Development of a "universal design" font with blur tolerance (1) -- A comparison of the readability of Ming, Gothic, and "universal design" typefaces --

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To verify the effectiveness of a font, its legibility and readability must be considered. In this study, we experimentally assess a new universal design (UD) font that could be easily seen and read by users with varied levels of visual acuity. We examined font readability based on the principle of the Japanese version of the MNREAD reading acuity charts in a blurring simulation (visual acuities are 0.2, 0.3, and 0.5). Results revealed that the new UD font was more readable than conventional fonts (Ming, Gothic, conventional UD fonts).

Objectives

EXPERIMENT COMPARING THE READABILITY OF MING, GOTHIC, AND NEW UD FONTS IN A BLURRING SIMULATION

To verify the effectiveness of a font, its legibility and readability must be considered. There are few studies on readability due to the complexity of controlling the difficulty of the text to read and conditions like the text's length. The Minnesota Low Vision Reading Test (MNREAD acuity charts, Legge et al., 1989) is a standardized reading test that is used extensively around the world. The current study sought to ascertain font readability based on the rationale of the MNREAD-J (Oda et al., 1989).

Methods

Participants

· 30 people with normal vision ages 20 to 40 (average: 28.5, SD: 6.8)
· Visual acuity was 1.0 or better.
· They were divided into 3 visual acuity groups.

Procedures

· This experiment was performed in accordance with standard MNREAD-J testing.
· Participant' s task was to read aloud the text shown as quickly as possible without any errors.

Equipments

· To simulate blurred vision, a spetial filter was used that continuously attenuate high spacial frequency components similar to those used by Legge et al. (1985) and Nakano et al. (2006). Simulated visual acuities were 0.3logMAR(0.5), 0.5logMAR(0.3), and 0.7logMAR(0.2).
· Standard MNREAD-J (the font is Ming) and the similar charts created in Gothic font or new UD.
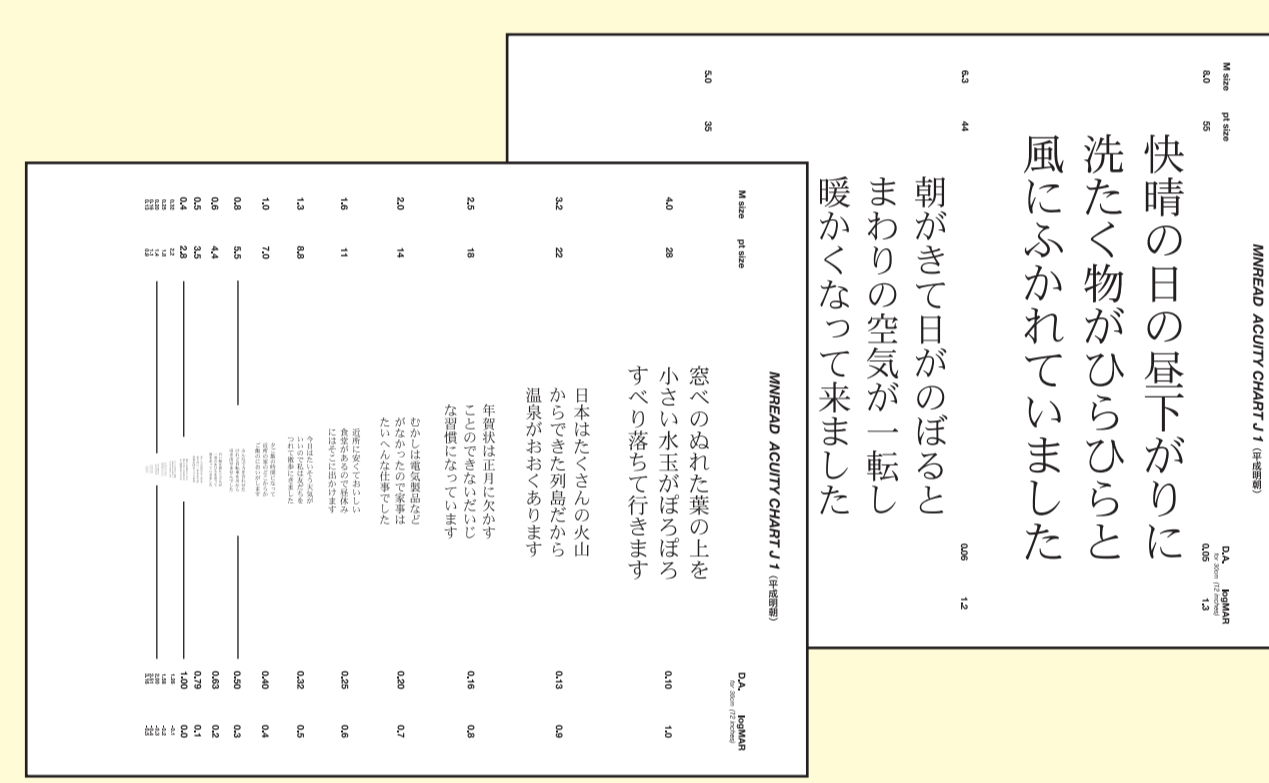· Luninance on the charts was 132cd/m^2 and average illuminance was 528lx.

