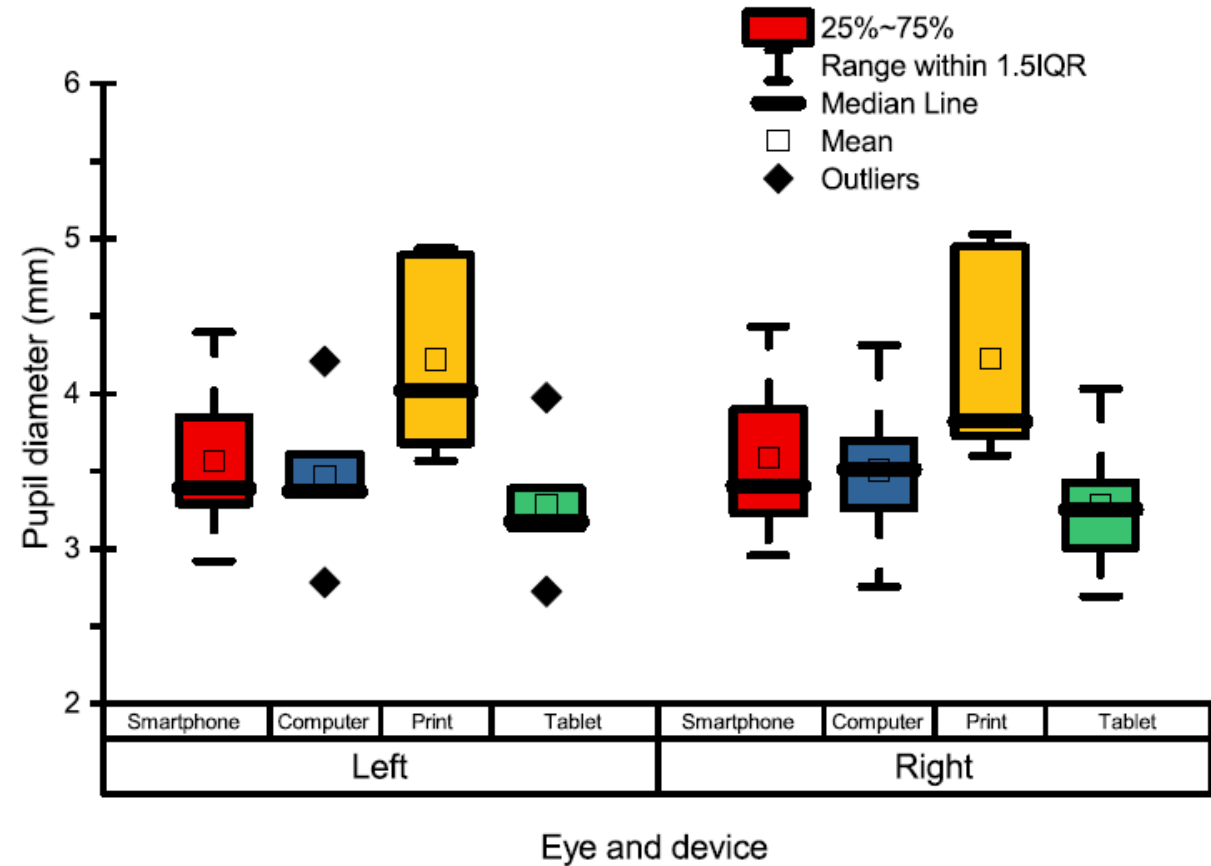
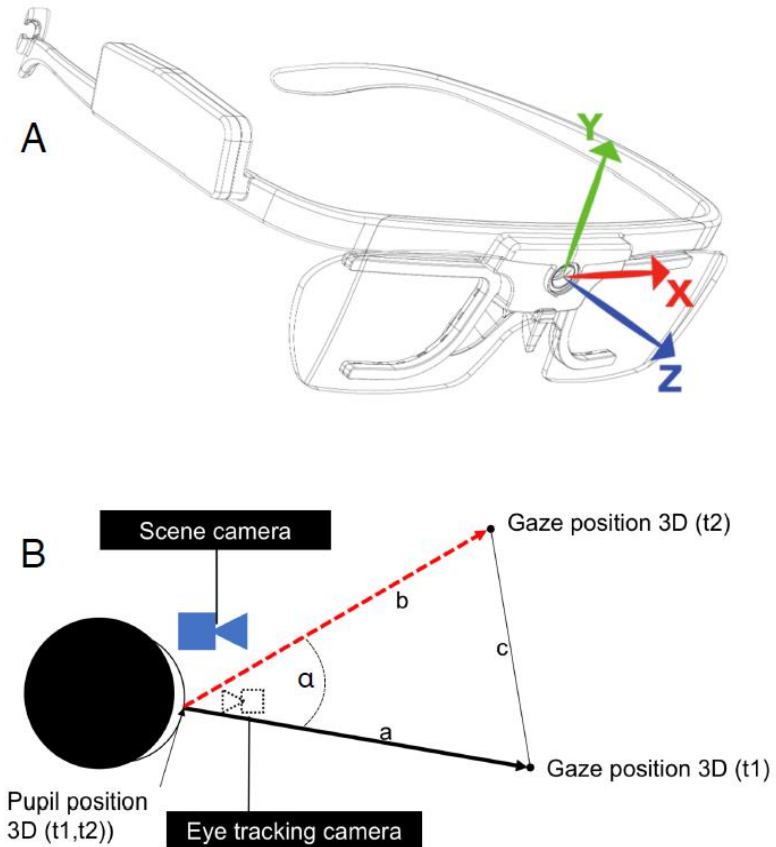
INTRODUCTION

