



Angular orientation during social contact: Relative orientation among auditory disorders and sexes in the classroom

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Introduction

- Social contact in children can be investigated using continuous measurement of location.
- Angular orientation within the radius of proximity-based social contact defined by a radial distribution function improves the definition of social contact.
- Child-child angular contact can be used to investigate differences in social contact of children with auditory disorders.
- Observing angular contact can also reveal contact preferences within and between the sexes.
- Spatial observations were collected from children in an auditory disorder inclusive preschool classroom.

Data Collection

- 11 times in the 2017-18 school year students (3.95 years old on average) and teachers in the Ladybugs classroom at the University of Miami wear vests with two Ubisense location tags that are tracked by four sensors in the classroom.
- The tags collect location and orientation data of the students and teacher in the classroom where a portion of the students have auditory conditions.
- This analysis considers the children's free play time: the 30 to 90 minutes of the day in which the influence of teachers, seating arrangements, and similar factors is minimized.



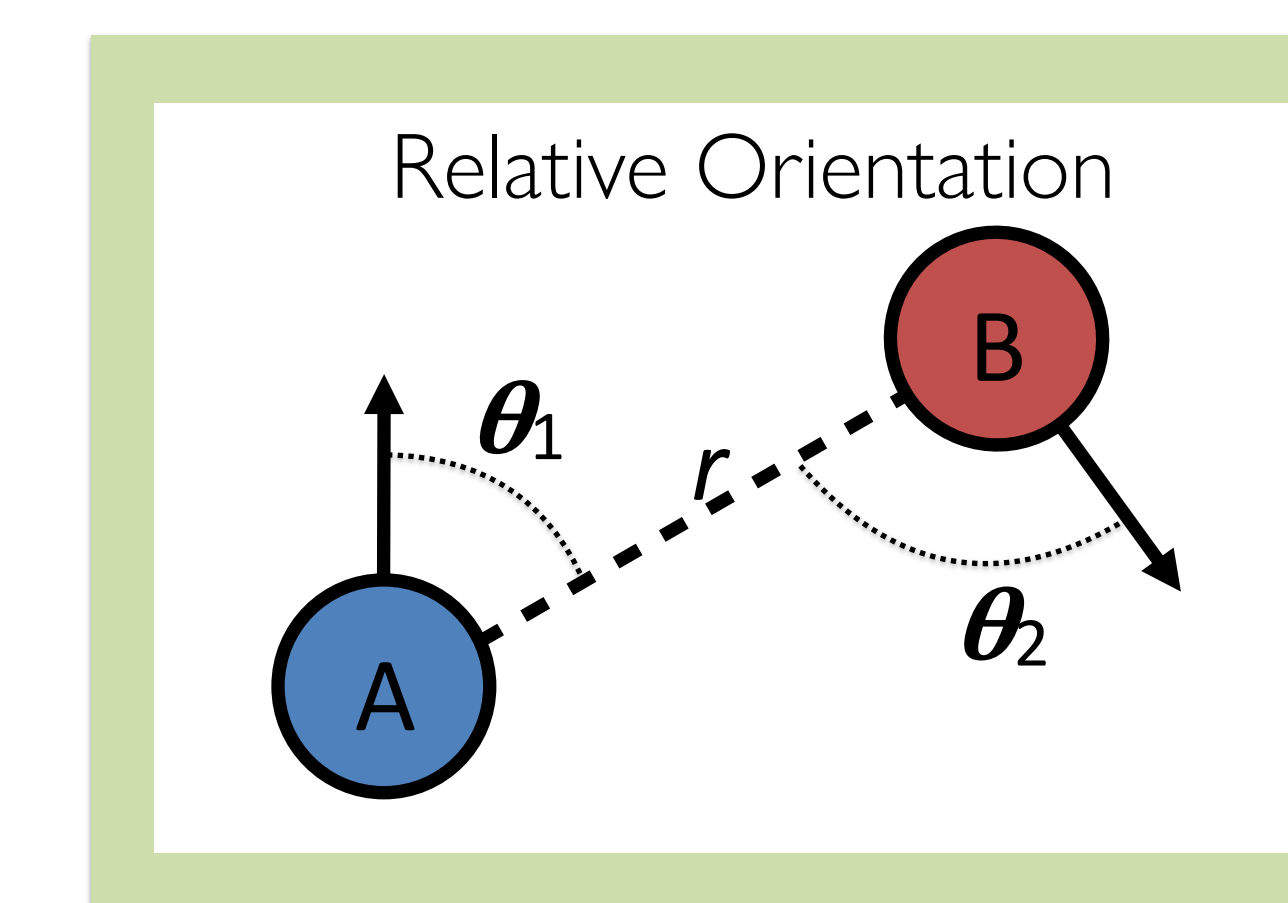
Classroom Breakdown

	Male	Female
Deaf or Hard of Hearing	3	4
Typical Hearing	2	1

From left to right: vest worn by children during data collection, Ubisense locational tag, Ubisense sensor.

