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Improving face recognition in age-related macular degeneration via caricaturing

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Footnotes

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Abstract

Purpose : Patients with age-related macular degeneration (AMD) have difficulty recognising faces and facial expressions. We examined if this could be improved using an image enhancement procedure derived from high-level cortical coding of faces in a perceptual 'face-space', namely caricaturing. Caricaturing exaggerates the ways in which the shape information in an individual face differs from the average. We tested whether caricaturing would improve face identity perception in AMD patients, and facial expression recognition in a simulation of AMD (normal-sighted young adults shown blurred faces).

Methods : To test identity perception, 12 Caucasian AMD patients (mean age 81, range 67-92, 8 females) with mild through severe stages of AMD performed a rating task using monocular vision. Using four levels of caricaturing (0, 20, 40 and 60% exaggeration), and 26 young adult Caucasian faces, participants rated how different two people's faces appeared when compared in pairs. To test expression recognition, 45 Caucasian normal-sighted undergraduates (mean age 22, 36 females) labelled expressions (as happy, sad, anger, fear, disgust, surprise) using two blur levels (50 and 70) to mimic the appearance of different severities of AMD and four levels of caricaturing (0, 40, 80, 100% exaggeration).

Results : For identity, a total of 19 eyes were included in AMD patients with visual acuities (VA) ranging from 6/6 to 6/360. Analysing individual eyes, a significant caricature advantage (at $p < .05$) was seen in 9/9 (100%) eyes with mild AMD (6/6 to 6/15), 3/6 (50%) eyes with moderate AMD (6/24 to 6/30), and 2/4 (50%) eyes with severe AMD (6/75 and 6/360). No change with caricaturing was found for one patient (both eyes; VA 6/19 and 6/24) and in 3 individual eyes (6/60, 6/120 and 6/360). For expression, caricaturing significantly improved expression recognition (at $p < .01$) at both blur levels

(simulating approximately moderate and severe AMD) with accuracy improved by approximately 7% (e.g., for severe blur, 44% correct in expression labelling without caricaturing, 51% with 100% exaggeration).

Conclusions : Caricaturing can significantly improve perceived differences in facial identity in patients with mild AMD and some patients with moderate and severe AMD. It also significantly improves expression recognition in simulated AMD conditions with normal-sighted young adults, suggesting it should also be useful for expression recognition in patients.

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