

# How to think about an setting an agenda for research on children's digital media use

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A case example: The development of sustained attention and a bit on noun learning

*An argument for dense real-time studies  
of infants and children's use of digital media*

# Psychology of digital media use

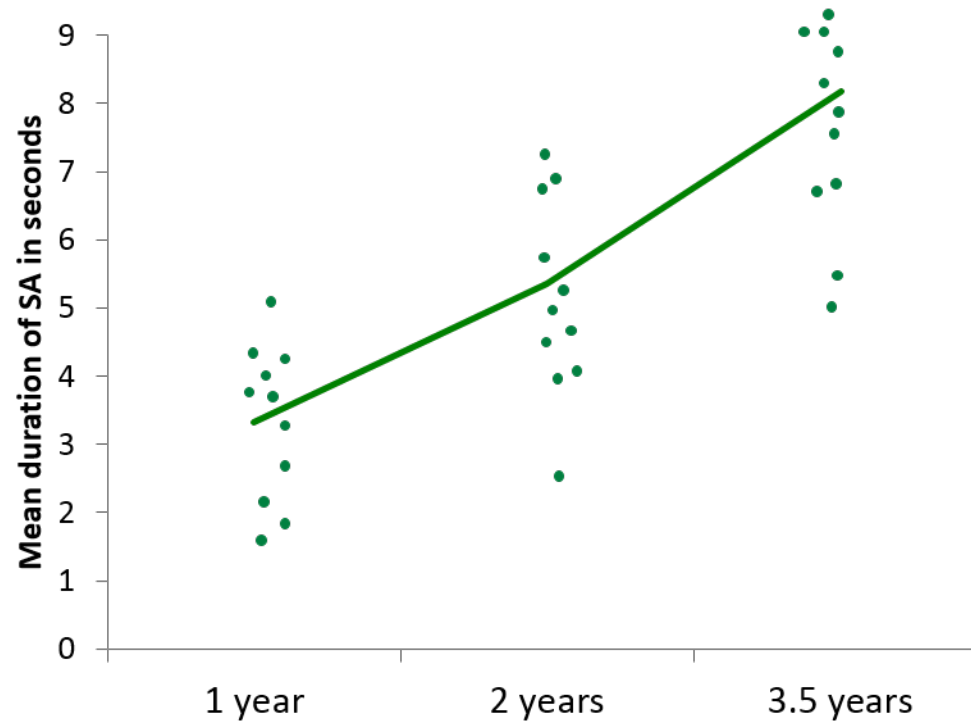
- Former Google employee Tristan Harris: “drawing on behavioral psychology research, many technology platforms actively condition user behavior, designing (and refining) products to be intentionally habit-forming.”
- Former Facebook President Sean Parker: “exploiting a vulnerability in human psychology”
- Former Facebook executive, Chamath Palihapitiya: “short-term, dopamine-driven feedback loops we’ve created are destroying how society works”
- Survey by American Speech Language Hearing Association: 87% of respondents said children spend too much time with technology

# The ability to concentrate on a single object or task

- Ruff and colleagues (Ruff, 1986; Ruff & Lawson, 1990; Ruff, Capozzoli & Weissberg, 1998; Ruff & Capozzoli, 2003)
- Sustained attention:
  - Enduring visual attention
  - Manual engagement
  - Still head