Reading on a smartphone affects
sigh generation, brain activity,
and comprehension



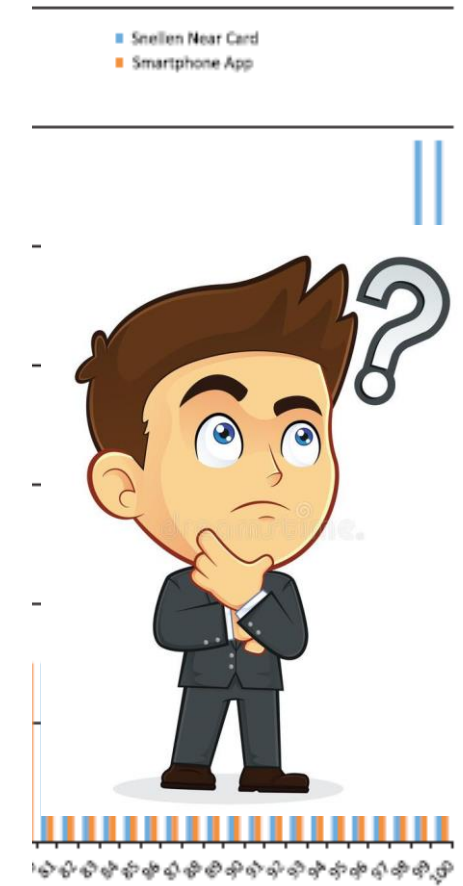
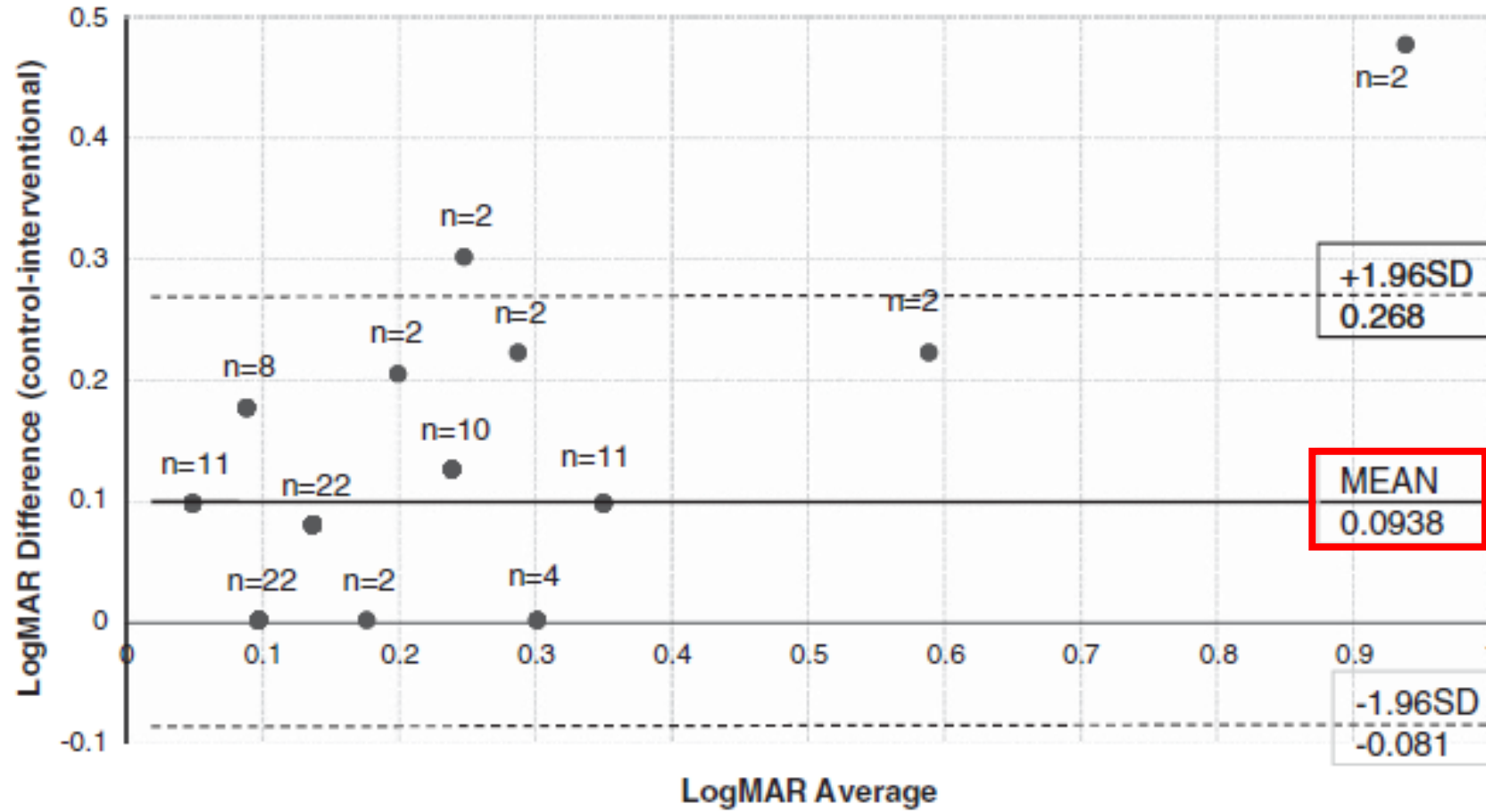
Honma et al., 2023 (*Scientific Reports*)

