

The Upper and Lower Visual Field of Man: Electrophysiological and Functional Differences*

W. Skrandies

Max-Planck-Institut für Physiologische und Klinische Forschung,
W.G. Kerckhoff-Institut, 6350 Bad Nauheim, FRG

1	Introduction: The Divided Outer World	2
2	Analysis and Origin of Visual Evoked Potential Components	6
2.1	Topographical Analysis of Scalp-Recorded Brain Activity	6
2.1.1	Why Topography?	7
2.1.2	Some Basic Considerations	8
2.2	Origin of Visual Evoked Potential Components	15
2.3	Temporal Activity Patterns	17
2.4	Conclusion	18
3	Differences in Latency and Topography of Visual Evoked Potential Components	19
3.1	Complete Scalp Field Distributions: Pattern Reversal Evoked Activity Recorded in 45 Channels	20
3.2	Generalization and Extension of Visual Evoked Potential Findings ...	22
3.2.1	Pattern Reversal Stimuli	22
3.2.2	Different Presentation Modes: Onset, Offset, and Reversal	26
3.2.3	Grating Stimuli	35
3.3	Implications for the Clinical Use of Visual Evoked Potentials	38
4	Electrophysiological Differences at Other Stages of the Visual System	41
4.1	Retinal Pigment Epithelium Activity	41
4.2	Human Pattern Electroretinograms	46
4.2.1	Spatial Distribution of Pattern Electroretinograms and Evoked Potentials	46
4.2.2	Differences Between Upper and Lower Retinal Areas	49
5	Functional Differences	51
5.1	Temporal Sensitivity	52
5.1.1	Results on Critical Flicker Fusion Frequency	53
5.1.2	Results on Double Flash Discrimination	54
5.1.3	Relation Between Critical Flicker Fusion Frequency and Relative Luminance	55
5.2	Visual Acuity and Contrast Sensitivity	57
5.3	Discrimination of Meaningful Stimuli	60
6	Evidence from the Literature	61
6.1	Anatomical Findings	62
6.1.1	Animal Data	62
6.1.1.1	Retina, Optic Nerve, and Optic Tract	62

2 W. Skrandies

6.1.1.2	Midbrain Structures	64
6.1.1.3	Cortical Areas	65
6.1.2	Human Data	67
6.1.2.1	Retina	67
6.1.2.2	Cortical Areas	69
6.2	Functional Differences	70
6.2.1	Animal Data	70
6.2.2	Human Data	71
6.2.2.1	Motor Reaction Time to Visual Stimuli	71
6.2.2.2	Temporal Sensitivity	72
6.2.2.3	Visual Acuity and Contrast Sensitivity	73
6.2.2.4	Perception	74
6.2.2.5	Evoked Potentials	75
6.3	Clinical Observations	78
6.3.1	Glaucoma	78
6.3.2	Retinal Circulation	79
6.3.3	Epilepsy	79
6.3.4	Cerebral Hypoxia	79
7	Summary and General Conclusions	80
8	References	84