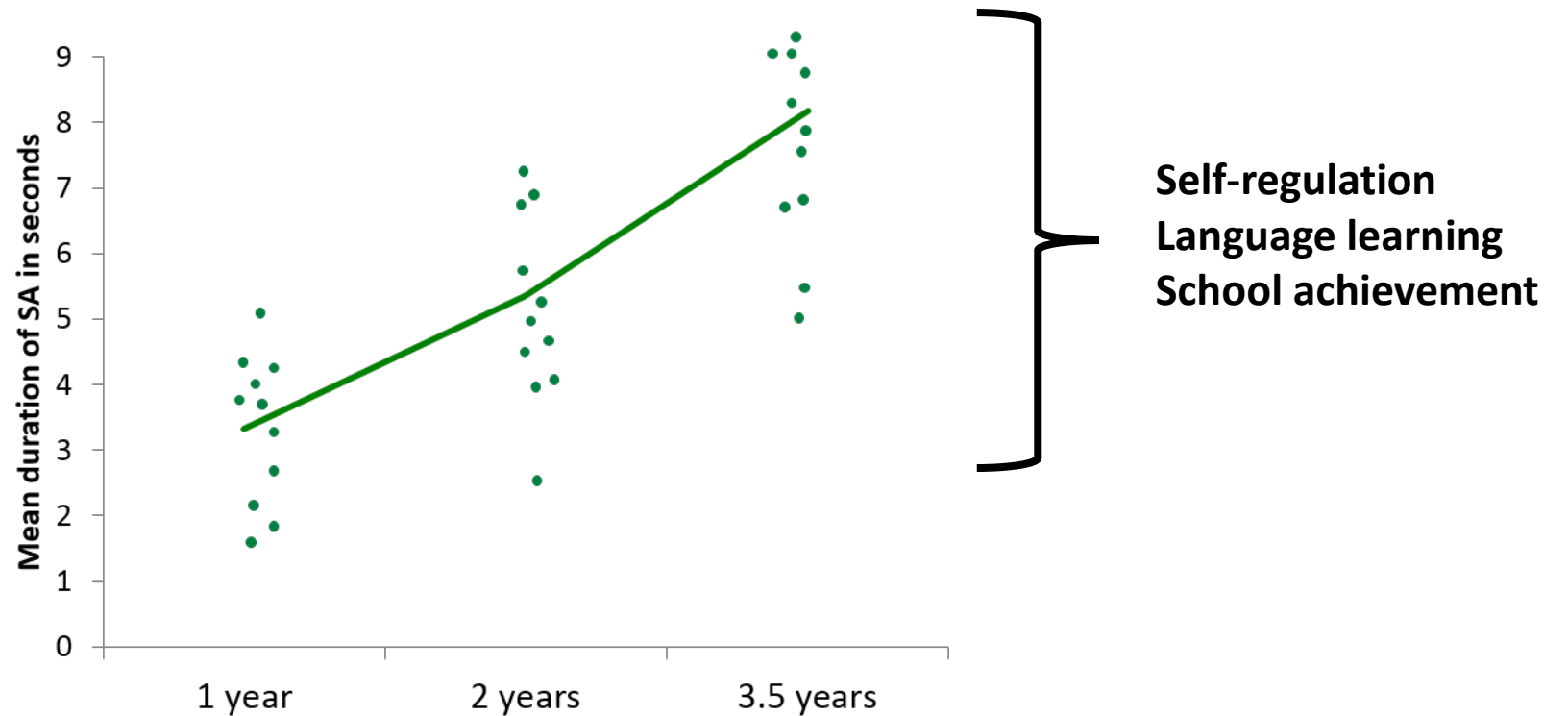


# Incremental growth and individual differences in sustained attention during toy play from 1 to 3.5 years of age



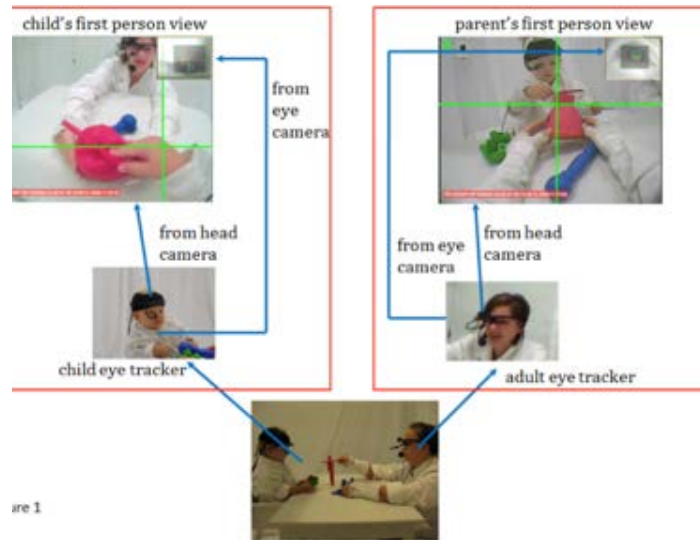
*Conceptual illustration:* Derived from Ruff & Lawson, 1990; Lawson & Ruff, 2004