INTRODUCTION



Miranda et al., 2018 (SJOVS)

INTRODUCTION



Tofigh et al., 2015 (Eye)

METHODS

Participants

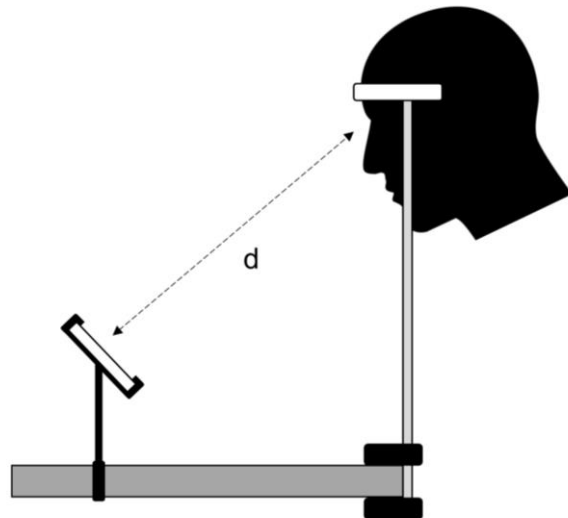
N = 85

mean age: 28.2 years

age range: 18-59

Measures

- Reading visual acuity:
 1. Smartphone Radner Chart
 2. Paper Radner chart
- Objective ocular refraction



Smartphone Radner Charts

High - 37 cd/m²

Il mattino dopo Adele chiamò il falegname, che le doveva tagliare delle nuove mensole

Medium - 16 cd/m²

Il mattino dopo Adele chiamò il falegname, che le doveva tagliare delle nuove mensole

