Do you see what I see? Comparing optic flow experienced by infants and their mothers

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Rick O. Gilmore[3] rogilmore@psu.edu **Florian Raudies**[1] fraudies@bu.edu **Kari S. Kretch**[2] kari.kretch@nyu.edu
John M. Franchak[2] franchak@nyu.edu **Karen E. Adolph**[2] karen.adolph@nyu.edu

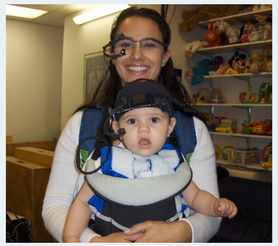
[1]Center for Computational Neuroscience and Neural Technology, Boston University
[2]Department of Psychology, NYU
[3]Department of Psychology, The Social, Life, & Engineering Sciences Imaging Center, PennState

Development of Patterns of Gaze and Heading

Gaze patterns differ by task, but how do task-relevant gaze patterns develop?
What are the differences in experienced flow between infants and adults?
Hayhoe, *Visual Cognition* 7, 2000
We compared patterns of eye and head motion produced while mothers carried their infants down an indoor hallway.

Eye-Tracking and Video Recording

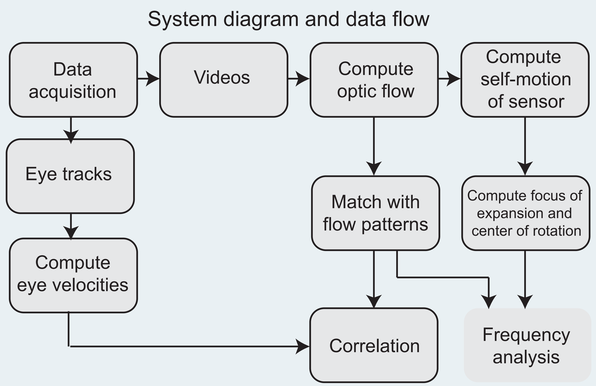
Parent/infant dyads (N=6) walk down an indoor hallway.
Parent and infant wore a head-mounted eye tracker and scene camera with a resolution of 800 x 600 pixels (54° x 42°) at 30fps.



More information on methods
www.positivescience.com
Franchak et al., *Child Development* 82, 2011

Data Processing

Optic flow and self-motion was computed from the video stream. Synchronized recordings of eye positions were transformed into rotational eye-velocities using a pinhole camera model.



Acknowledgments

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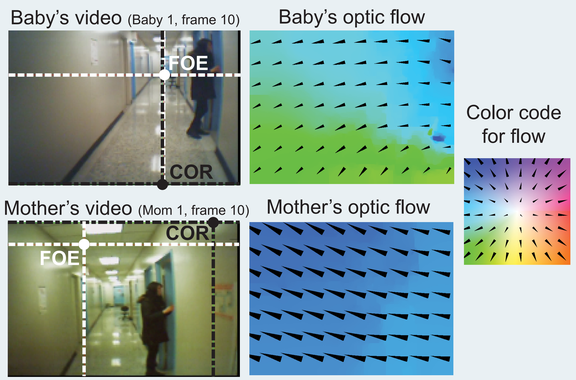
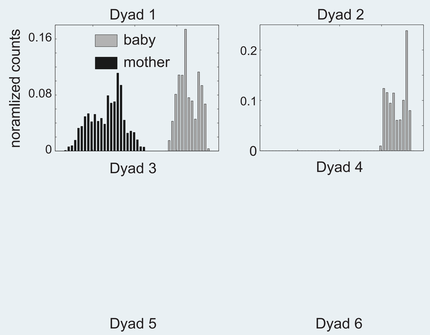
Estimating Optic Flow from Videos

Optic flow is estimated from videos using an algorithm that assumes gray-value-constancy between frames and smoothness for the detected flow.
Brox et al., In Proceedings of *ECCV LNCS 3024*, 2004



