Toy preferences of toddlers who are D/deaf or hard of hearing and toddlers with typical hearing in a free play setting.

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INTRODUCTION

PLAYFUL LEARNING & SYNCHRONY

- Children benefit from playful learning[1,2].
- Curiosity, interest, and intrinsic motivation are driving forces of that play and learning[3,4,5,6,7].
- Toys that vary in properties affect the type, complexity, and diversity of play[8].
- A child's sustained attention on an object during an interaction provides an opportunity for an adult to name the object and the child to learn the word[9]. In this context, we see an intersection of the roles of learning, play, interest, and the toy.

HEARING STATUS AND EFFECT ON PLAY

- Hearing experience and associated language development have been observed as factors that determine how a child plays with their parents[10] and their peers[11].
- Research on children who are D/deaf or hard of hearing (DHH) before and after receiving a cochlear implant (CI) shows that objects were explored as often as their hearing peers but in different ways (e.g., mouthing vs. noisemaking)[12].

APPLICATIONS FOR EARLY INTERVENTIONISTS

- Some toddlers who are DHH and use cochlear implants and/or hearing aids (HAs) show expressive and receptive spoken language delays compared to their typically hearing peers[13].
- Learning more about the association of hearing experience, language development, and interest in different toys can help inform the work of early interventionists in the homes of children who are DHH[14].

METHODS

HEAD-MOUNTED EYE TRACKERS

- Parent and child were asked to wear head-mounted eye trackers while being recorded from various angles

FRAME-BY-FRAME CODING

- All videos were synched and coded frame-by-frame (30fps) for child eye gaze, parent eye gaze, child hand touching (left and right), and parent hand touching (left and right).

PLAY SESSION

- Parent was instructed to play with child as they normally would at home for 10 minutes with 10 toys (Figure 1).

COLLECTED MEASURES

- Duration of look per look per toy
- Number of looks per toy per subject
- Novelty of toy name by parent report

	NH (N=7)	DHH (N=9)	Total (N=16)
female	3	3	6
male	4	6	10
age (months) < 27	1	0	1
27 ≤ age < 30	3	5	8
30 ≤ age < 33	2	3	5
age ≤ 33	1	1	2
bilateral cochlear implants		5	5
bilateral hearing aids		4	4

Table 1: Description of the make-up of the normal hearing (NH) and D/deaf or hard of hearing (DHH) groups.

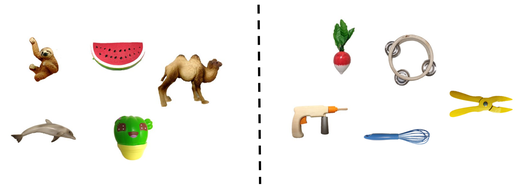


Figure 1: The 10 toys used were divided into "simple play" toys (left) and "complex play" toys (right) based on the ratio of play behavior derived from a behavioral coding scheme in which complex play was the use of any of the objects symbolically or functionally[15].

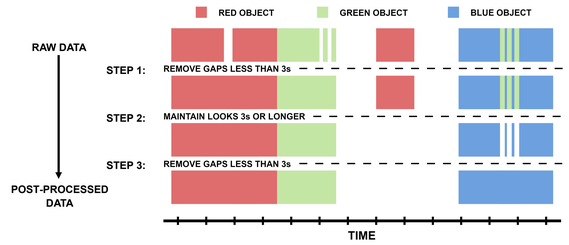
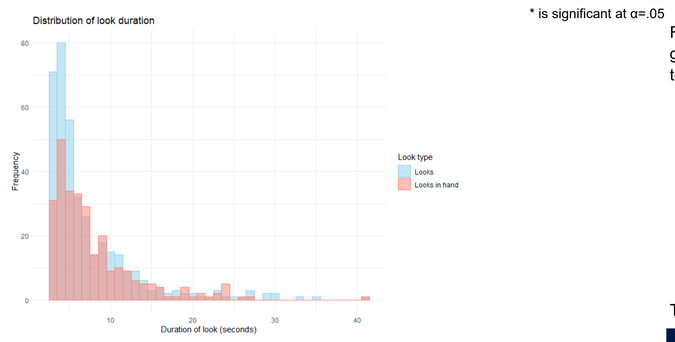


Figure 2: An illustration of the raw data processing from frame-by-frame coding into the final data set. A block on the timeline represents an instance where many subsequent frames were coded as the an object in the room.

RESULTS



* is significant at α=.05

Figure 3: The distribution of duration of looks and looks in hand from both groups pooled together.

