Margaret Livingstone

What Art Can Tell Us About The Brain

Abstract:
Artists have been doing experiments on vision longer than neurobiologists. Some major works of art have provided insights as to how we see; some of these insights are so fundamental that they can be understood in terms of the underlying neurobiology. For example, artists have long realized that color and luminance can play independent roles in visual perception. Picasso said, "Colors are only symbols. Reality is to be found in luminance alone." This observation has a parallel in the functional subdivision of our visual systems, where color and luminance are processed by the newer, primate-specific What system, and the older, colorblind, Where (or How) system. Many techniques developed over the centuries by artists can be understood in terms of the parallel organization of our visual systems. I will explore how the segregation of color and luminance processing are the basis for why some Impressionist paintings seem to shimmer, why some op art paintings seem to move, some principles of Matisse's use of color, and how the Impressionists painted "air". Central and peripheral vision are distinct, and I will show how the differences in resolution across our visual field make the Mona Lisa's smile elusive, and produce a dynamic illusion in Pointillist paintings, Chuck Close paintings, and photomosaics. I will explore how artists have intuited important features about how our brains extract relevant information about faces and objects, and I will discuss why learning disabilities may be associated with artistic talent.

Bio:
Margaret Livingstone is a Professor of Neurobiology and Harvard Medical School. She has done research on lobsters, fruit flies, and monkeys.

In collaboration with David Hubel she described a new subdivision in primate visual cortex involved in processing color, and described the anatomy and physiology of this previously unknown system. Livingstone and Hubel suggested that visual processing in general is parallel, with each subdivision processing different kinds of visual information. Each of the subdivisions has distinct physiological characteristics, being differentially sensitive to color, contrast, spatial and temporal frequency. They used these characteristics to explore human visual processing to ask whether different human visual tasks seem to be carried by one or the other visual processing streams. Their findings on the parallel organization of the visual system provided a deep structure for linking a large body of perceptual and physiological work, and this idea has had a profound impact in many fields.

Livingstone in collaboration with Albert Galaburda’s laboratory looked at differences in visual processing in subjects with dyslexia, and found a selective slowing of the fast achromatic visual channel. This work has had wide-reaching influence in the learning-disability field.

In the last few years Livingstone's laboratory used functional magnetic resonance imaging in alert monkeys and found that macaques, like humans, have specialized regions of the temporal lobe that are selectively involved in face processing. This study showed that monkeys, like people, use specialized regions of the brain to process faces.

Livingstone has extended these studies of the modular organization of the temporal lobe to ask whether such modular organization is innate (as is believed by much of the field) or depends on early experience. Her laboratory has shown that intensive early experience can modify the modular organization of the temporal lobe in juvenile trained monkeys, but not in adults. These ongoing studies should expand our understanding of how experience and training-related expertise affect the organization of high-level perceptual mechanisms. For understanding autism spectrum disorders and for understanding consequences of early deprivation and abnormal early experience it is important to know whether something as basic as face-processing domains are innate, or if they are molded by social experience and can be modified by abnormal experience. This work is important for understanding normal and abnormal human development and the role of education and early experience in brain organization.

Lastly, Livingstone has explored the ways in which vision science can understand and inform the world of visual art. She has written a popular lay book, Vision and Art that has sold more than 30,000 to date, and she has a revised edition in the works. This work has brought her acclaim in the art world as a scientist who can communicate with artists and art historians, with mutual benefit.