Project PRAKÄSH: Development of Object Perception Following Long-term Visual Deprivation

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Abstract:
Understanding how the human visual system learns to perceive objects in the environment is one of the fundamental challenges in neuroscience, and is also the motivation behind a new humanitarian and scientific initiative that we have launched, called 'Project Prakash'. This project involves a systematic study of the development of object perception skills in children following recovery from congenital blindness. We are conducting the experimental part of this study in India where we have located children with treatable congenital blindness. Working in conjunction with recent outreach initiatives by eye-hospitals in India, we have the unique opportunity to help congenitally blind children gain sight and then to study the development of object perception following sight onset. A particular strength of this project is that it affords us an opportunity to continuously follow the development of visual skills and associated neural markers from before the sight restoration treatment to after. Here we provide an overview of Project Prakash and also describe a specific study related to the development of face-perception skills following sight recovery.

The influence of early visual experience on the development of human face processing skills is a topic of much scientific and applied significance, but experimental data on this issue are scarce. A few studies have reported profound impairments in face recognition following early visual deprivation. However, it is unknown how visual deprivation influences performance on the more basic task of face versus non-face classification. Here we report studies with two children, both of whom suffered from congenital blindness lasting at least the first 7 years of life. We assessed their face classification skills following surgical restoration of sight. For one child, the experiments were performed 1.5 months after surgery and for the other, four years post-surgery. Our results indicate that these children are able to detect faces and distinguish them from distracters with high reliability, comparable to control subjects. Furthermore, this ability appears to be based on the use of overall facial configuration rather than individual features – a finding that presents an interesting contrast to the hypothesis of piecemeal processing used to explain impairments in face identification. These results have implications for the nature of face-concept learning schemes in human and computational vision systems. I shall describe our ongoing efforts to develop a computational model of object learning, inspired by the experimental data.