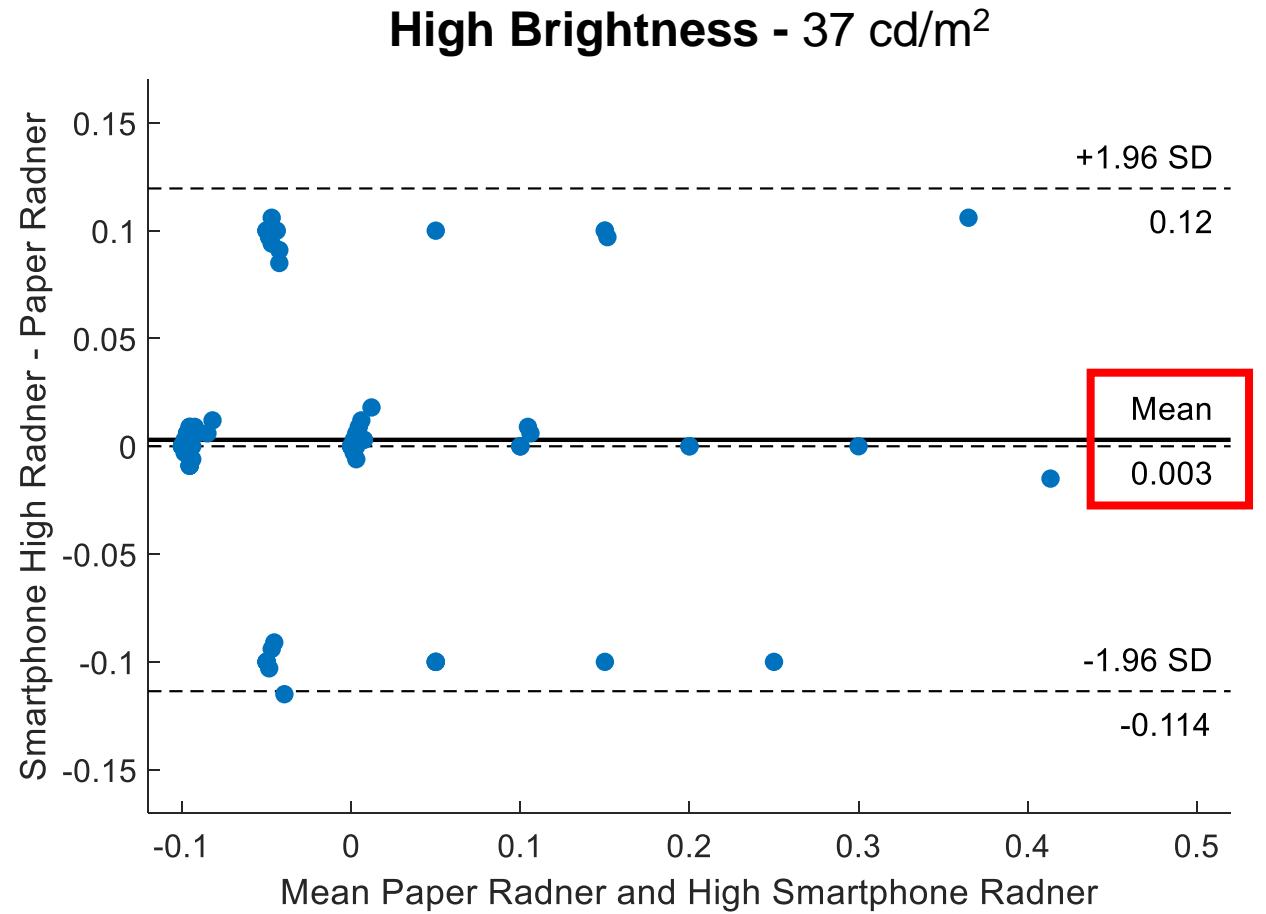
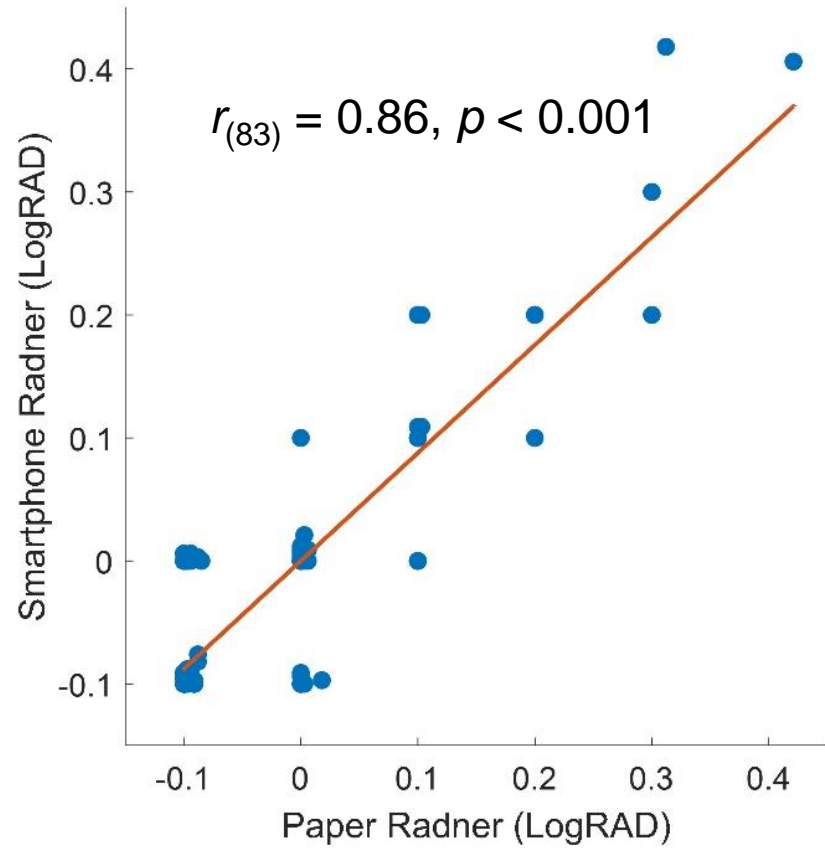
Low - 8 cd/m²

Il mattino dopo Adele chiamò il falegname, che le doveva tagliare delle nuove mensole

