

Eye-Gaze Development in Infants: Learning to look and looking to learn

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Within seven hours after birth infants take a remarkable interest in their mothers' faces and have been shown to imitate facial expressions made by caregivers.¹ This early period and the development of synchronous eye-gaze with a caregiver has been shown to be important for attachment,² as well as providing infants with the ability to regulate stimulation and join in turn-taking.²

By four to five months of age, the infant develops an interest in objects³ and this early ability to coordinate eye-gaze with adults leads to joint communication between a caregiver, the infant and an object.⁴ This ability to obtain and regulate eye contact, or eye-gaze, is crucial for numerous developmental milestones in communication and language,³ and is predictive of later vocabulary.^{5,6} This eye-gaze skill following should be developed by 10 to 11 months for optimal scaffolding of later joint attention, language development and the transmission of cultural knowledge.⁷

Hearing Infants

How do hearing caregivers establish their children's ability to follow their eye-gaze?

Hearing caregivers and infants use a simultaneous visual/auditory approach in communication.⁸ For example, as the infant looks at a mobile, the caregiver can simultaneously talk about the mobile while the infant attends to both the auditory (i.e., adult's voice) and the visual information (i.e., the mobile).

Importantly, infants who follow adult eye-gaze, look longer in the direction of the adult's gaze, point to the object, and have more words in their vocabularies between 14 and 18 months of age.^{5,6,9} When the infant points at the object, it invites the adult to provide a word, which has positive implications for the infants' vocabulary development.⁶ Here, it is clear that hearing caregivers/infants tend to use an oral/aural mechanism to gain and maintain attention, which is related to language acquisition and larger vocabularies.

Deaf Infants

What about deaf infants? Deaf caregivers use several techniques to establish eye-gaze following. First, Deaf caregivers wait for deaf babies to gaze at objects, and then look back at them before responding.^{10, 11} Deaf caregivers will wait a relatively long time for the infant to make eye contact and then they follow up with comments about the interaction.¹² Infants make a stronger connection between objects and symbols when caregivers point before and after signing.^{10, 13} This sequential shift in eye-gaze does not impede language development;^{8,13} rather, deaf infants with Deaf caregivers develop language similarly to those who are hearing.¹⁴ "These deaf [caregivers] have the cultural knowledge about how to interact with their infants in this special environment in order to get and maintain their attention"¹² (p. 106). Here we see that Deaf caregivers/infants tend to use visual/tactile sequential mechanisms to gain and maintain attention in contrast to the visual/auditory simultaneous mechanisms used by hearing caregivers.

Strategies to Develop Eye Gaze

Deafness itself is not the problem that contributes to learning difficulties;^{8, 15} rather, it is the mismatch in caregivers/infants who use different attentional mechanisms to get and maintain eye-gaze. Hearing caregivers, who communicate successfully with infants, use techniques that Deaf caregivers tend to employ.¹⁶ When caregivers successfully redirect eye-gaze towards themselves and then use visually accessible communication,

they are teaching their child how to see, search and gain information.¹⁶ See **Table** for a summary of the techniques used intuitively by Deaf caregivers with deaf children.

The language used by the caregiver is not important at this early stage of development, from birth to between 10 and 11 months. Rather, it is the visual engagement that scaffolds visual attention and turn-taking,¹⁷ as well as having both linguistic and paralinguistic information (i.e., gestures, facial expressions, smiles, etc.) within a visual/tactile modality. This establishment of early attention creates the necessary skills for later joint attention, where caregivers and infants play and engage with objects in the environment. This later joint attention then allows for the transmission of linguistic and cultural knowledge¹⁸ because caregivers and infants have built a highly interactive visual/tactile sequential mechanism to get, maintain, and discuss experiences and objects in their environment - leading to high language skills and strong social emotional bonds.

Six ways to support and develop eye-gaze or visual attention with infants	
Caregiver Behaviors	Infant Behaviors
Waiting until the infant looks at caregiver, followed by immediate communication	Infant directs eye-gaze to caregiver
Pointing to an object	Infant directs eye-gaze to the object
Gesturing in the infant's visual direction and field of vision Waving arm or hand	Infant directs eye-gaze to caregiver
Physical Touch Stroking Tapping	Infant directs eye-gaze to caregiver
Vibrating the floor or on an object	Infant directs eye-gaze to caregiver
Vocalizing in the infant's general direction	Infant directs eye-gaze to caregiver
List synthesized from 12, 16, 8, 11, 10, 3, 13.	

Early Intervention is Key

Caregivers who are hearing and Deaf can successfully establish sequential visual attention, which will enhance language and communicative learning.¹⁹ Above all, families who establish visual-tactile signals support attentional shifts.¹⁷ If your infant is not showing signs of appropriate visual eye-gaze by 11 months of age,⁵ you should contact your pediatrician and other service providers. Early intervention is the key to academic and social success.²⁰

During the fall semester of 2014, Gallaudet University in Washington, DC offered a seminar titled "Age of Acquisition for Language." Professor Dr. M. Diane Clark, Department of Education, and her doctoral students, Amarilys Galloza-Carrero, Cara L. Keith, Julie S. Tibbitt, Ju-Lee A. Wolsey, and Heather G. Zimmerman, decided to develop a paper based on their course "ah-ha" moments. To represent themselves, they coined the name Team Attention. To contact the team, email diane.clark@gallaudet.edu.

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