Children with restored vision demonstrate acquired face perception ability

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(Medical Xpress)—The milestones of infant brain development are difficult to study. So researchers often seek out subjects with disabilities that prevented them from reaching those developmental stages in infancy. One early achievement of babies is visually distinguishing between faces and nonfaces. It was unknown whether this ability is

subject to a critical period of brain development, or if it is a skill acquired through experience.

Recently, a group of researchers in India had a rare opportunity to study a group of five children between the ages of nine and 17 with unusual visual histories—all had early-onset blindness before one year of age due to dense bilateral cataracts, and were identified as candidates for surgery to restore their sight. Following the surgeries, the researchers tracked the progress of the children longitudinally to determine whether or not they could acquire categorical face perception after infancy, and how quickly. They have published their results in the *Proceedings of the National Academy of Sciences*.

Unsurprisingly, none of the children were able to distinguish faces preoperatively; a few days after sight restoration, all performed poorly on a facial recognition test. The test contained 300 images that range from patterns resembling faces to pictures of actual faces. The image set included true hits and false positives derived from an AI face detection system.

The performances of the newly sighted subjects improved over a period of several months; all progressed from exhibiting no biases among the stimuli to the acquisition of graded preferences for face-like patterns and eventually to the discrimination of faces from face-like patterns. The researchers conclude that this ability can be acquired late in life, even years after infancy. They note that the acquisition of face/nonface discrimination ability is rapid, and that the progression of skill acquisition involves intermediate stages of graded responses.

"The finding of a progressive improvement in face identification performance, rather than an abrupt onset of the ability, has bearing on the nature-nurture issue," the authors write. "If face detection were subserved by an innately available face schema that survived an extended

period of deprivation, we would expect to see a high level of discrimination ability immediately after sight onset."

However, they note that the results don't preclude the possibility that infants are born with such a hard-wired face-pattern schema, suggesting that these patterns may be available early in life, but are extinguished during long periods of visual deprivation such as that experienced by the test subjects.

The study is quite limited, due first to the small number of participants. Secondly, these children were not analogous to normally developing infants after their surgery, and their trajectories in the subsequent months may not be aligned with normal visual development. And the researchers also note that face/nonface discrimination is only one of many face perception tasks that humans perform. "We chose this task because face/nonface discrimination is arguably a fundamental precursor to other analyses of facial information," the authors write, and observe that their findings may not apply directly to other face perception tasks like emotional judgements or identity determination. They suggest future work could involve correlating the changes in face perception performance with the changes in functional brain organization via neuroimaging.

More information: Emergence of categorical face perception after extended early-onset blindness. *PNAS* 2017 ; published ahead of print May 22, 2017, DOI: 10.1073/pnas.1616050114

Abstract
It is unknown whether the ability to visually distinguish between faces and nonfaces is subject to a critical period during development. Would a congenitally blind child who gains sight several years after birth be able to acquire this skill? This question has remained unanswered because of the rarity of cases of late sight onset. We had the opportunity to work

with five early-blind individuals who gained sight late in childhood after treatment for dense bilateral cataracts. We tested their ability to categorize patterns as faces, using natural images that spanned a spectrum of face semblance. The results show that newly sighted individuals are unable to distinguish between faces and nonfaces immediately after sight onset, but improve markedly in the following months. These results demonstrate preserved plasticity for acquiring face/nonface categorization ability even late in life, and set the stage for investigating the informational and neural basis of this skill acquisition.