INFORMATION THEORETICAL APPROACH FOR OPTIMIZING ELECTRICAL STIMULATION OF CAT RETINA BY A RETINA IMPLANT.

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Goal. Optimization of the electrical stimulation of retinal ganglion cells in cats for the development of a retina implant for blind humans with damaged photoreceptors. Basic visual perception seems possible even with few electrodes if stimulation patterns are optimized such that the evoked cortical activity reflects as much visual information as possible. **Methods**. Electrical stimulation of retinal ganglion cells of anesthetized cats by epiretinally placed microelectrodes while single-unit and population activities (LFP: 1-150 Hz; MUA: 1-10 kHz) are recorded via multiple microelectrodes from the striate cortex. Stimulation parameters might be improved by increasing the Shannon information between retinal stimulation and cortical responses (in bits per second). Rather irregular pulse trains as they might occur in ganglion cells of an intact retina in response to visual stimuli are used as stimulus triggers. These events trigger elements of a set of stimulation current waveforms ("symbols") that differ by systematic variation of one stimulus parameter at a time, including amplitude and duration of rectangle pulses or inter-phase delay. To exclude potential effects of instationarities or inter-stimulus dependencies, symbols are applied in random order. The dimensionality of the cortical responses is compressed by principal component representation before information measures are calculated. **Predictions.** 1.) Compression to the first 4 principal components will be sufficient. Preliminary results show that they already represent 85 % of the signals' variance. 2.) Retino-cortical information transmission will depend on the precise temporal pattern in the case of identical symbols, because each symbol will mainly activate the same local population of retinal neurons. 3.) Transinformation will also depend on the waveform of single symbols, because they will stimulate different local groups of ganglion cells at a different strength, and hence, will evoke different numbers of spikes that contribute to the retinal and cortical "population spike". **Conclusions.** Information theory allows the quantification of retino-cortical information transmission and offers the opportunity for estimating the resolution in space and time for visual stimuli to be transmitted to cortical perception with retina implants.

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