Paper Radner Charts

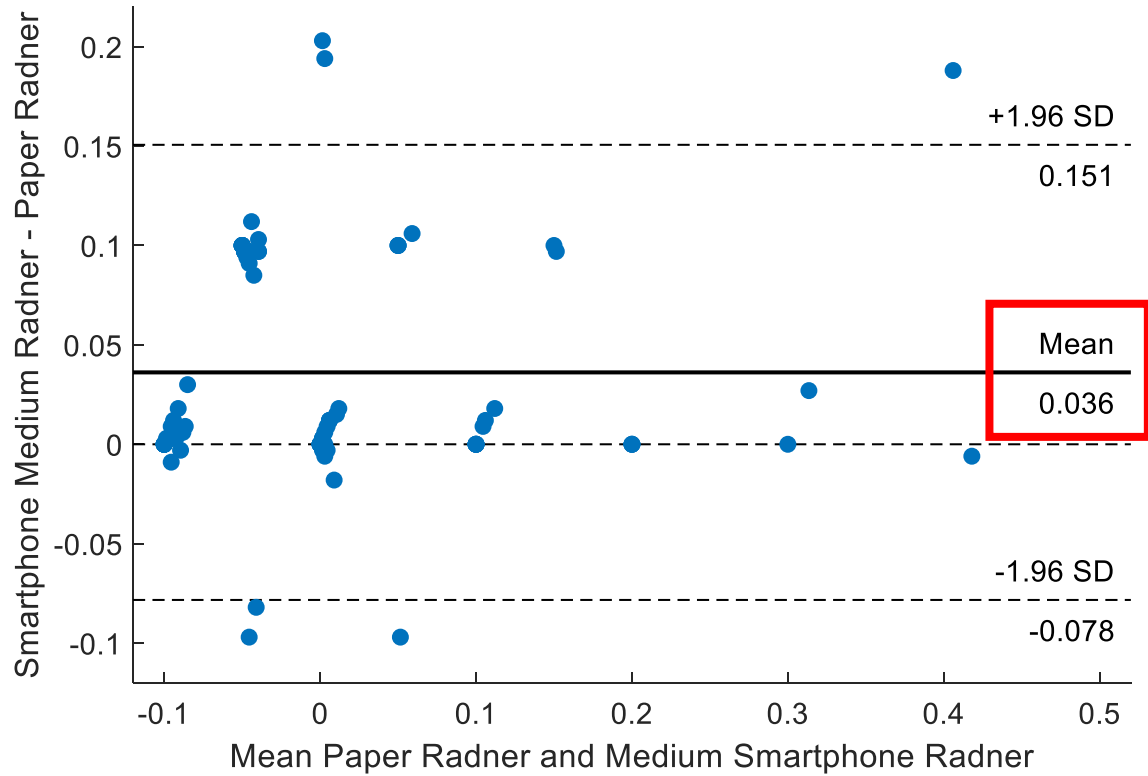
logRAD 40cm _{60cm}	Unità M	RADNER - TAVOLA 3 Per distanza di lettura di 40 o 32 cm logRAD = equivalente di lettura del logMAR	Decimale 40cm _{60cm}
0,9/1,0	3,2	La camera della bambina era in disordine, ma lei giocava ancora senza darsi pensiero	0,13/0,10
0,8/0,9	2,5	Il mattino dopo Adele chiamò il falegname, che le doveva tagliare delle nuove mensole	0,16/0,13
0,7/0,8	2,0	Le avevo detto diverse volte di andarsene, ma non voleva partire senza aver pranzato	0,20/0,16
0,6/0,7	1,6	La regina volle parlare solo al cavaliere, che lei avrebbe voluto nella grande impresa	0,25/0,20
0,5/0,6	1,26	Il piccolo Luigi aveva preso un burattino, che non voleva mettere dentro quella scatola	0,32/0,25
0,4/0,5	1,0	Lo zucchero era caduto tutto dal barattolo, che lei aveva posato sopra quella mensola	0,40/0,32
0,3/0,4	0,8	Il giardino era davvero pieno di ciclamini, che gli piaceva guardare dalla loro finestra	0,50/0,40
0,2/0,3	0,6	Le volevo dare indietro uno dei dischetti, che mi aveva portato quando erano partiti	0,63/0,50
0,1/0,2	0,5	Si girava più tardi della prima, e non aveva visto il suo orologio	0,8/0,63
0,0/0,1	0,4	Le stivali della signora erano di cuoio, e lei aveva comprato un paio di stivali di cuoio	1,00/0,80
-0,1/0,0	0,32	La signora era molto alta, e lei aveva comprato un paio di stivali di cuoio	1,26/1,00
-0,2/-0,1	0,25	La signora era molto alta, e lei aveva comprato un paio di stivali di cuoio	1,6/1,26

