

Supporting Information

Enhanced Gaze-Following Behavior in Deaf Infants of Deaf Parents

Brooks, Singleton, & Meltzoff

Developmental Science doi:10.1111/desc.12900

Gaze Following

The analysis of covariance (ANCOVA) reported in the main text revealed a main effect for group (Deaf infants having significantly higher scores than hearing infants) and age (increased gaze following with age). The raw scores for Deaf infants of Deaf parents (DoD) and hearing of hearing parents (HoH) are shown in Figure S1.

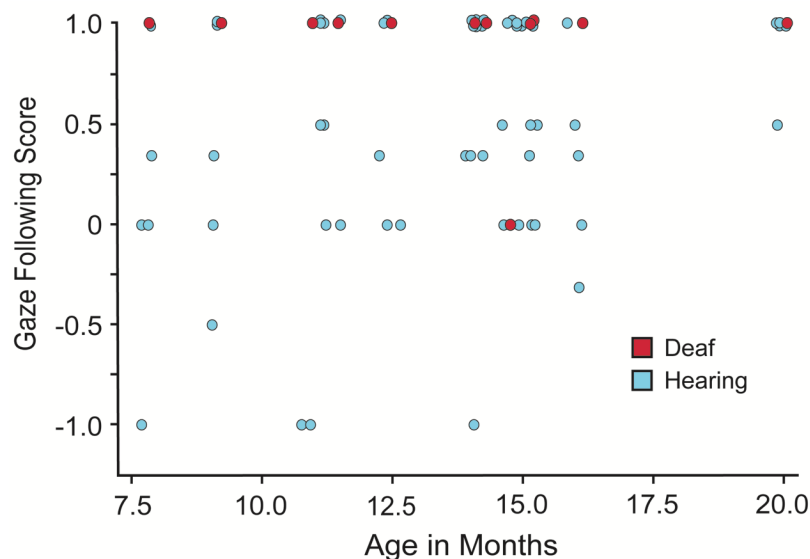


Figure S1. Each dot represents an infant. The plot shows the gaze-following scores of DoD infants (dark red) and HoH (light blue) infants as a function of infants' age.

Checking Back to the Adult

Rationale for analysis. In the literature with hearing infants, visually checking back to the adult is described as an advanced behavior (Desrochers, Morissette, & Ricard, 1995; Walden & Ogan, 1988). Infants are thought to deploy check backs to gain further information from adults (Baldwin & Moses, 1996), such as an adult's pragmatic cues or affective evaluations of the object (fear, happiness, surprise). In fluent adult signers, visually checking with an interlocuter is an integral part of communication (Emmorey, Thompson, & Colvin, 2009; Lieberman, Borovsky, & Mayberry, 2018). According to observational studies, DoD infants and children show substantial amounts of checking-back behavior (Lieberman, Hatrak, & Mayberry, 2014; Spencer, 2000). Against this background, we thought it informative to assess checking-back behavior in this sample. We note that checking back depends on an initial gaze-following event, and thus it is not a wholly independent assessment. With larger samples, it might be possible to statistically separate checking back from gaze following, but we could not do so in this study (12 DoD infants). Nonetheless, we wish to report the results, because the effects fit very well with the observational studies in the literature (see main text for a summary), and the results we obtained may serve as a useful guide for future work by researchers and clinicians.

Operational definition. Following the work with hearing infants (Desrochers et al., 1995; Walden & Ogan, 1988), checking back was defined as occurring when an infant looked back

from a target (first target per trial) to the experimenter’s face. For each trial, checking back was scored as correct for turning back from the correct target or incorrect for turning back from the incorrect target. The “checking-back score” was a proportion (number of trials of correct checking back minus the number of trials of incorrect checking back, divided by the total number of trials with any checking back, with zero assigned to infants without any check backs).

Results. A significant effect of group (DoD infants showing higher checking-back scores than HoH infants) was found using the same two statistical approaches from the main text: (a) *t*-tests with the Satterthwaite method for unequal variances and bootstrapping for 95% CI and (b) a linear mixed model for four test trials.