Fig1 MNREAD-J Chart

a) 0.3logMAR(0.5)   b) 0.5logMAR(0.3)   c) 0.7logMAR(0.2)
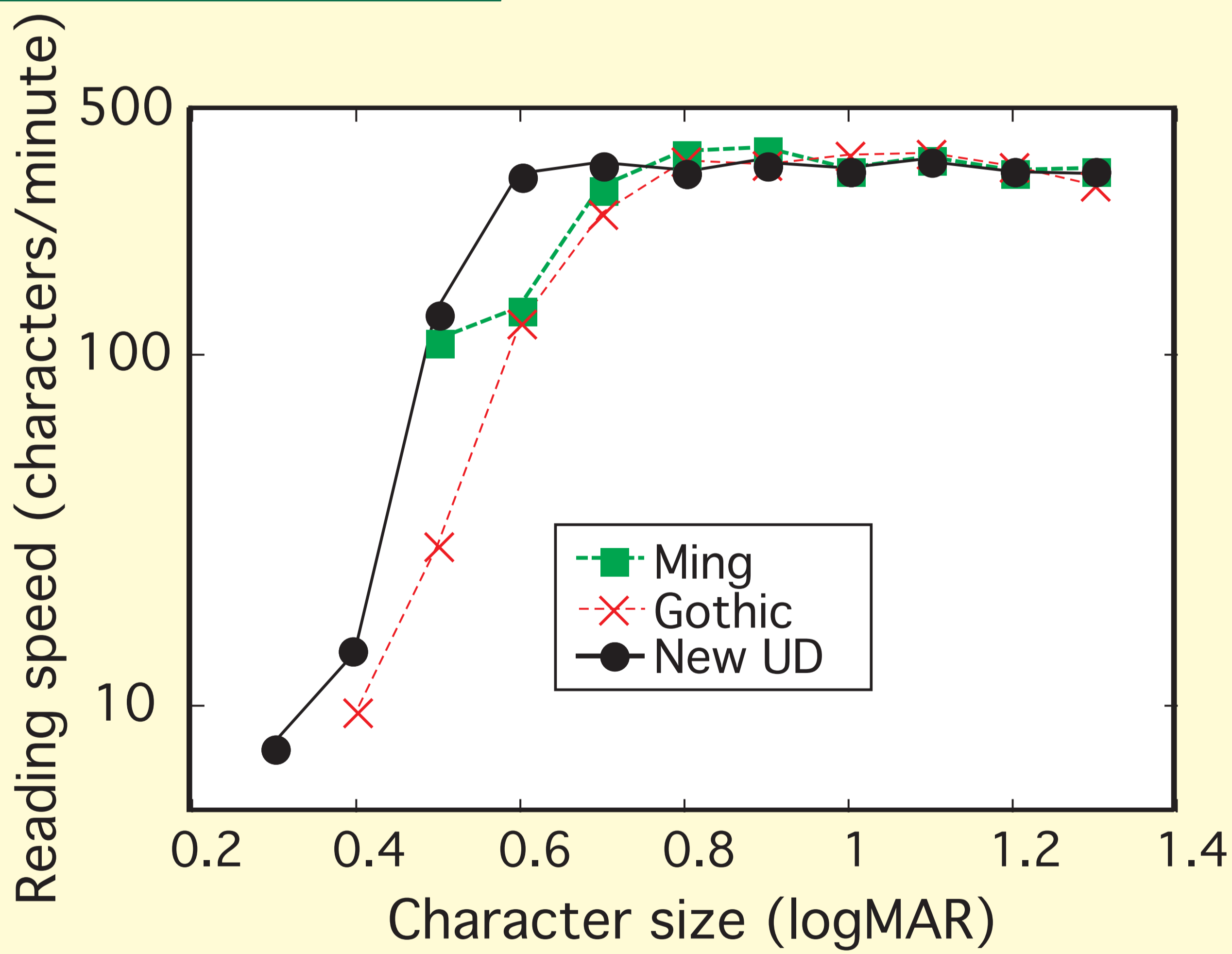