# Individual differences that predict later outcomes



e.g., Ruff, H. A., Lawson, K. R., Parrinello, R., & Weissberg, R. (1990). Lawson, K. R., & Ruff, H. A. (2004).  
Razza, R. A., Martin, A., & Brooks-Gunn, J. (2010)

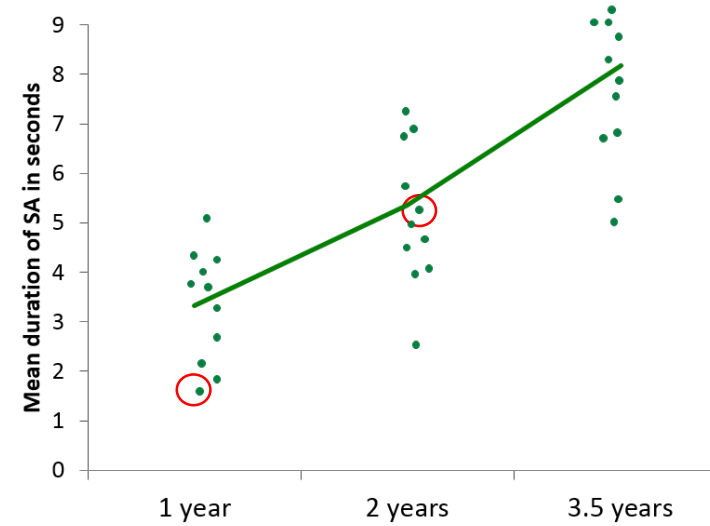
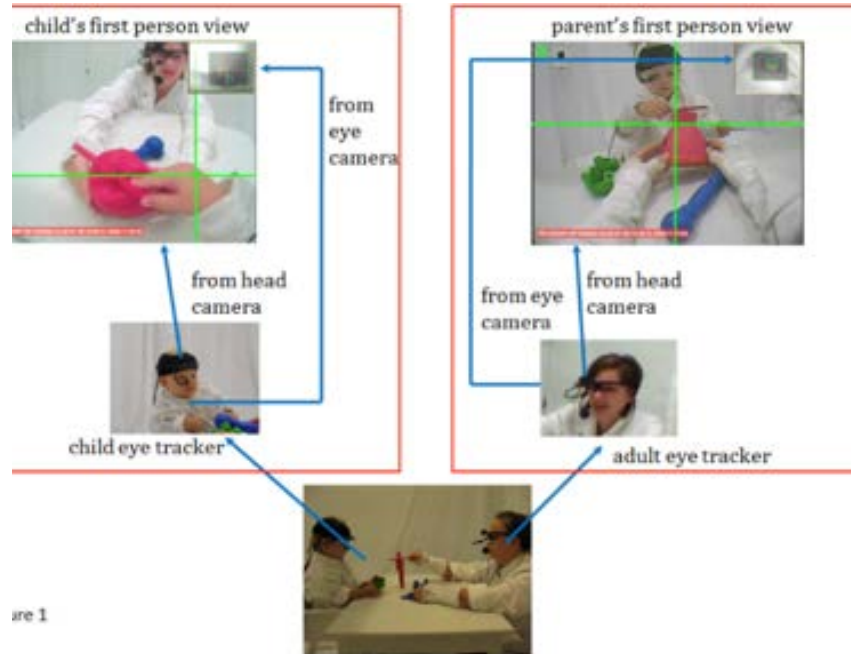
# Not saccades or fixations, duration of looks to pixels belonging to the same object without looks elsewhere



- Yu, C. & Smith, L. B. (2017) Child Development.
- Yu, C. & Smith, L. B. (2016) Current Biology.
- Yu, C. & Smith, L. B. (2016) Cognitive Science.
- Pereira, A., Smith, L. B. & Yu, C. (2014) Psychonomic Bulletin & Review.

