

FECHNER'S LAW AND VISUAL FIELD EFFECTS

JAN KOENDERINK

Utrecht University

Fechner's 'psychophysical law' states that the natural intensity scale is logarithmic. This has evoked many 'explanations', most of them having to do with Weber's law, ecological optics (independence of absolute level of illumination), or optimal channel capacity. I show that a totally different interpretation is possible. This interpretation is somewhat in the sense of Fechner as it identifies the 'natural' structure. I generalise the law to regions of the visual field in order to be able to describe spatial structure: then the problem of comparison of intensities at different locations arises. One needs a formal structure that accounts for the many familiar 'congruences', such as brightness and contrast (gamma) changes that somehow leave the image invariant. The solution to this problem is a Cayley-Klein geometry with one isotropic dimension. The aforementioned congruences are the motions of this space. One obtains a very general framework that is of immediate use in image processing (algorithmic vision) and may serve as a model of the visual field (biological vision).