Dviejų spalvinių objektų sąveika

A spherical model of colour vision, colour discriminability and simultaneous contrast

Demo: Two colours interaction.

Description:

1. Colour is described by three factors: brightness (or lightness), saturation and hue. The last two properties of colour are called a chromaticity. These three parameters of colour are coded by responses of three (or four) neurons, which can be considered as components of three (or four) dimensional vector. Usually the lightness is associated with the length of vector; the two angles defining orientation of the vector specify the chromaticity (hue and saturation). The three adopted coordinate axes are mutually orthogonal.
2. If the brightness of colour is constant then the length of the above mentioned vector is also constant and we have a sphere. Hence, the chromaticity is defined by coordinates of the point at which a color vector intersects the surface of the described 3-D sphere. All monochromatic colours are mapped onto a curved line located on the surface of the sphere (the sphere and curve are depicted in the centre part of figure). Blue colours (short wave monochromatic ones) are located at one of the line's end. The red colours (or long wave monochromatic ones) are mapped at another end. The difference in wave length between two adjacent shown points is equal to 5 nm. By means of the mouse we can rotate the sphere in any direction and inspect the position of each colour on the sphere.
3. Assume that we change responses of the above mentioned three neurons in such a way that the distance between the given adjacent points on the sphere increases. That means we increase sensitivity to changes of the chromaticity in the vicinity of these points.
4. It is well known that if two objects of different colours are located alongside each other then the perceived colour of one of them is affected by the colour of the other object. The changes in the perceived colour depend upon differences in both chromaticity and brightness. Hence, if monochromatic colours are displayed on some coloured background then the distances between points of these colors on the sphere (i.e. along the monochromatic line) change in some way.
5. Assume that initially the functions of spectral sensitivity of the above mentioned neurons are chosen in such a way that the area, on which all colours are mapped, is maximal. Then any transformation in spectral sensitivity of the neurons could not increase this mapping area. In the best case the size of this area does not change. Let us assume that we used such transformation which stretches some part of mapping area. As the whole area could not enlarge in size then the other parts of spherical surface must inevitably shrink. That means if we increase the sensitivity to the chromaticity in some region of colours then in other regions it must inevitably decrease.
6. The above mentioned is illustrated in the figure. At the right side of the presented figure we see large annulus with a white hole in the center. We can change the colour of annulus. To do this firstly we need to move a cursor to some number displayed in the centre of a square. This number means a wavelength of monochromatic light. After choosing of the required hue we must press the key of the mouse. As the result of that the annulus gets colored. Another imaginary object is located in the centre of annulus. The hue of that virtual object changes from deep blue to deep red colours. Taking into account interaction related with simultaneous contrast a color of the central imaginary object changes. Hence, under the influence of annulus the location of central object colors on the sphere changes as well. That is easy to see rotating the sphere under different colours of annulus.
7. The value of colour changes depends upon the strength of simultaneous contrast interaction determined by the value of coefficient "alpha". We can change that from "0" (there is no interaction) to 0.999 (maximal interaction).
8. As it is easy to see if the distances in some region between depicted points increase then in other region they decrease.