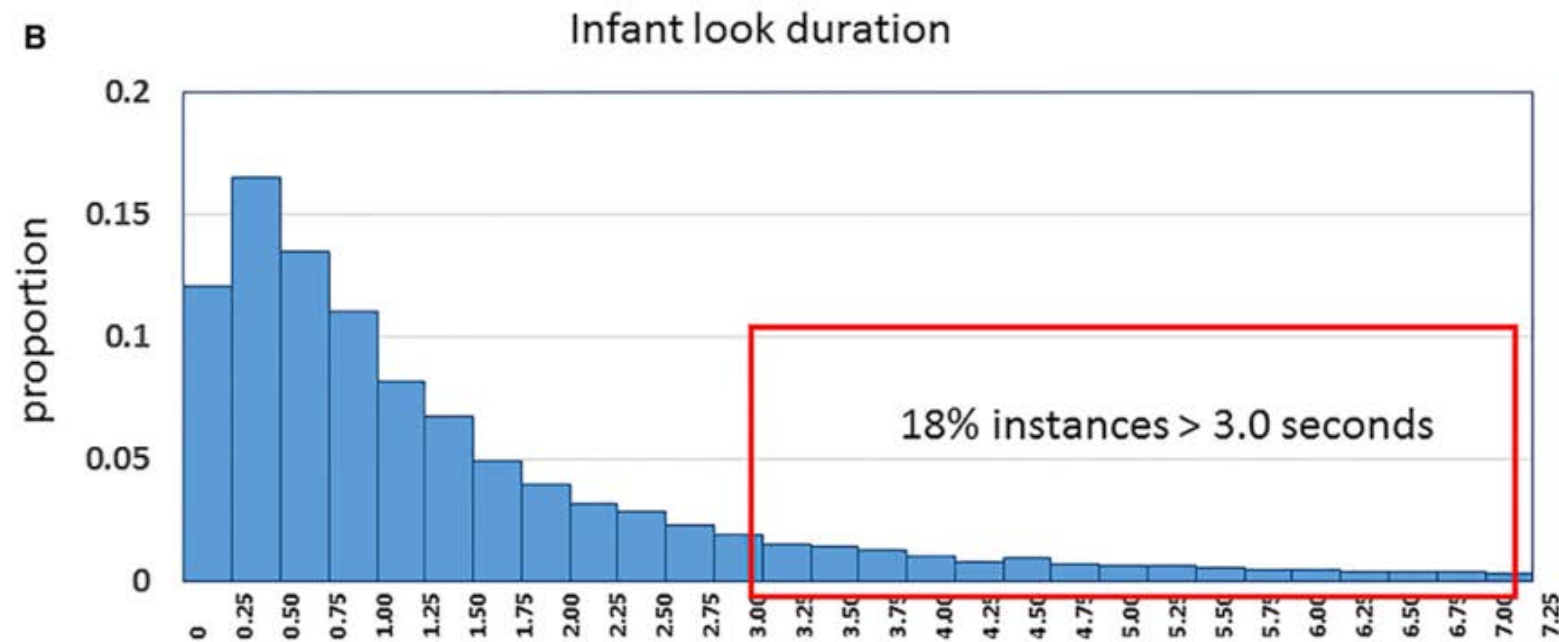
- Continuous engagement and purpose not based on gaze

