Sight resolution and brain integrative role during painting of miniature portrait

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Abstract

The report addresses miniature painting in the context of brain function and plasticity. Summary of own experience in watercolor portrait miniature painting, its perception, and possible correlation with the integrative and selective brain activities is presented. Sight resolution and integrative function of human central nervous system is analyzed and a new idea for studying this function by neuroimaging is suggested.

Keywords: Sight resolution, Brain integration, Miniature portrait.
Aim & motivation

While painting portrait miniatures, I obviously think about all those aesthetical and psychological matters every painter does. Besides that, I try to look on a painting and looking at the miniature as an eyeball and neural network activity. Due to small dimensions of the painting (Figure 1) and the below-mentioned technique I use, the problem of the resolution of human sight is essential.

Remarks & Controversies

A precise visualization of any detail and color is possible within an angle of approximately 1 degree when an image is projected on the macula lutea of the retina, the area with the highest concentration of cone cells.

Resolution is an optical parameter measured by different methods depending on which biological or technical system is investigated. In photography, resolution is defined as a number of pairs of contrasting colored lines per millimeter identified as a separate elements (Figure 2).

The best camera lenses have a resolution of up to 400/mm. The resolution of light-sensitive negative materials reaches 800/mm. A resolution of 100/mm is quite good for the system of a lens and a negative material [1]. The resolution of the human sight, at best conditions—including contrast, the intensity of light, health of the viewer, and the optimal distance (±25 cm) of the object from the eye—is about 8/mm [2], which seems very poor compared to other analyzed optic systems (Figure 3).

However, the human visual system depends not only on the properties of the eye’s optics but also on the activity of several brain structures. Numerous methods (morphological, electrophysiological, neuropsychological) have been used for studying human vision. Laser studies performed in the 1960s showed that the optic system of a healthy human eye has a substantially better resolution than the human sight [3].

Functional magnetic resonance imaging (fMRI) during challenges of the visual system [4] confirmed specific neuronal activity in response to numerous optical factors. In addition, dynamic changes of these factors (color spectra, light angle, its intensity, background contrast) affect the sensitivity and activity of the retina, neurons of the lateral geniculate nucleus, V1 field in Brodmann area 17, and fields V2 through V5 in areas 18 and 19 of the cerebral cortex [5, 6]. Thus, it is the visual perception which enables identification of a known stimulus or its classification as unknown, ambiguous [7], interesting or not. Innate predispositions and acquired skills as well as the experience (i.e., recognition of letters or other symbolic signs) make seeing an extremely individualized process, requiring not only the perception but also analysis (distinguishing, verification, and elimination) of a visual stimulus.

The localizing, defensive, and emotional parts of the nervous system are also activated due to activation of mesencephalon [8].

Analysis & Conclusions

Individual life experience and temporal flow of data from other structures of the brain influence visual perception. It is possible that our nervous system eliminates some details of visual information coming from the eye. Instead of those details, it gives us a comprehensive and clear picture through integrative processes.
Colored points of a watercolor paint with extremely small dimensions evoke—usually subconsciously—an integrative activity resulting in the creation of colored spaces, lines, or graphic symbols. While painting color dots under the magnifying glass, I see only a fragment of a miniature. Then, when I look at the whole miniature, I cannot distinguish separate small color dots. I see only the integrated picture of a face. Similarly, when one looks at other pointillist paintings that have larger size blotches, if the distance is sufficient or some special maneuvers are used like eye squinting (to intensify light diffraction which limits resolution), one can see the integrated picture.

Questions

When and where does this limitation of eyesight resolution happen?

Is it an active elimination or neglecting?

Is it possible to observe this integrative activity of the human brain by fMRI?

Abbreviations

fMRI: Functional magnetic resonance imaging

Competing interests

The author declares no conflict of interest.

References