RESULTS

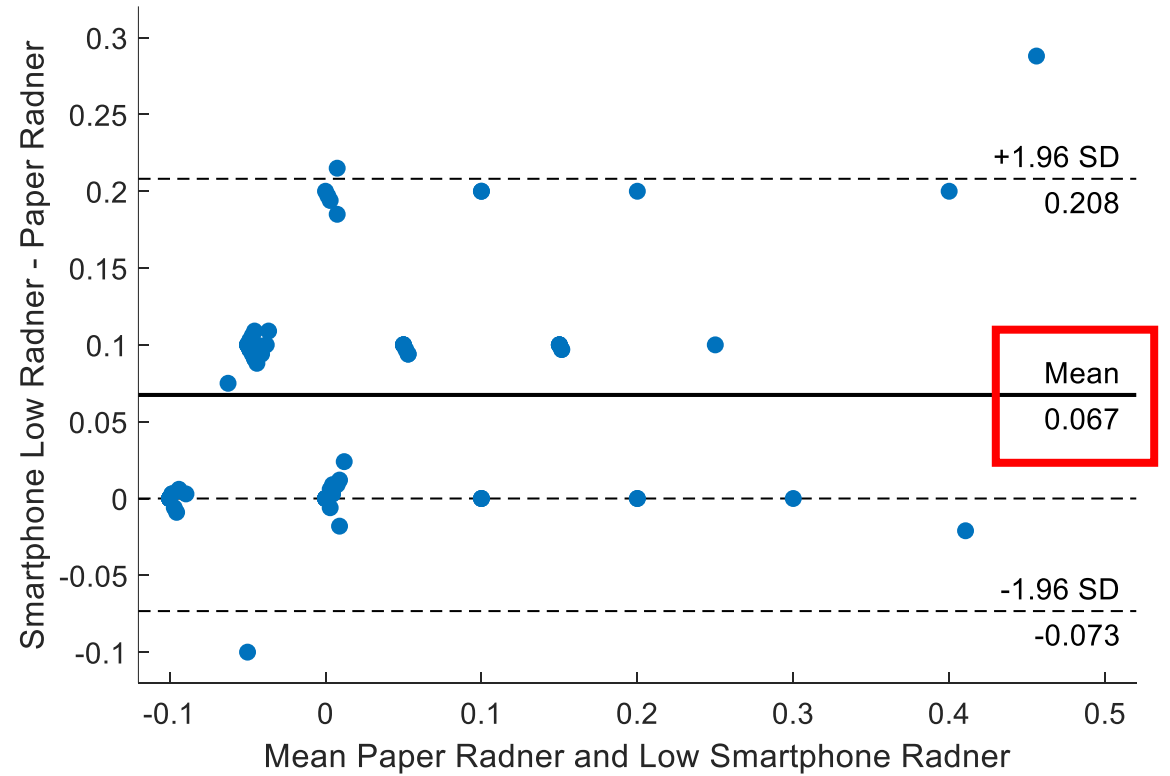


RESULTS

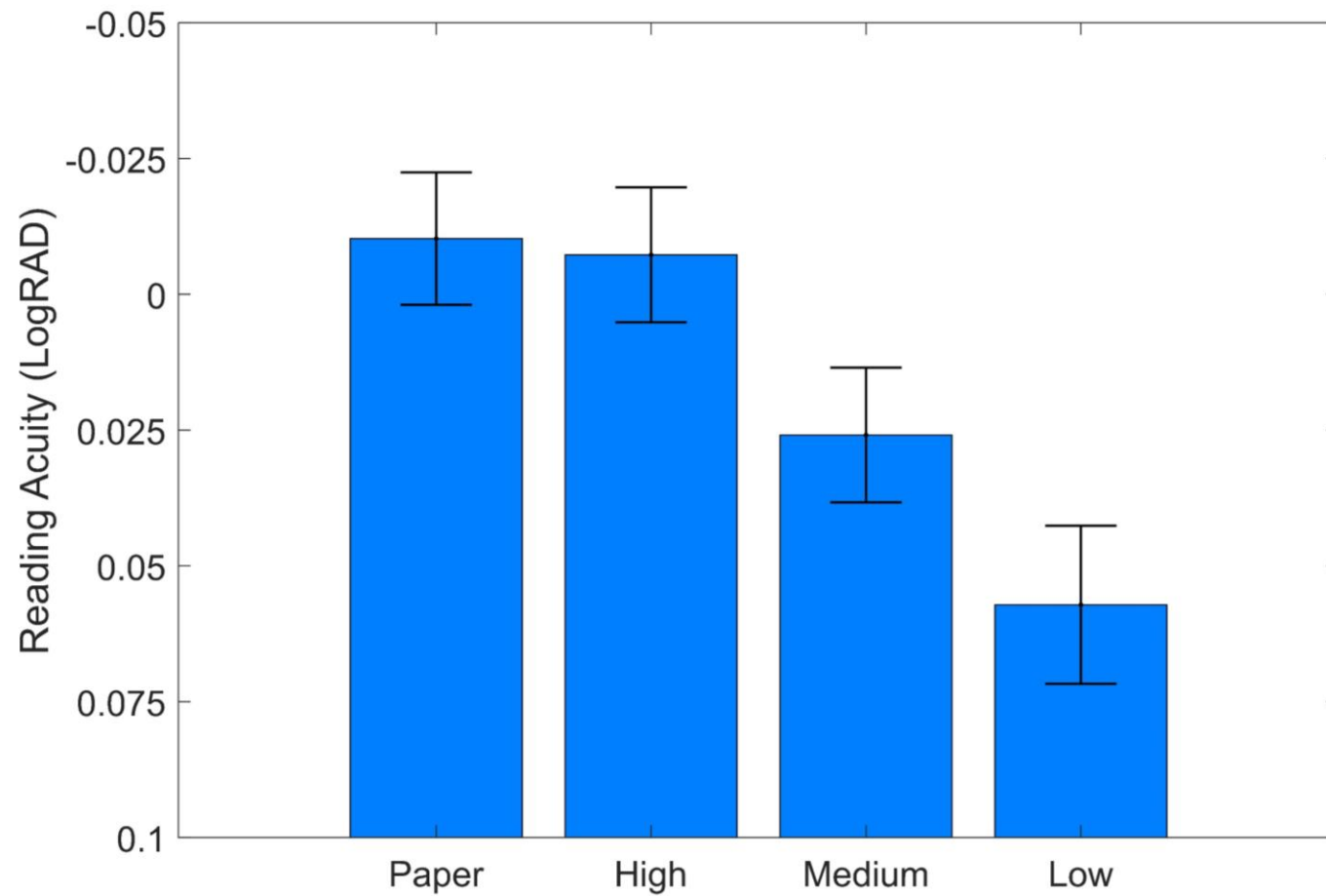
Medium Brightness - 16 cd/m²



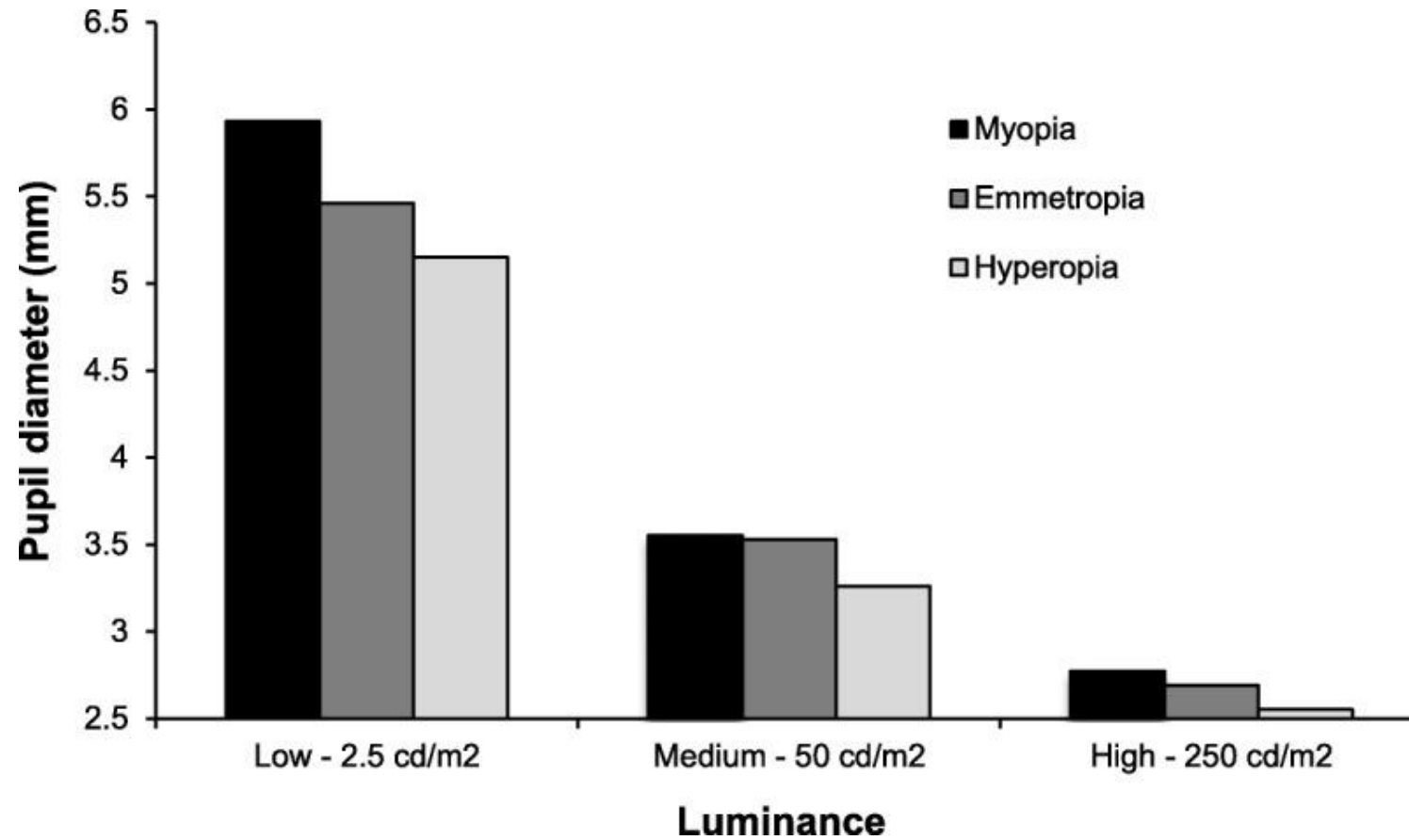
Low Brightness - 8 cd/m²



RESULTS

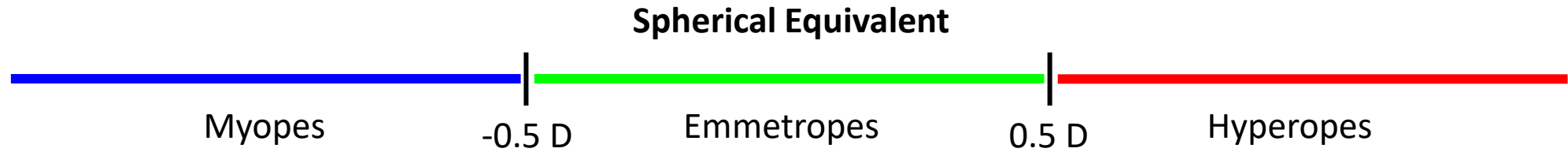


RESULTS



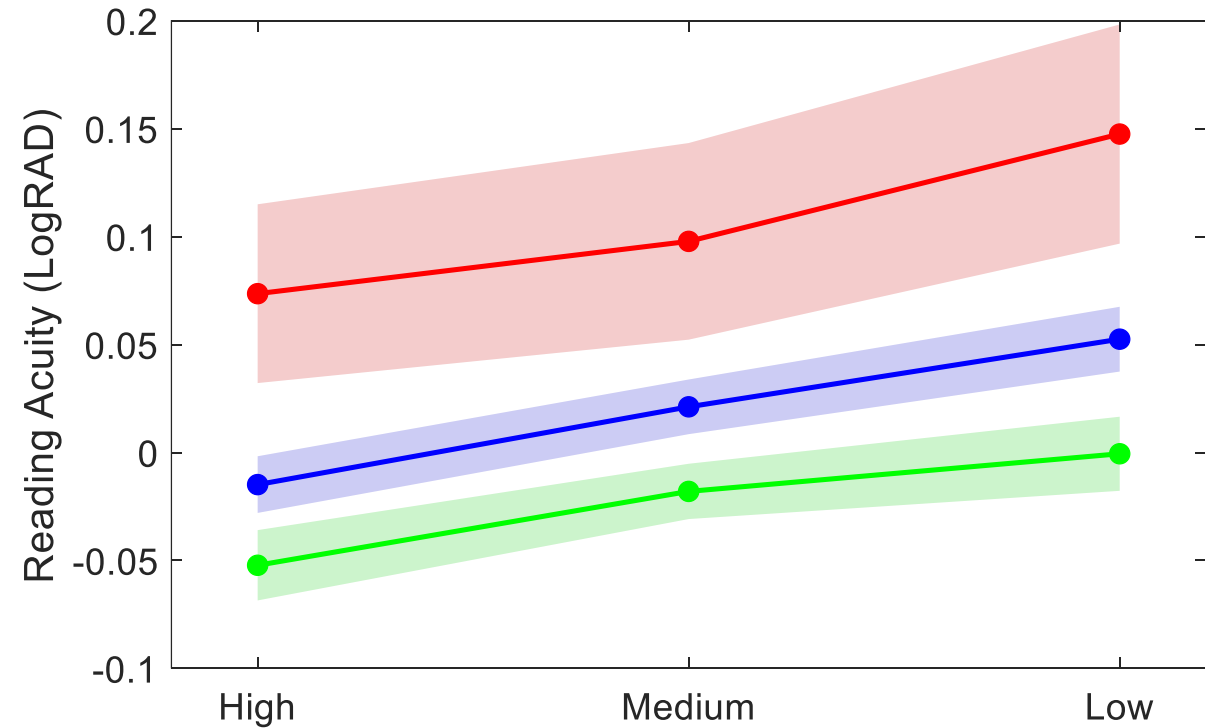
Guillon et al., 2016 (*Optom Vis Sci*)

RESULTS



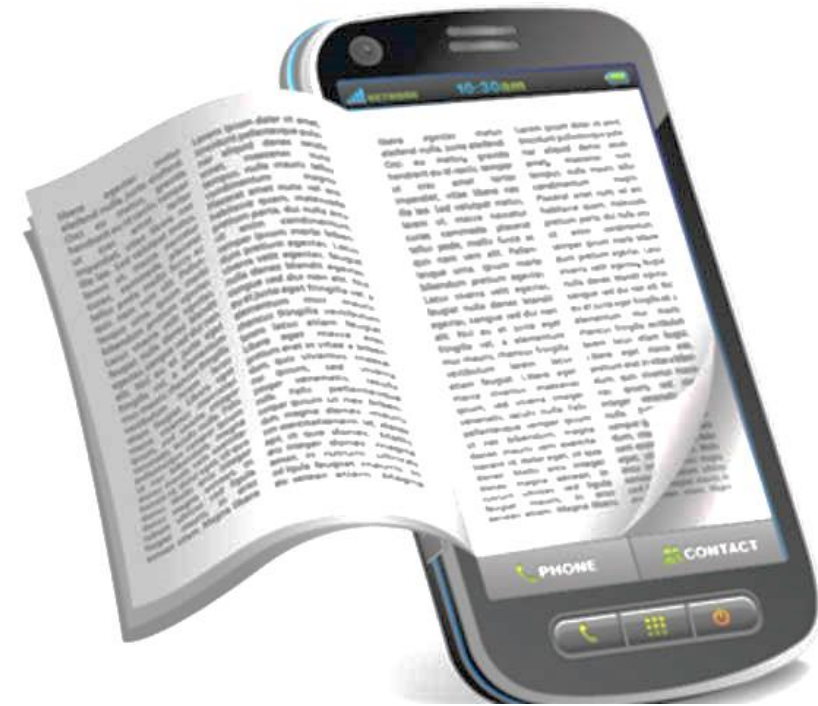
Objective ocular refraction:

- 17 hyperopes
(mean age: 33.17 years)
- 23 emmetropes
(mean age: 25.61 years)
- 45 myopes
(mean age: 27.58 years)



CONCLUSIONS

- Smartphones can be exploited for reliable measurements of near visual acuity