# Measures of attention



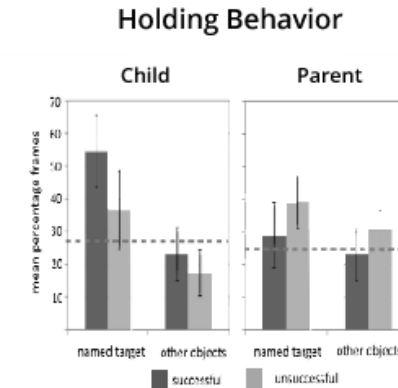
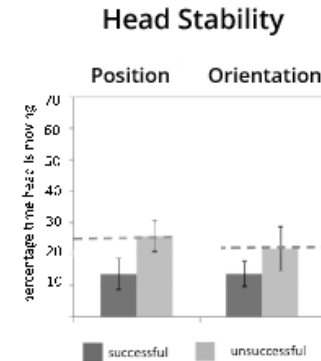
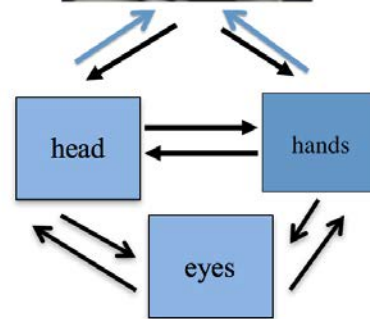
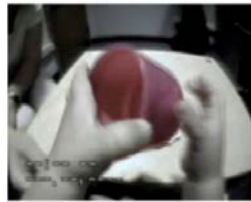
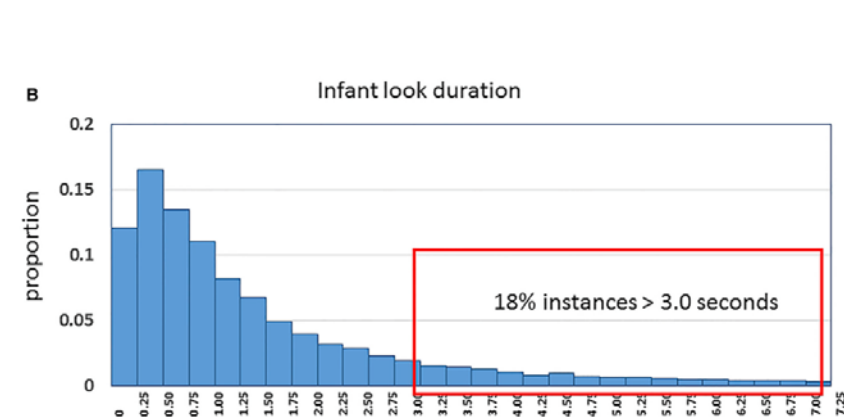
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# Many different bouts of attention that vary in their duration



Yu, C. & Smith, L. B. (2016) The Social Origins of Sustained Attention in One-Year-Old Human Infants. *Current Biology*, 26, 1-6.

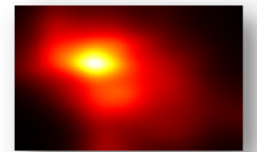
# Sustained Attention Linked to Acting in a 3D World



## Head and Eye Alignment

Gaze Distribution Head Camera Image

Holding Toy



Empty Hands



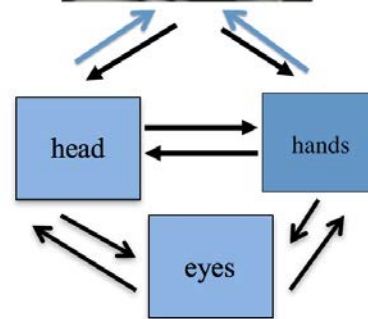
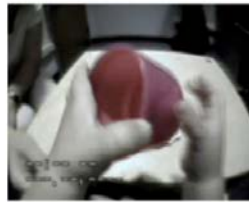
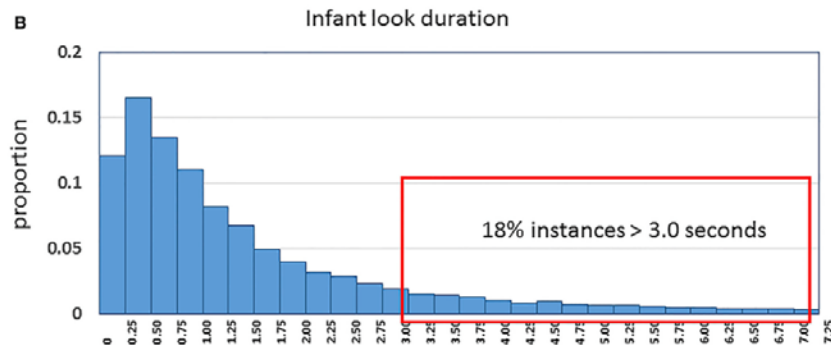
Pereira, A., Smith, L. B. & Yu, C. (2014) Psychonomic Bulletin & Review.