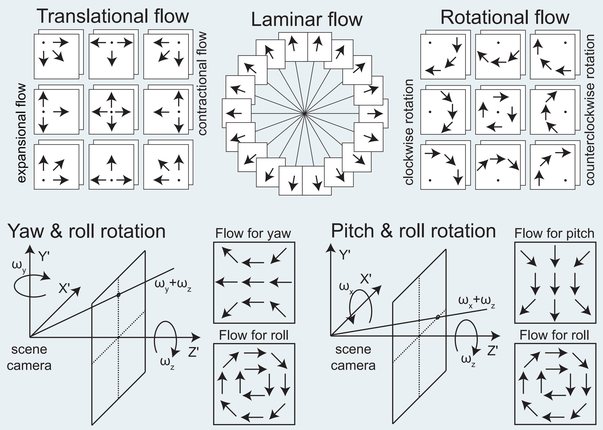
Results: Do infants and mothers experience similar speeds of flow?

Hou et al., *Vision Research*, *49*(20), 2009
Kiorpes & Movshon, *Visual Neuroscience*, *21*, 2004

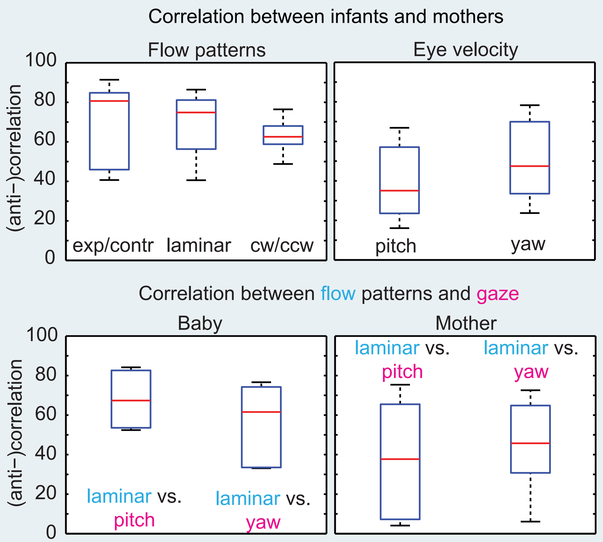


Matching Optic Flow against Flow Patterns

We match the detected optic flow against a set of flow patterns.

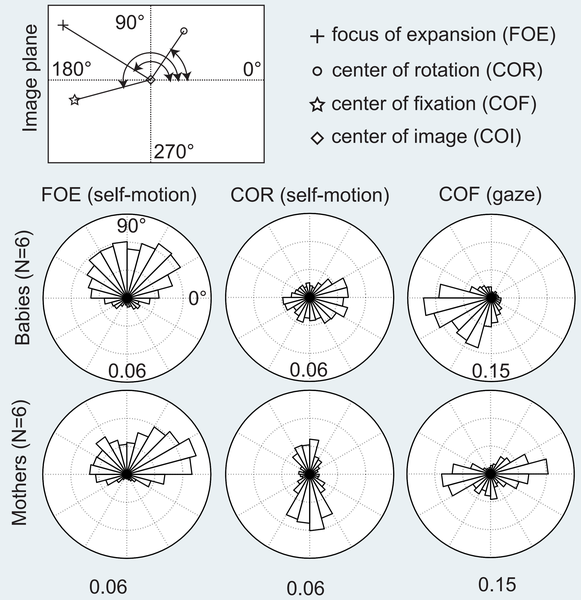


Results: Do flow patterns correlate -- between mothers and infants or with gaze?



Results: Focus of Expansion and Gaze Statistics

We evaluated the angular statistics of the focus of expansion and gaze location in the image plane referencing the image center.



Results: Summary

In infants, the FOE pointed upward, consistent with a downward pointing head.
Mothers' FOEs pointed to the left and right.
Babies CORs were elongated along the horizontal axis; that of mothers was elongated along the vertical axis.
Mothers shifted gaze left/right more often than up/down.
Correlations between flow of the scene videos from babies and their mothers were higher (~70%) than those for the eye-velocities and laminar flow (~55%), and were higher than those for eye-velocities of mothers and their babies (~40%).

Conclusions

Mothers explore the scene along the horizontal axis more so than infants.
Passively carried infants experience pitch rotation and generally direct their head toward the ground.