

LONG-TERM DEPRIVATION HAS DIFFERENTIAL EFFECTS ON COLOR, MOTION AND PATTERN PROCESSING IN HUMAN VISUAL CORTEX

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We characterized visual processing in a patient (MM) whose cornea was restored by stem cell replacement after suffering severe visual deprivation between the ages of 3 and 43. Deprivation resulted in a behavioral and neural shift in spatial frequency tuning towards low spatial frequencies: his resolution limit, measured psychophysically and with fMRI was 1cpd. MM also showed behavioral impairments in 3D shape perception, object and face recognition. Though sensitive to occlusion, MM was insensitive to transparency, shading and perspective. MM performed at 25% correct on an object recognition task and 70% correct in a face gender identification task. Control observers, using stimuli blurred to match MMs neural resolution losses, performed at 100% in both tasks. In contrast, MMs performance on color and motion tasks was relatively normal. Consistent with this behavioral data, fMRI activity in MMs MT complex was as great and covered as large an area as control observers, while responses to retinotopic stimuli in V1/2 were weak and these areas appear to be smaller than normal. Face and object stimuli did not produce activity in areas near fusiform and lingual gyri associated with face and object processing; normal observers viewing blurred stimuli did show activity these areas. Long-term interruptions in visual experience, even beyond the traditional critical period, have significant effects on visual processing, and these effects differ between both visual functions and visual areas.

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