Fig2 Blured images of MNREAD-J
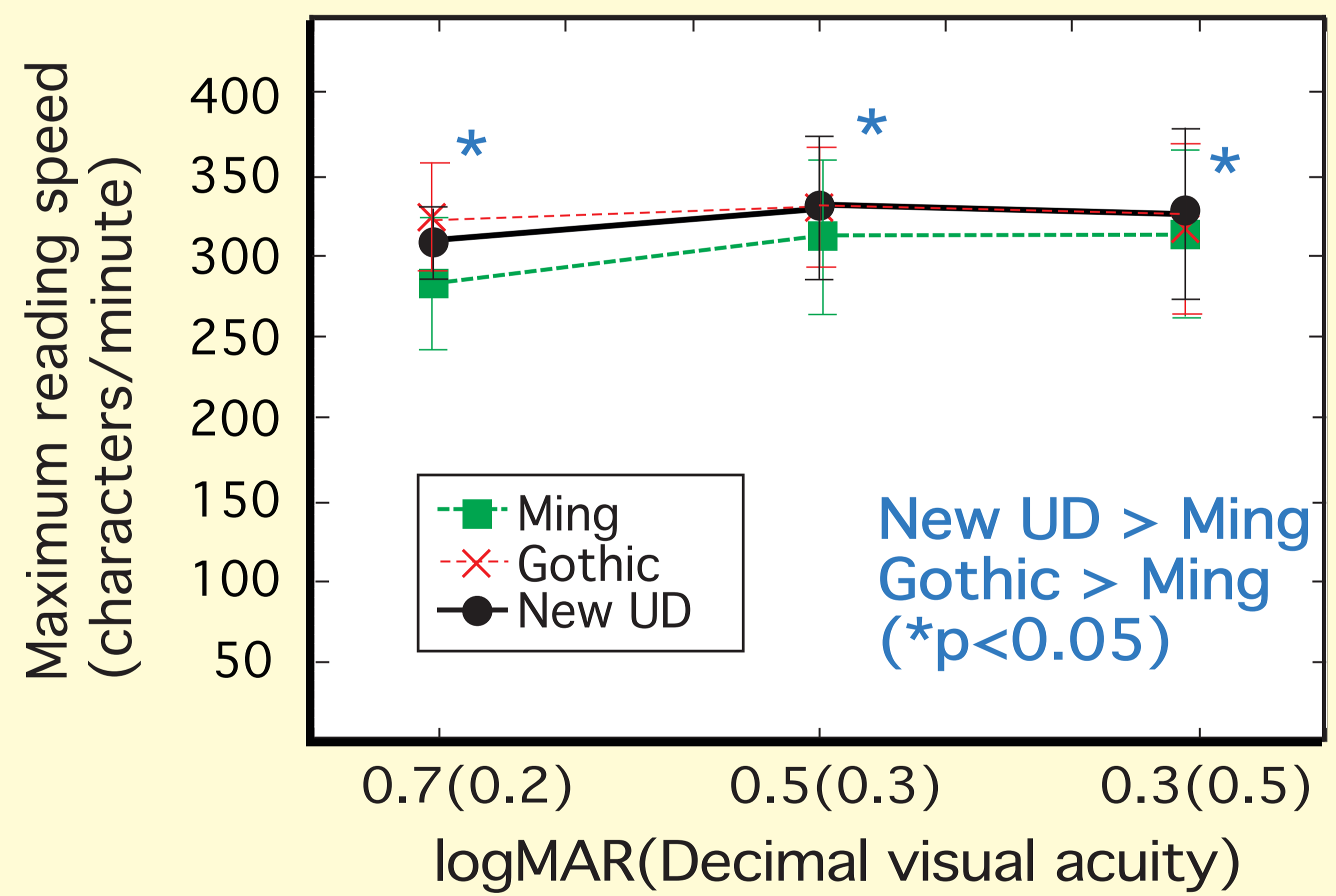
Results

Fig3 Typical example of MNREAD-J.