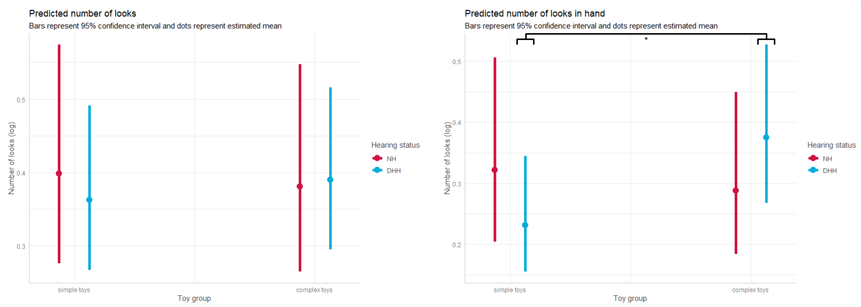


Figure 4: The estimated mean counts of looks and looks in hand (log transformed) adjusted for gender, age, & toy novelty show that children in the DHH group would look at toys in the complex toys group more than toys in the simple toys group.

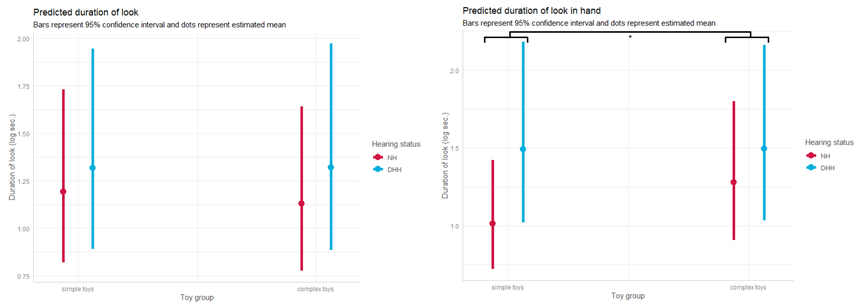


Figure 5: The estimated mean duration of looks and looks in hand (log transformed) adjusted for gender, age, & toy novelty show no significant group difference in duration of looks and looks in hand. The estimated mean duration of looks in hand was significantly higher for toys that were sorted into the complex toy group.

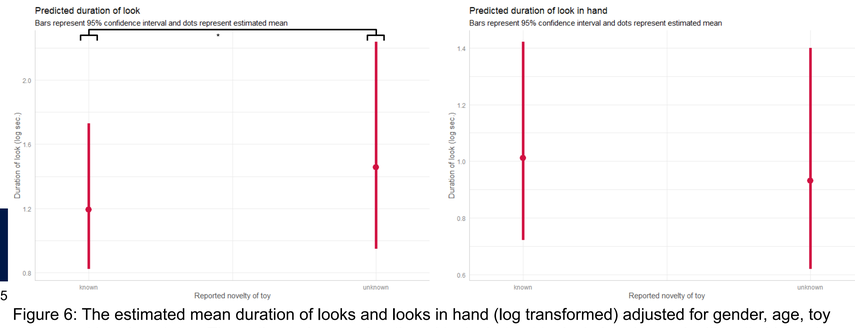


Figure 6: The estimated mean duration of looks and looks in hand (log transformed) adjusted for gender, age, toy group, and hearing status. The estimated mean duration of looks but not looks in hand was significantly higher for toys reported as unknown.

variable	group	cactus	camel	dolphin	drill	melon	pliers	radish	sloth	tambourine	whisk
number of looks											
	NH	0.48	0.3	0.45	0.36	0.36	0.42	0.26	0.3	0.38	0.4
	DHH	0.52	0.42	0.22	0.41	0.41	0.41	0.37	0.19	0.33	0.39
duration of looks											
	NH	1.33	0.9	0.96	1.41	1.28	1.06	1.37	1.45	1.02	0.99
	DHH	1.61	1.31	1.44	1.5	1.17	1.68	1.41	1.38	1.32	1.19
number of looks in hand											
	NH	0.29	0.21	0.38	0.36	0.36	0.32	0.15	0.23	0.17	0.34
	DHH	0.42	0.18	0.12	0.4	0.3	0.46	0.36	0.08	0.18	0.42
duration of looks in hand											
	NH	1.2	1.03	0.79	1.37	1.06	1.26	1.56	1.07	1.12	1.23
	DHH	1.66	1.6	1.69	1.66	1.34	1.5	1.14	1.22	1.64	1.71

* Significant at level of toy type

* Significant at level of hearing status *and* toy type

Table 2: Estimated means on a toy-by-toy level separated into counts and duration of looks and looks in hand.

DISCUSSION & FUTURE DIRECTIONS

INTRICATE NATURE OF PARENT-CHILD INTERACTIONS

- The role of the parent in the interaction is an area for further study since differences in parenting styles with and without hearing differences could play a role. For example, the results illustrated in Figure 6 could imply that parents play will the less familiar toys more often.
- The small sample size and low R^2 values of many of the linear mixed-models imply that the collected data do not account for all of the variability in number and duration of looks and looks in hand.

DIFFERENT MEASURES OF INTEREST AND STATES

- Future directions include incorporating parent behaviors into the model or perhaps modeling "interest" in a toy differently. Modeling states of the child's interest could help distinguish interest in a toy rather than attentiveness to it.

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