Yu, C. & Smith, L. B. (2012) Cognition.

Smith, L. B., Yu, C., & Pereira, A. F. (2011) Developmental Science.

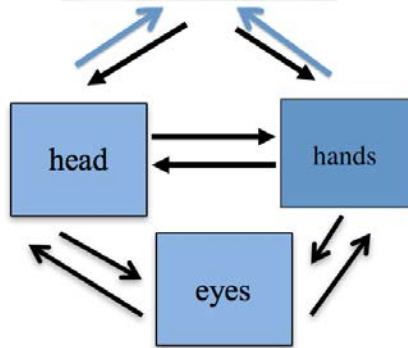
# Sustained Attention Linked to Acting in a 3D World

- Sustained Attention is Extended in Social Contacts
- Sustained Attention predicts learning (concurrent and future) about objects, object names, vocabulary *for infants when measured between 9 and 18 months*

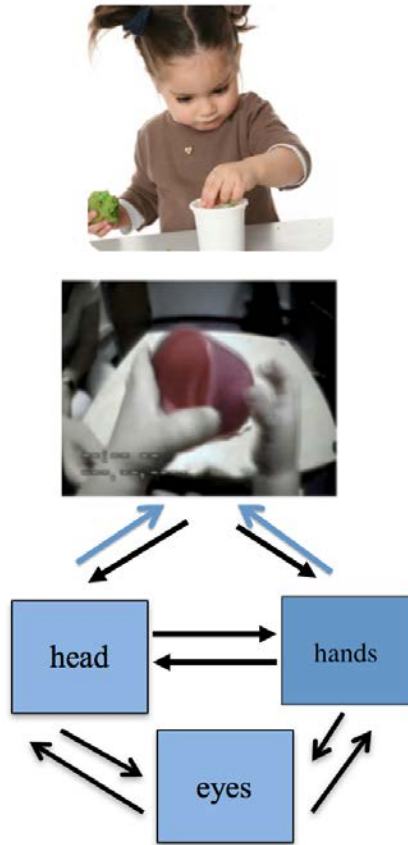


Yu, C. & Smith, L. B. (2016) Current Biology.  
Yu, C. & Smith, L. B. (2016) Cognitive Science.  
Pereira, A., Smith, L. B. & Yu, C. (2014) Psychonomic Bulletin & Review.  
James, K.H., Jones, S.S., Swain, S., Pereira, A., & Smith, L.B. (2014) Developmental Science.

# Real time properties of behaviors in a 3-dimensional social world



# Data show that

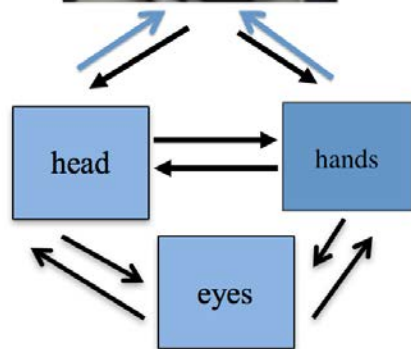


- Sustained attention to objects and its development plays an important role in early visual and cognitive development, as well as self regulation.
- And the contexts and likely drivers of that development occur in the context of actions in a 3-dimensional and social world.