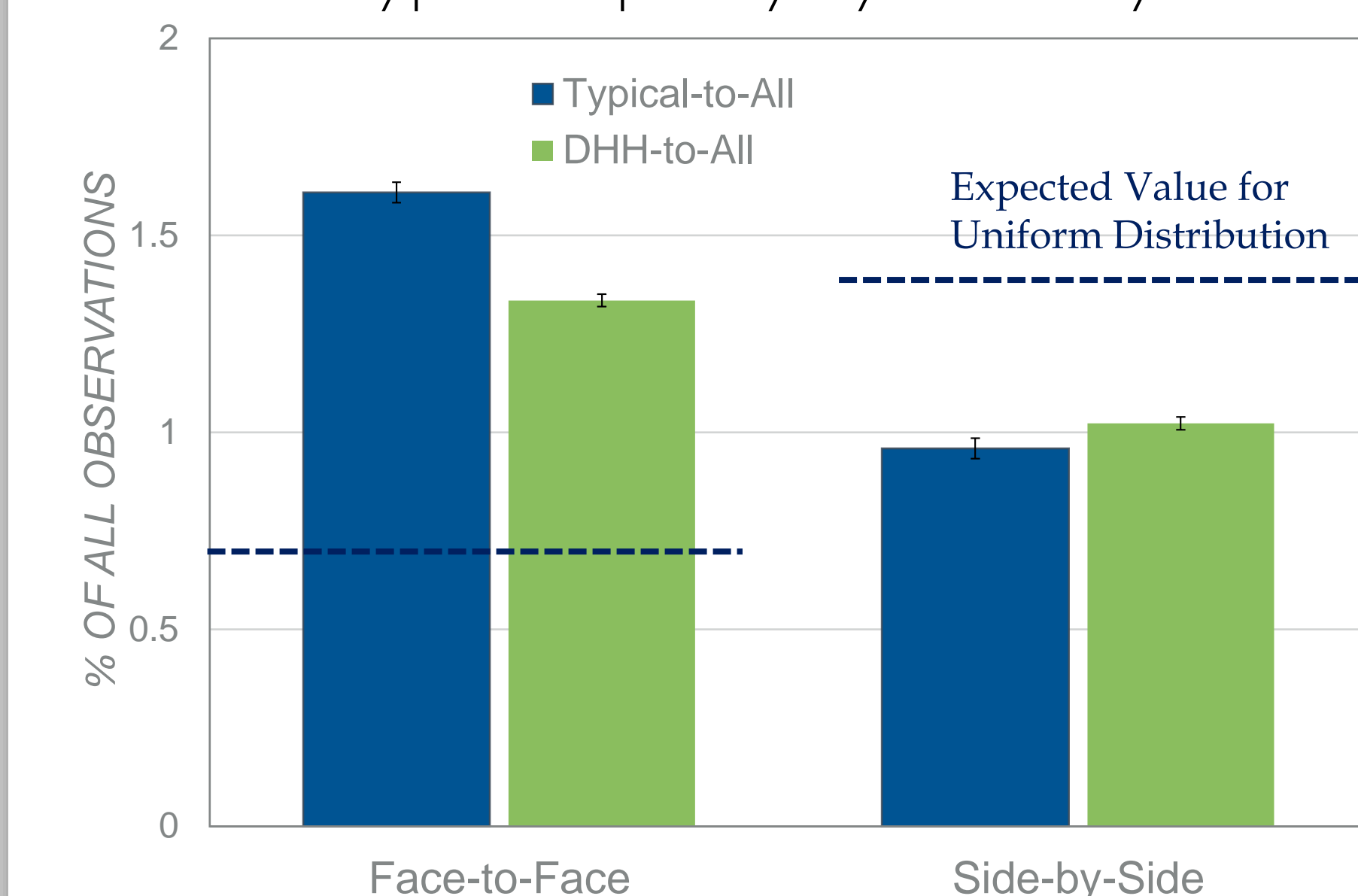
Measuring Orientation

- **Relative orientation:** angle between the heading of a child and another child within social contact (0.3m-1.5m).
- Utilizing two tags per child allowed heading to be determined. For each child, heading and location were found from the left and right tags.
- Ubisense tag data was extrapolated to every 0.1s time step t . Gaps in individual tag data longer than 60s were recorded as missing.
- At each time t , the relative orientations for each child-child pair are found.
- θ_1 is the angular position of person B relative to child A.
- θ_2 is the angular position of person A relative to child B.