First, the checking-back score was tested for a group difference between the Deaf and hearing infants (Figure S2a) using a *t*-test. Deaf infants ($M = 0.75$, $SD = 0.45$) had significantly higher checking-back scores than hearing infants ($M = 0.41$, $SD = 0.67$). The effect of group was significant, $t(21.9) = 2.20$, $p = 0.038$, $d = 0.54$, M difference = 0.34, 95% CI [+0.03, +0.62]. In line with previous literature, which describes checking back as a developmentally advanced behavior (Desrochers et al., 1995; Walden & Ogan, 1988), the “younger” infants (see main text for definitions of age groups) in both the Deaf and hearing groups had generally low checking-back scores. The groups of younger infants did not significantly differ from each other, $p = 0.33$, M difference = 0.27, 95% CI [−0.17, +0.77], although the Deaf infants had somewhat higher scores than the hearing infants, Figure S2b (left two bars). In contrast, among the “older” infants there were highly significant effects. Deaf infants had higher checking-back scores than hearing infants, $t(29) = 4.13$, $p = 0.0003$, $d = 0.82$, M difference = 0.42, 95% CI [+0.26, +0.64] (Figure S2b, right two bars).

Second, the linear mixed model tested the fixed effect of group (Deaf vs. hearing) with age as a covariate. The model nested trials within infant (four trials per infant, with each trial categorized as correct checking back [+1], no checking back [0], and incorrect checking back [−1]). This analysis yielded a significant effect for age: $b = 0.05$ ($SE = 0.01$), $F(1, 104) = 22.25$, $p = 0.000007$ and for group: $b = 0.18$ ($SE = 0.16$), $F(1, 100) = 4.40$, $p = 0.038$, with higher scores for Deaf infants ($M = 0.40$, $SD = 0.49$) than hearing infants ($M = 0.22$, $SD = 0.53$). In sum, both this and the *t*-test approach revealed that the effect of group (Deaf vs. hearing) was significant.

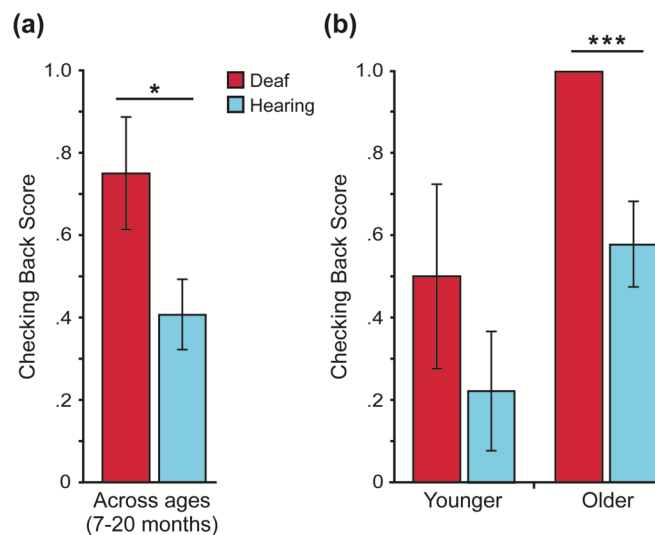


Figure S2. Mean checking-back scores for Deaf (dark red) and hearing (light blue) infants, displayed (a) across age and (b) split at median age (14.12 mo. of age). Error bars ± 1 SE.

* $p < 0.05$. *** $p < 0.0005$.

References

- Baldwin, D. A., & Moses, L. J. (1996). The ontogeny of social information gathering. *Child Development, 67*, 1915-1939. <https://doi.org/10.1111/j.1467-8624.1996.tb01835.x>
- Desrochers, S., Morissette, P., & Ricard, M. (1995). Two perspectives on pointing in infancy. In C. Moore & P. J. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 85-101). Hillsdale, NJ: Erlbaum.
- Emmorey, K., Thompson, R., & Colvin, R. (2009). Eye gaze during comprehension of American Sign Language by native and beginning signers. *Journal of Deaf Studies and Deaf Education, 14*, 237-243. <https://doi.org/10.1093/deafed/enn037>
- Lieberman, A. M., Borovsky, A., & Mayberry, R. I. (2018). Prediction in a visual language: Real-time sentence processing in American Sign Language across development. *Language, Cognition and Neuroscience, 33*, 387-401. <https://doi.org/10.1080/23273798.2017.1411961>
- Lieberman, A. M., Hatrak, M., & Mayberry, R. I. (2014). Learning to look for language: Development of joint attention in young deaf children. *Language Learning and Development, 10*, 19-35. <https://doi.org/10.1080/15475441.2012.760381>
- Spencer, P. E. (2000). Looking without listening: Is audition a prerequisite for normal development of visual attention during infancy? *Journal of Deaf Studies and Deaf Education, 5*, 291-302. <https://doi.org/10.1093/deafed/5.4.291>
- Walden, T. A., & Ogan, T. A. (1988). The development of social referencing. *Child Development, 59*, 1230-1240. <https://doi.org/10.2307/1130486>