New UD > Ming
Gothic > Ming
(*p<0.05)

Fig4 Average Maximum Reading Speed (maximum speed of reading with the optimal print size)

New UD < Gothic
Ming < Gothic
(*p<0.05)

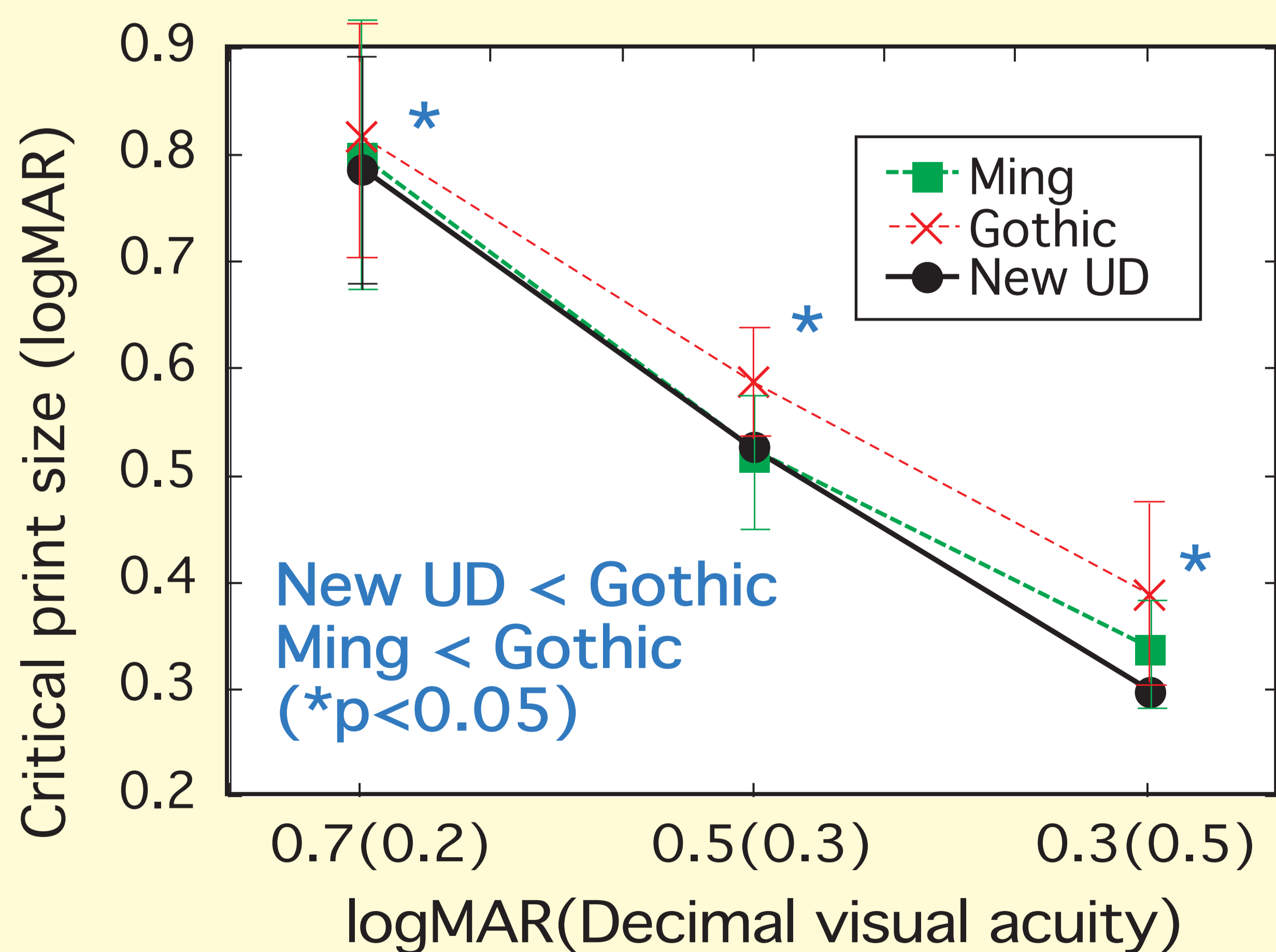Fig5 Average Critical Print Size (smallest print size at which the maximum reading speed could be maintained)

