Perspective taking in newly-sighted kids: Do they orient towards an interlocutor's face?

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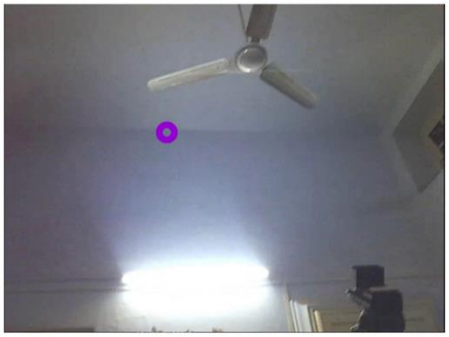
Project Prakash was launched in 2005 with a humanitarian and a scientific mission: alleviate the problem of child blindness in India, and study brain plasticity (or how the brain learns to see after years of visual deprivation). In collaboration with Project Prakash, we have recently started to investigate the pragmatic abilities of newly sighted children. In our first study, we investigated Prakash children's perspective-taking abilities in referential communication, starting with their natural orientation towards an interlocutor's face. We investigated this question during naturalistic interaction (Exp. 1) and more controlled conditions (Exp. 2).

The Prakash children in this study (7F/5M, mean age: 11.3; range: 7-15) all suffered from early-onset profound visual deprivation due to congenital dense bilateral cataracts, considerably occluding their sight and leaving them with the ability to perceive motion and color and to resolve some fine visual detail only in the near space. All were defined as legally blind prior to surgery, with near visual acuity ranging from 20/535 to 20/3251 and markedly improving after surgery (ranging from 20/183 to 20/846 at the time of the second experiment). Our first experiment was a referential communication task: we tested 12 Prakash children in pairs and had them select their favorite toy in a display and communicate their choice to their partner. While not our main aim, we observed that the Prakash children made less fixations on their interlocutor's face than the neurotypical controls. Of the 6 Prakash children who got to wear eye-tracking glasses, we observed that they made an average of 11 fixations on their listener's face (as they spoke) and 10 fixations on the speaker's face (as they listened; average task duration: 10min). The 4 control children who got to wear the glasses (data collection ongoing) made an average of 13 fixations on their listener's face and 27 on the speaker's face (average task duration: 7min). Given this difference, we ran a follow-up manipulating perceptual cues.

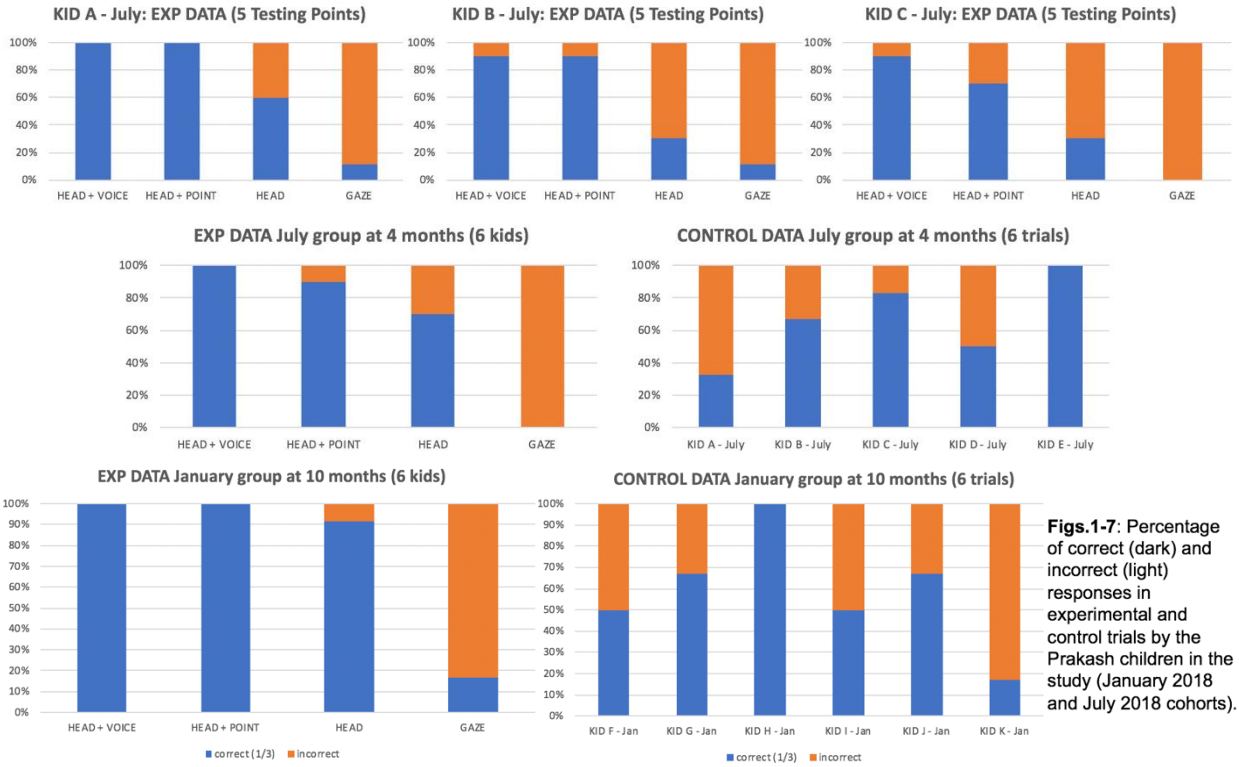
It is well known that both children and adults follow gaze to disambiguate reference (Hanna & Brennan, 2007; Brennan et al., 2008; Csibra & Volein, 2010; Macdonald & Tatler, 2012), so we wanted to directly investigate whether the Prakash children would do the same. For this purpose, we designed a task where children could make use of various perceptual cues to disambiguate an instruction ('Could you give me that one?' – from a line of 3 rolls of red tape placed between the child and the Experimenter): Head orientation + Voice direction, Head orientation + Pointing, Head orientation only, and Gaze only (presented in that order for increasing difficulty). The Experimenter looked at the target object in all four conditions and, except for the first condition, she made the verbal request looking at the child *before* providing the disambiguating cue(s). Because the task was administered right after surgery (among earlier and later test points), the task was kept short (1 warm-up trial + 8 experimental trials, 2 per condition; EXP DATA in Figs. 1-7). At the end of the last testing session (4- and 10-month Follow-up for each cohort), the Experimenter collected control data by asking the child: 'Look at my face, where am I looking now?' and shifting her gaze (6 trials; CONTROL DATA in Figs.1-7).