- A correct control of screen brightness is crucial for comparisons with standardized classical measurements
- No evidence for a different effect of brightness based on initial refractive condition



Thanks for your attention

Thanks for your attention

Thanks for your attention

Thanks for your attention

Thanks for your attention

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Thanks for your attention

REFERENCES

- <https://www.statista.com/statistics/1084948/daily-usage-of-smartphone-in-italy/>
- Honma, M., Masaoka, Y., Iizuka, N., Wada, S., Kamimura, S., Yoshikawa, A., ... & Izumizaki, M. (2022). Reading on a smartphone affects sigh generation, brain activity, and comprehension. *Scientific reports*, 12(1), 1589.
- Miranda, A. M., Nunes-Pereira, E. J., Baskaran, K., & Macedo, A. F. (2018). Eye movements, convergence distance and pupil-size when reading from smartphone, computer, print and tablet. *Scandinavian Journal of Optometry and Visual Science*, 11(1), 1-5.
- Tofigh, S., Shortridge, E., Elkeeb, A., & Godley, B. F. (2015). Effectiveness of a smartphone application for testing near visual acuity. *Eye*, 29(11), 1464-1468.
- Guillon, M., Dumbleton, K., Theodoratos, P., Gobbe, M., Wooley, C. B., & Moody, K. (2016). The effects of age, refractive status, and luminance on pupil size. *Optometry and vision science*, 93(9), 1093.

