Advanced method of perceptual training for improving near visual functions using mobile devices

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Introduction

What is presbyopia?
Presbyopia, the Greek word for aging eye, is an age-related near vision impairment:
- the first-reported effects of presbyopia occur between 42–44 years of age
- everyone is affected by the age of 51
- common solution is reading glasses or bifocals

Presbyopia causes a decline in contrast sensitivity and processing speed
Perceptual learning improves vision and restores visual deficits (Polat et al., 2004, 2009, 2006; Fahle 2002; Sag & Tanne, 1994)

Our recent study used structured perceptual learning to improve near vision by improving contrast sensitivity, discrimination and processing speed, with no changes in either of the optical functions: pupil size, accommodation or depth of focus!

Methods

PC & iPhone users.
Dissolved into two subgroups:
1. Early Presbyopic Stage
2. Advanced Presbyopic Stage

Gabor's quality is higher on iPhone vs. PC, as illustrated by:
- Gabor profiles with low (2.7 cpd) and high (5.3 cpd) spatial frequency
- remarkable differences in Gabor's matrix sizes

Results

Contrast Sensitivity

Eye Age Gain
Despite the expected deterioration, the biological “eye age” has decreased from 50.5 to 41.9 (6.8 years)

Apparatus & Stimuli

Visual Acuity using ETDRS
Gain of 0.25 logMAR 
80 % improvement
Pretest: 0.4 (J5)
Posttest 0.15 (J1-J2)

Contrast Sensitivity

Early Presbyopic Stage
Advanced Presbyopic Stage

PC & iPhone users

iPhone users in Early Presbyopic Stage subgroup had better initial acuity, but still showed improved acuity (at 5.3 cpd) on iPhone 2.5x-3.5x more than PC users, most likely due to a “training” effect (p<0.02).

Apple users showed comparable early improvement using dynamic electronic VA test (p>0.05).

Conclusions

- Our training method is effective in improving visual functions in people with presbyopia by enhancing the image representation in the brain
- The results show that smartphones and mobile devices can be used as an effective solution for training near visual functions

References:

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