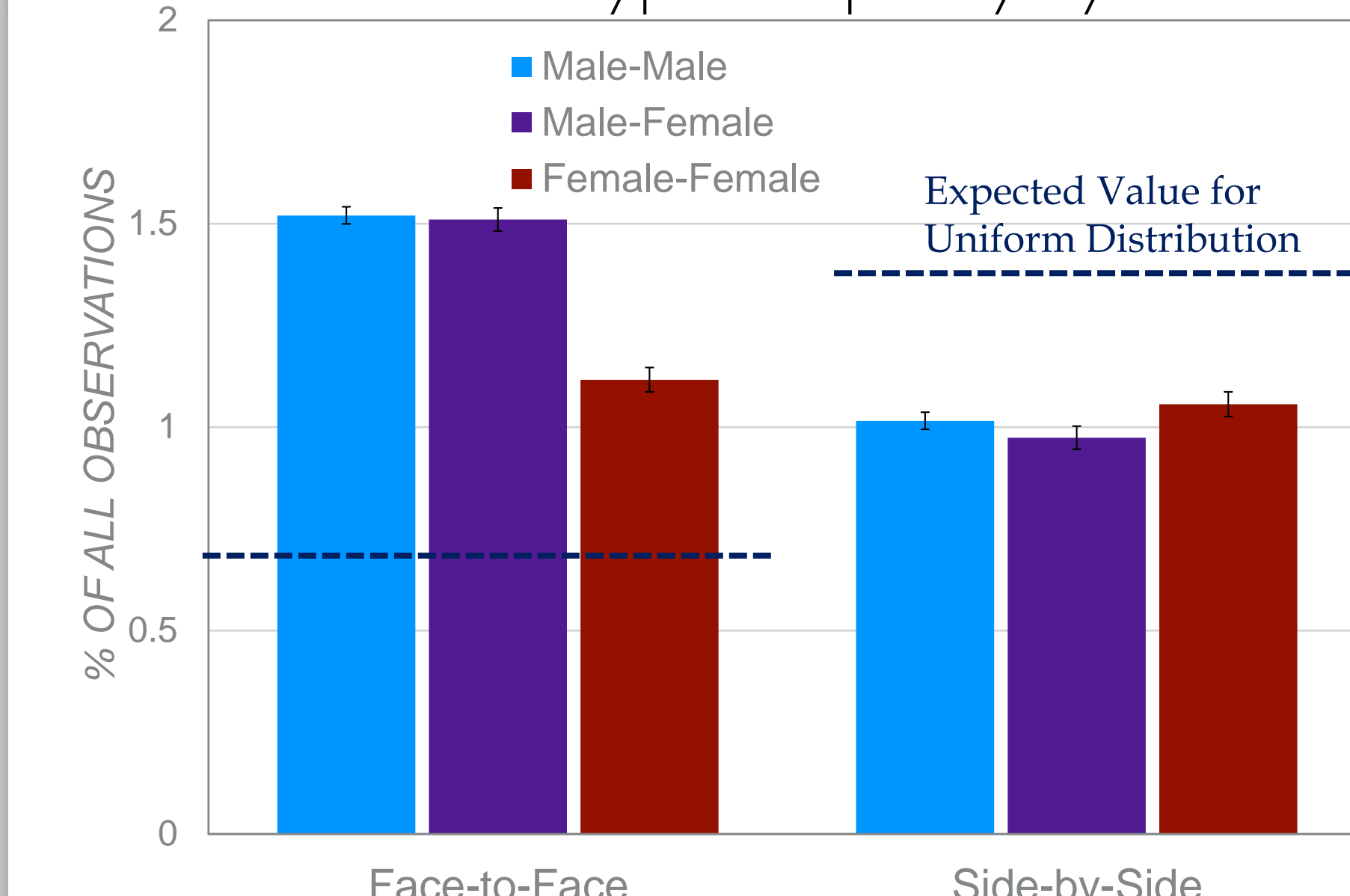


Results

Contact Type Frequency by Auditory Condition



Contact Type Frequency by Sex

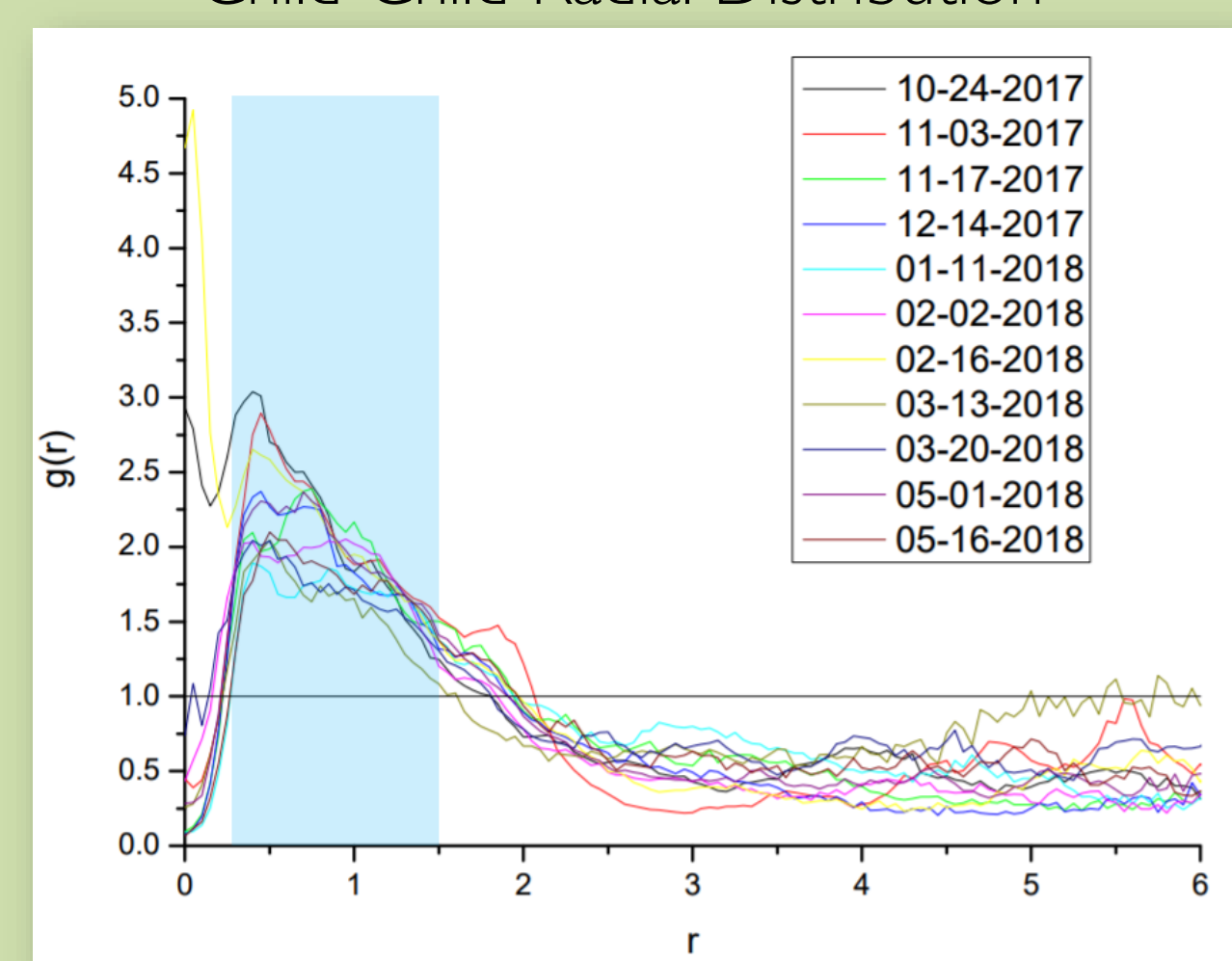


- Face to face: both θ_1, θ_2 within 15° of 0°
- Side by side: both θ_1, θ_2 within 15° of $|90|^\circ$ (one positive, one negative)