New UD < Ming
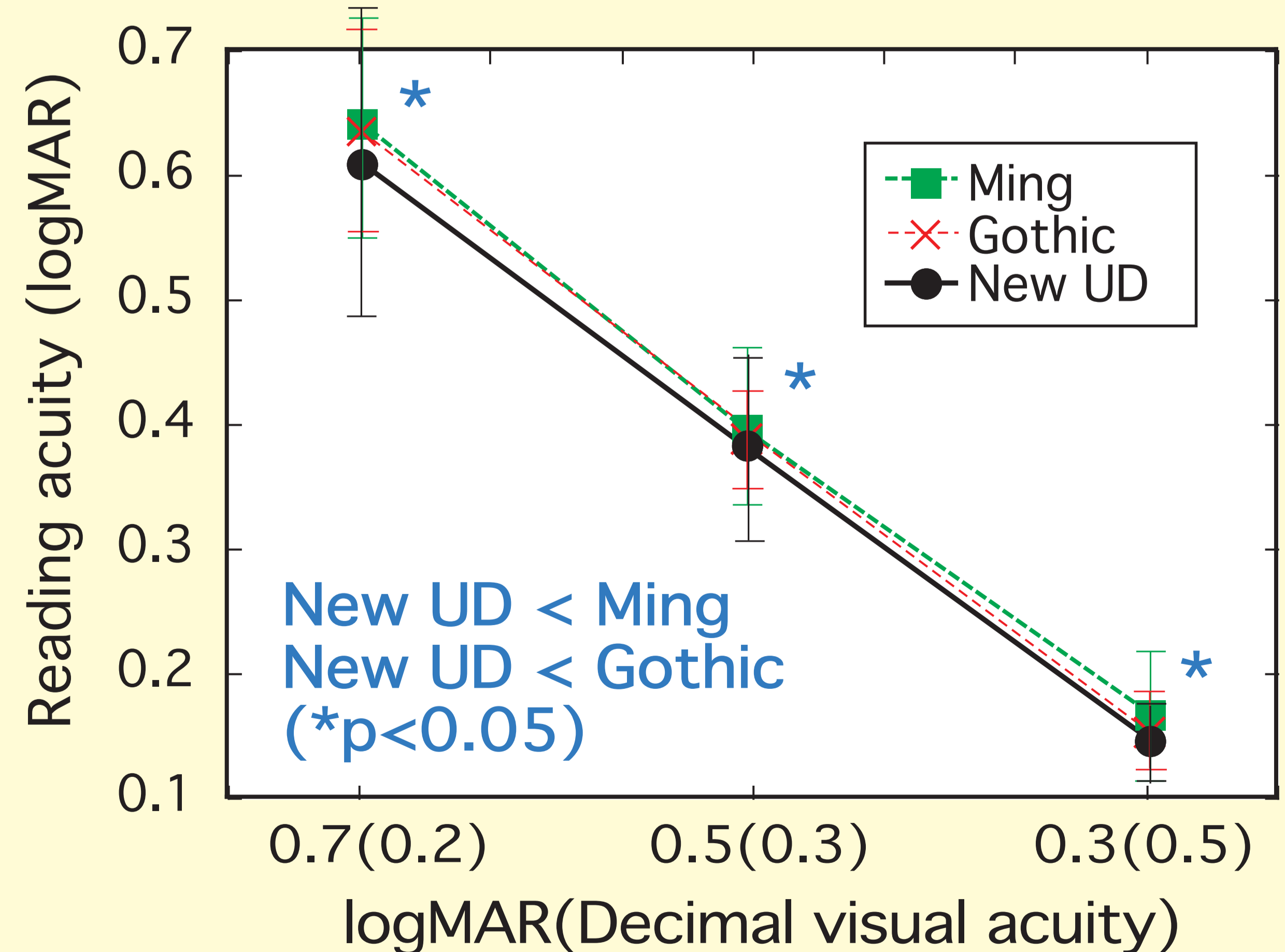New UD < Gothic
(*p<0.05)

Fig6 Average Reading Acuity (smallest print size that was readable)

The UD fonts had a higher readability than the Ming and Gothic typefaces did. In addition, results revealed that the new UD font devised in this study resulted in a smaller critical print size and better reading acuity than the other fonts did.