

d2 – a new metric for characterising retinotopic areas

Abstract

The retino-cortical visual pathway through the thalamus up to area V4 is retinotopically organized: Neighbourhood relationships on the retina are preserved in the mapping. Local size relationships in that mapping are inversely proportional to eccentricity in the visual field. Globally, the locations in these maps are given by a logarithmic function (Fischer, 1973) if certain premises are fulfilled. An individual map can be characterised by the decrease of the cortical magnification factor (CMF) with eccentricity, or by a set of iso-eccentricity contours drawn on a flat map of the cortex. Here I propose, as a concise alternative, a new structural parameter d_2 to characterize these maps; it is defined as the radial distance, in millimetres, from the retinotopic centre to where the cortical magnification factor (CMF) is halved. It is a neuroanatomical counterpart to E_2 , known from psychophysics, the eccentricity where the foveal scale is doubled. d_2 captures the map in a single number along a radius, or a single contour on the map. It is the scaled product of the central CMF, M_0 , and E_2 , and it is more stable than either of these parameters. It can be used across studies, across radii, across individuals, and even across species. It can further help assess the retinotopic centre's CMF, M_0 . Typical values for d_2 and M_0 are given for a number of well-known mapping studies. The comparison of d_2 and M_0 across mapping studies shows considerable variation, and I discuss possible reasons for this.

Keywords: Cortical map; logarithmic map; cortical magnification factor; visual cortex; M-scaling; E_2 value; retinotopy; M_0 ; retinotopic centre; visual field; local/global; neuroanatomy