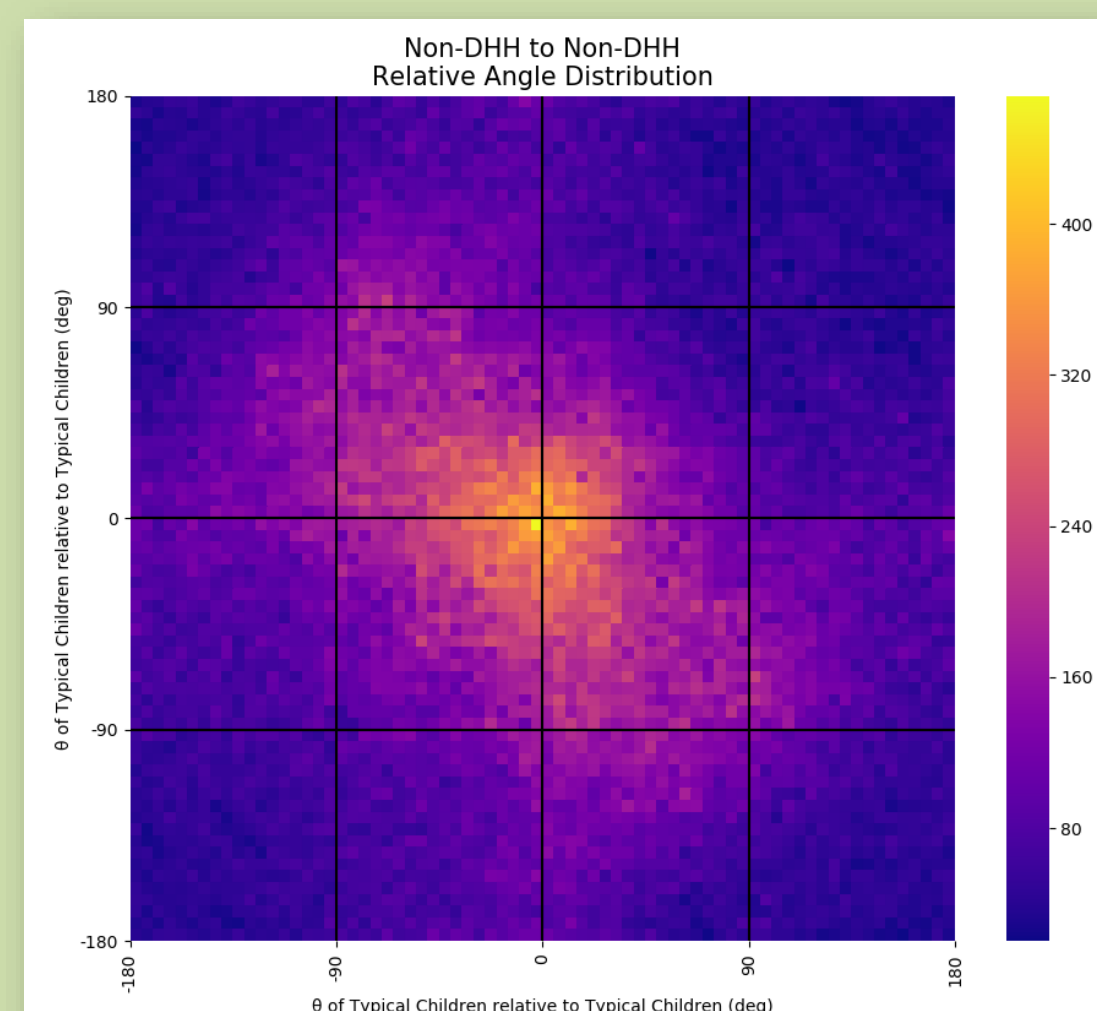
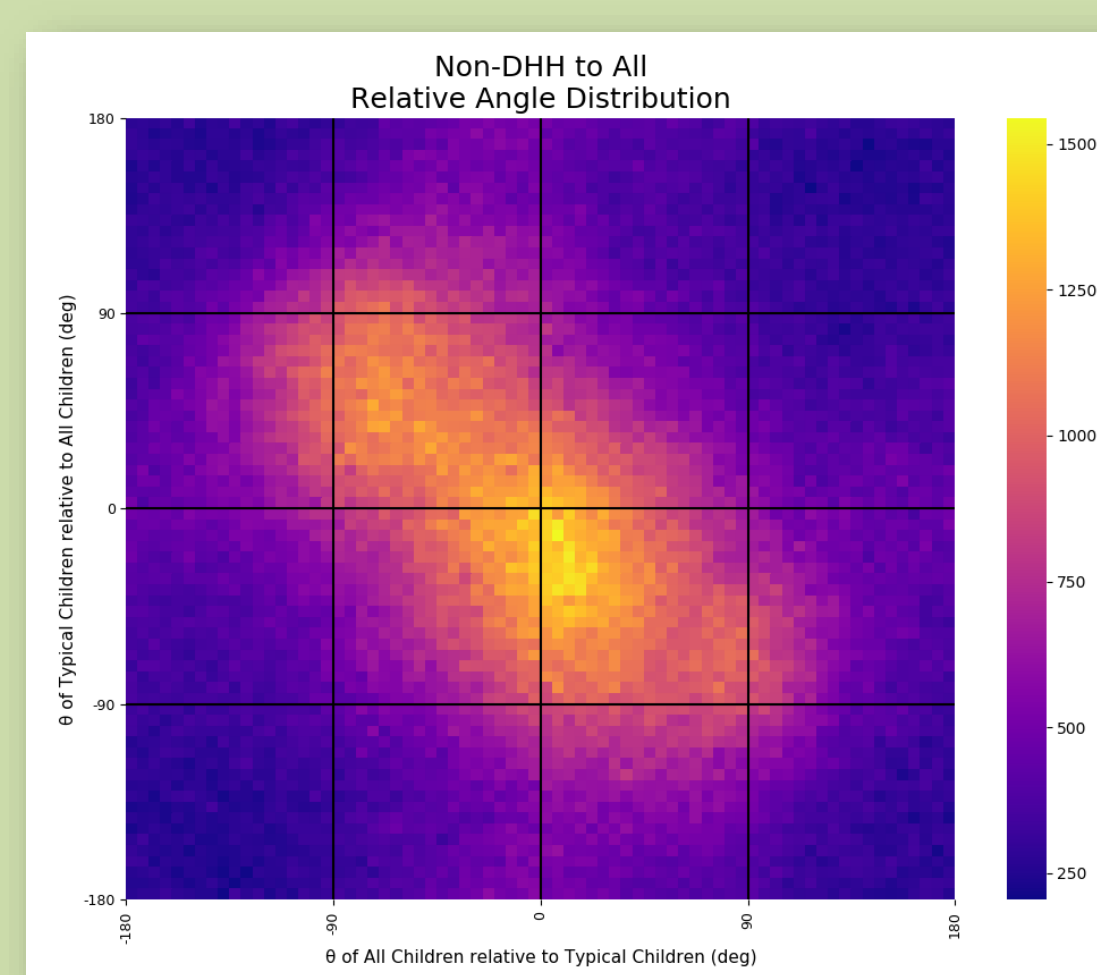