# So which is better?



versus



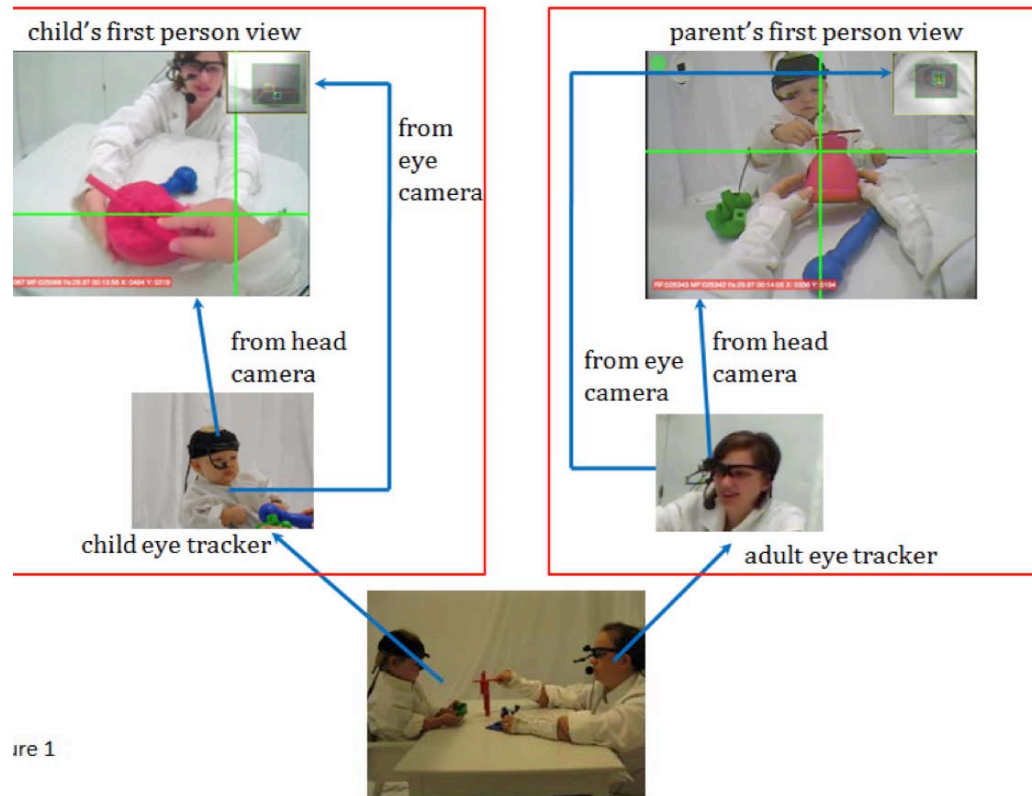


# Long-term benefits of being read to:

- Promotes
  - later academic performance
    - (Lonigan and Whitehurst, 1998)
  - reading fluency
    - (Ardoyn et al., 2008)
  - print knowledge
    - (Lonigan et al., 2008)
- Social, but not 2D and not whole-body -- mostly just looking



# Eye gaze in two contexts – 18 to 25 month olds and their parents

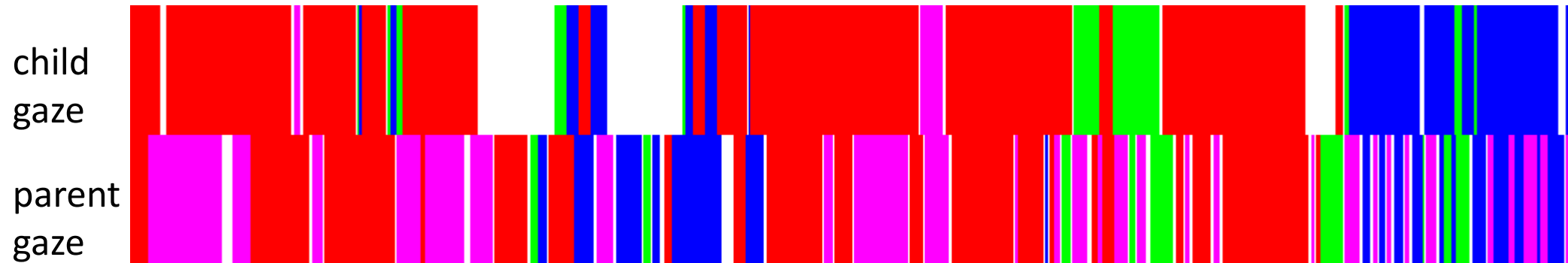
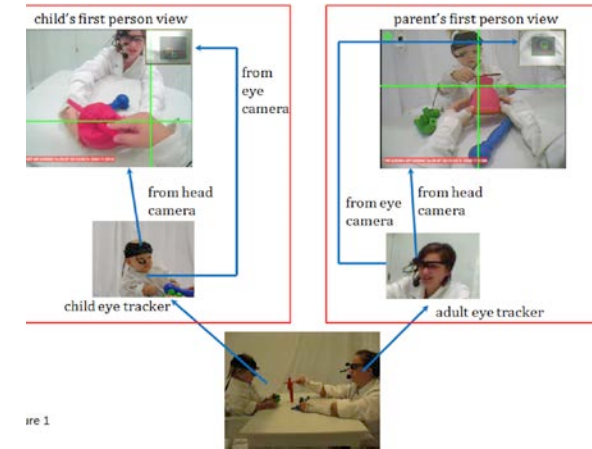


