Population Coding of Neural Correlates and the Generalized Fechner Law

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Abstract : It is proposed that Fechner's and Stevens' laws can be viewed as special cases of a Generalized Fechner law (GFL) if the psychophysical process occurs in two steps, namely, the neuro-physical transduction by Stevens' law followed by the psycho-neural decoding by Fechner law for perception. It is argued that the physical stimulus impinging on any sense organ is invariably a form of energy, mostly electromagnetic, and the stimulus intensity is proportional to the incident energy density, a portion of which is absorbed by the sense organ and is relayed to the brain for the formation of the neural correlate. Once the neural correlate is formed, the perceived intensity which is coded by the population of neurons in the correlate will then depend on the number of neurons forming the correlate. It is reasonable that the large number of neurons must then be logarithmically scaled down to get the perceived intensity relative to the threshold as per the Fechner law. The phenomena of sensory adaptation and saturation are explained.

[FULL PAPER]