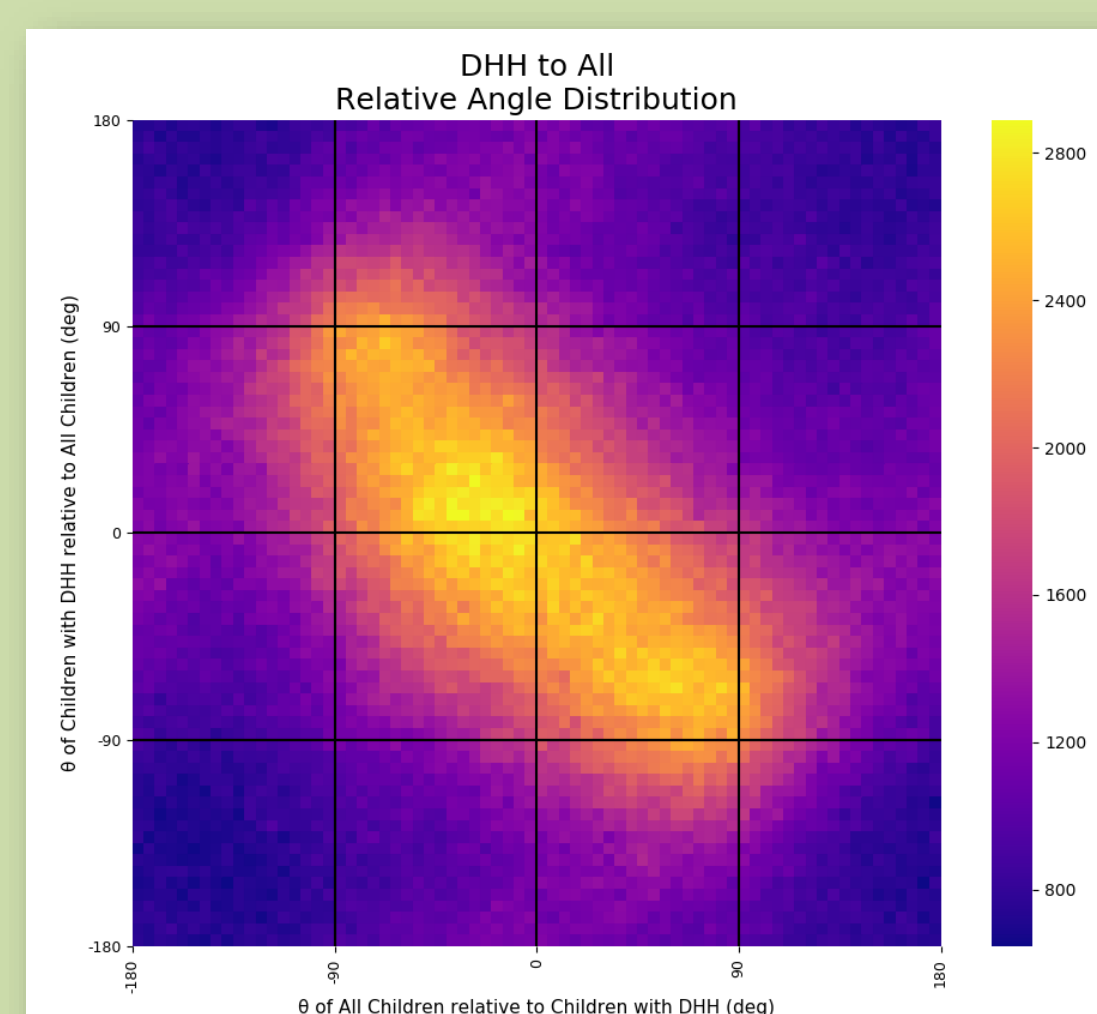
Determining Social Contact