As expected, children found the last two conditions (Head only and Gaze only) the hardest, clearly benefitting from voice direction and pointing. Interestingly, however, children were better at following the Experimenter's gaze in the control trials than in the experimental conditions (see Figs. 1-7), suggesting that they required prompting to look towards the Experimenter's face. By contrast, the 11 neurotypical controls (matched by age and gender) were at ceiling in all conditions. The percentage of time children fixated on the Experimenter's face (see Figs. 8-11) confirmed that the Prakash children (especially the July group, who had lower vision pre-op) did not naturally orient towards the Experimenter's face.

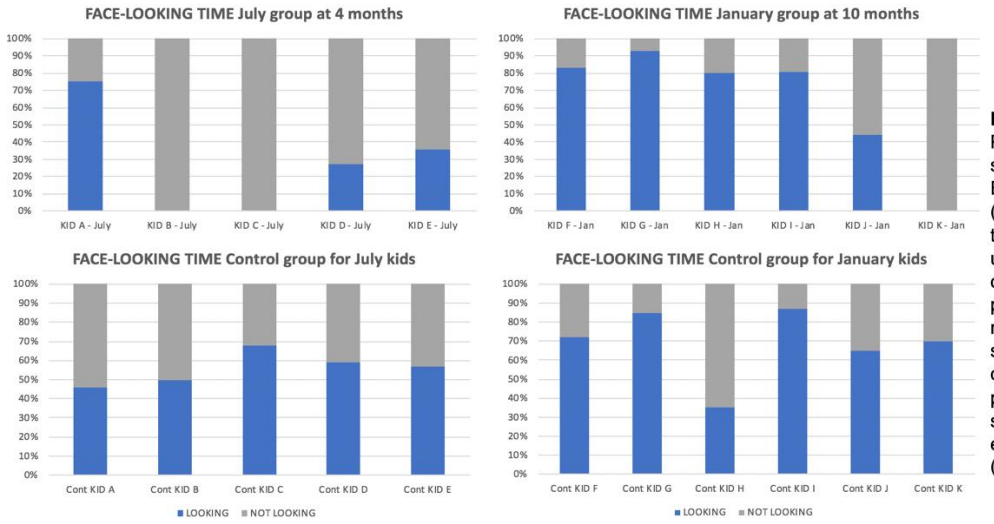
Gaze following is seen as a basic mechanism in the development of both language and pragmatics (Brooks & Meltzoff, 2002, 2005; cf. Akhtar & Gernsbacher, 2008). However, the results of our first referential communication study with Prakash children suggest that after years of visual deprivation, orienting towards an interlocutor's face may not come naturally.



Video frames from the Referential Communication task: Kid A (July) is wearing the ET glasses (purple dot shows their gaze), hears the Experimenter laugh and orients towards her (left picture). Kid A fixates at the base of her neck and following her raised chin and hands, next fixates on the ceiling (right picture). However, the Experimenter's gaze shows she is making eye contact with someone else further away in the room.



Figs.1-7: Percentage of correct (dark) and incorrect (light) responses in experimental and control trials by the Prakash children in the study (January 2018 and July 2018 cohorts).



Figs.8-11: Percentage of time spent looking at the Experimenter's face (dark bars) during the 4-month follow-up session (July cohort – top left plot) and the 10-month follow-up session (January cohort – top right plot), and the sighted control for each Prakash kid (bottom plots).