- Observations were restricted to a radius of 0.2m-2.0m between children, the range of social contact as defined by a radial distribution function, $g(r)$.
- $g(r) = P_{AB}(r) / P_{AB, NULL}(r)$, where $P_{AB}(r)$ is the total time child A and B were separated by r and $P_{AB, NULL}(r)$ is the product of child A and B's location probabilities for radius r .
- Values of $g(r)$ indicate the prevalence of contact at each distance normalized by the expected prevalence found using temporally randomized positions.
- Where $g(r) > 1$, children are more likely to be found at r than expected.
- Observations were restricted to this region, defined as the region of proximity-based social contact.

Child-Child Radial Distribution

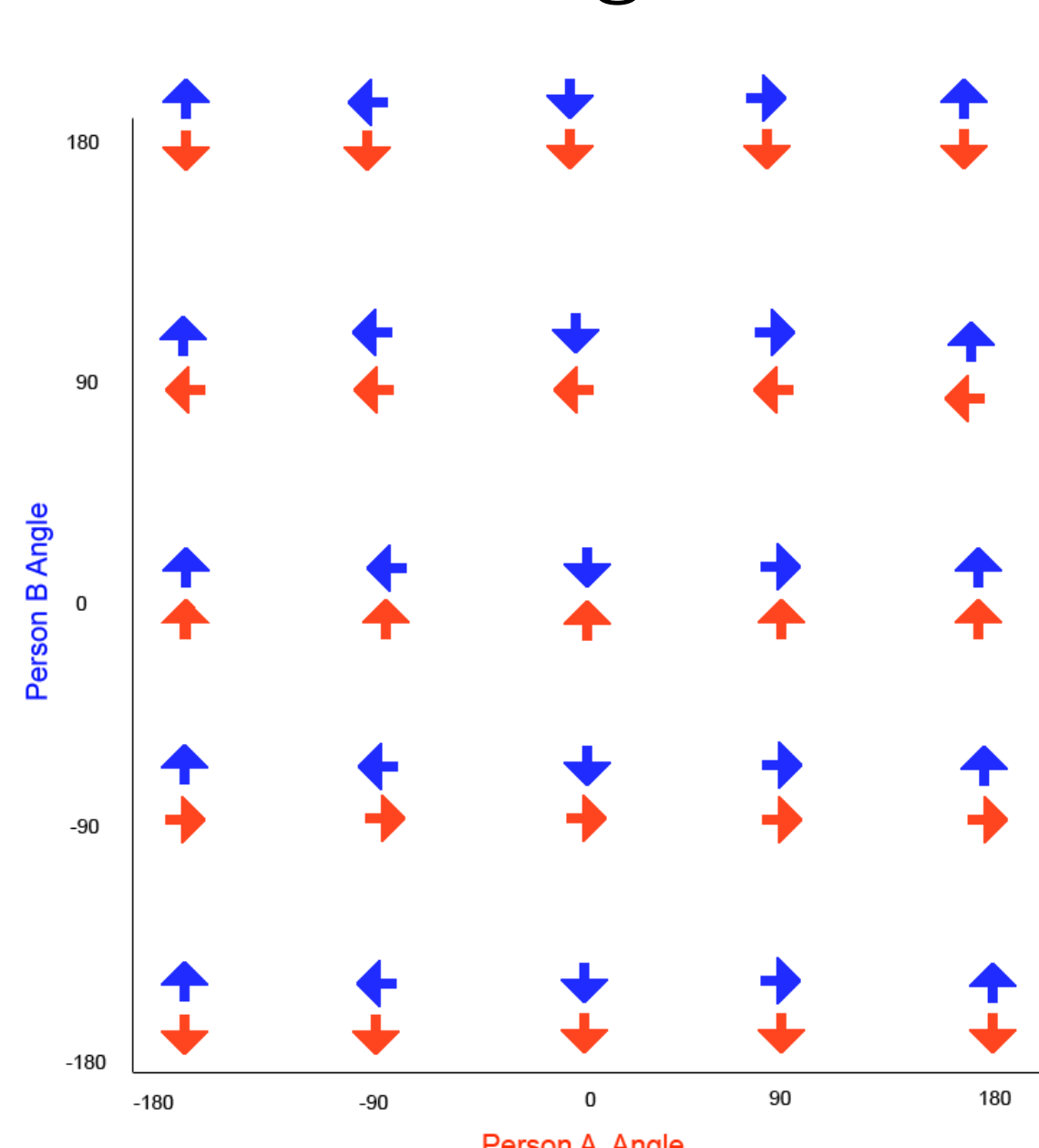


Typically Hearing vs. Deaf/Hard of Hearing



Relative Orientation During Free Play

Figure Interpretation

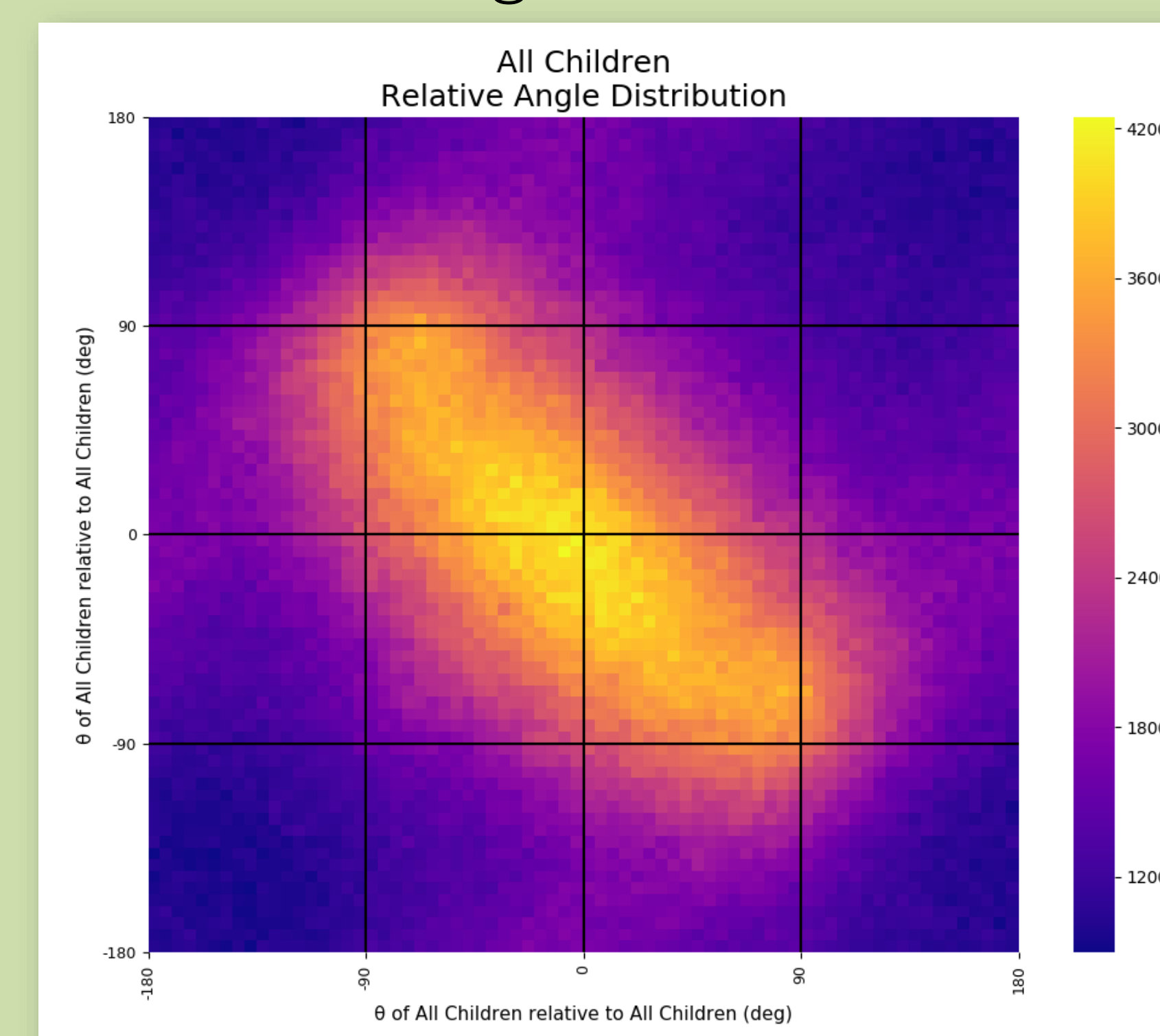


Orientations of interest:

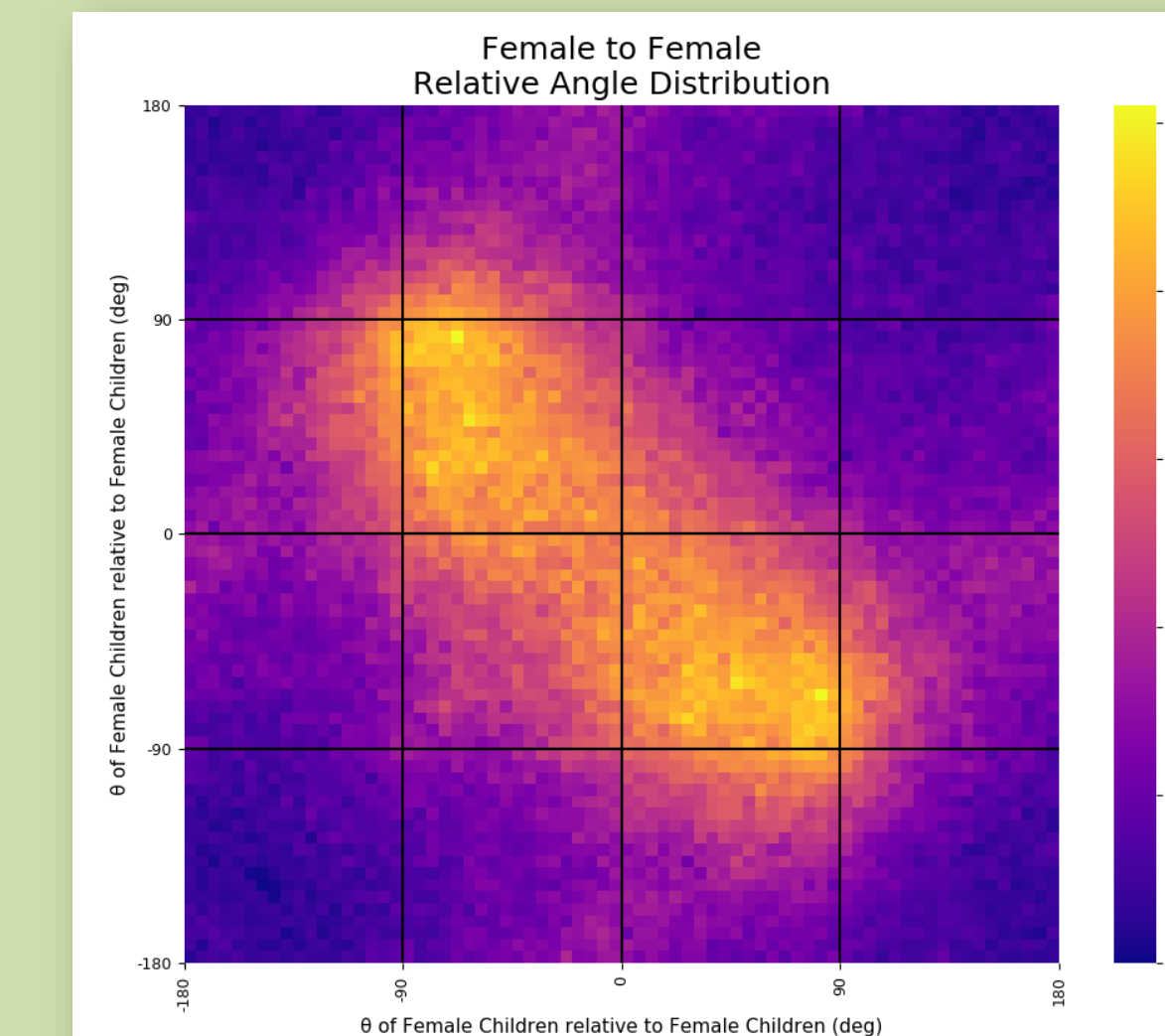
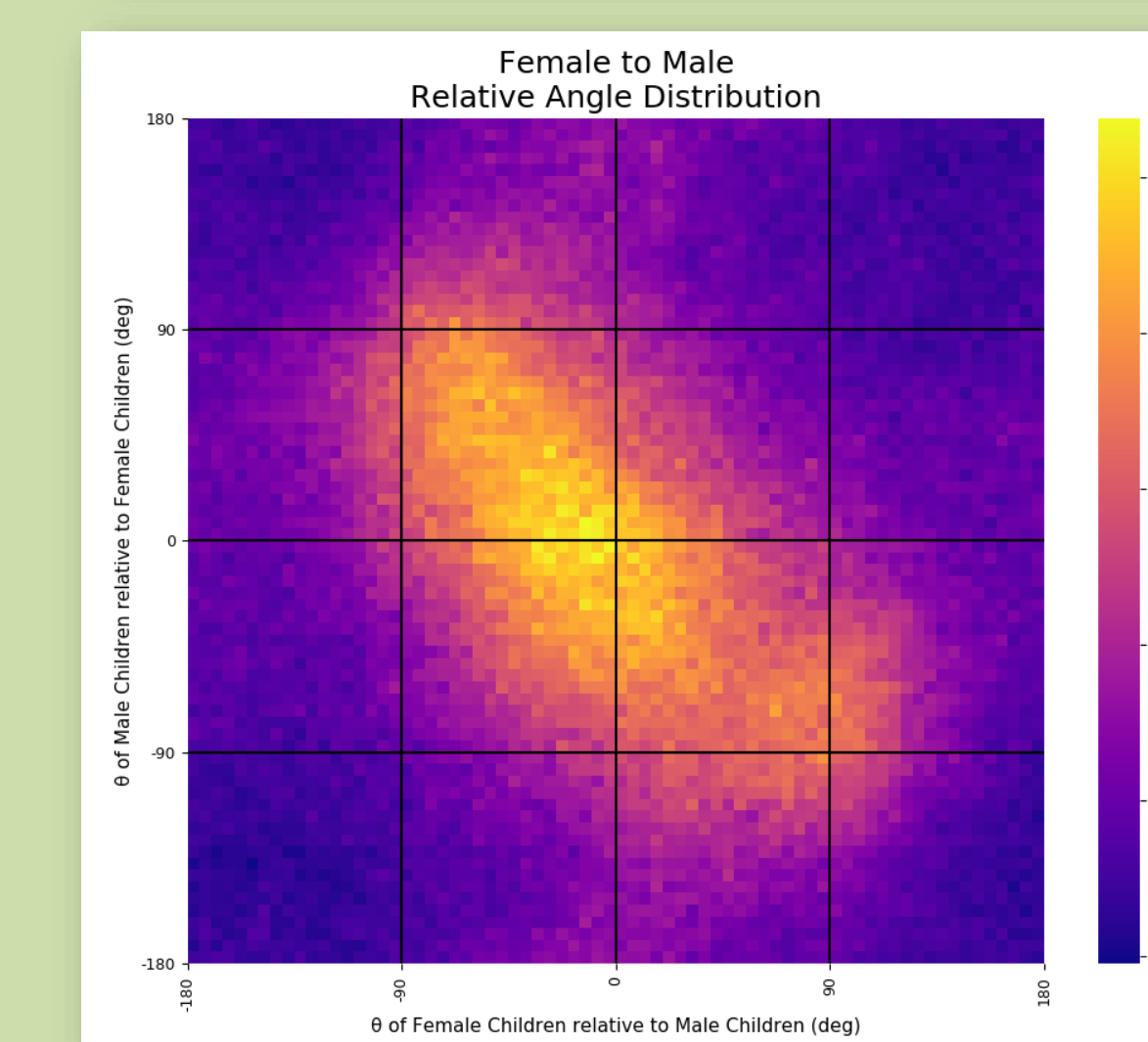
- $(0^\circ, 0^\circ)$: face to face
- $(+90^\circ, -90^\circ)$: side by side

Note: DHH stands for Deaf or Hard of Hearing

Among All Children



Male vs. Female



Conclusions

- Face-to-face orientations are significantly more common across all groups than expected from a uniform distribution, while side-by-side orientations were less frequent than expected.
- **Typically Hearing vs. Deaf/Hard of Hearing:** Typical-to-All exhibit greater face-to-face orientation than DHH-to-All.
- **Male vs. Female:** Male-to-male and female-to-male orientations are more commonly face-to-face than female-to-female orientations.
- Common features in relative orientation suggest including orientation in the definition of social contact, with an application to social network creation.

Acknowledgements

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