- Toy Play

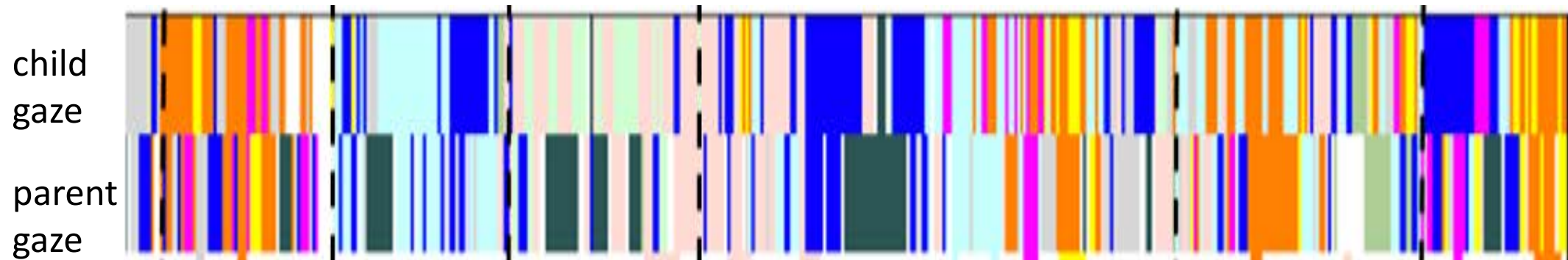


- Book Reading

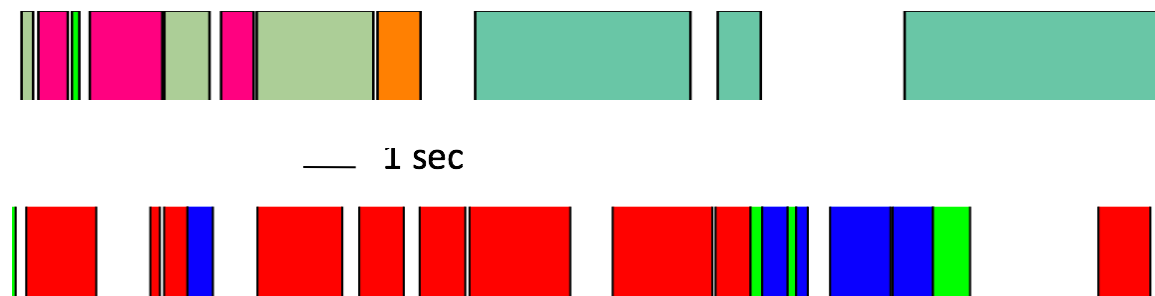
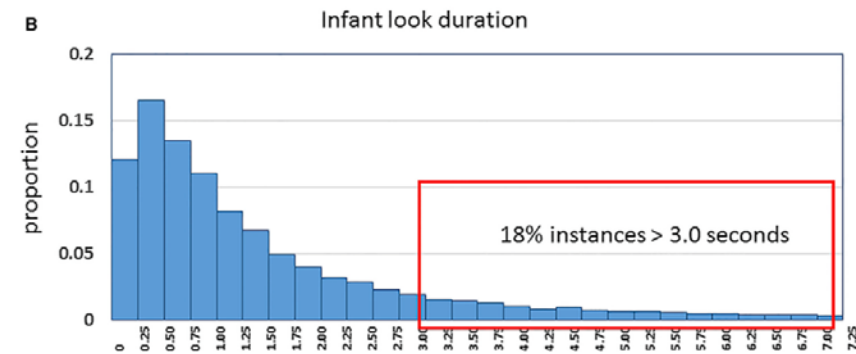
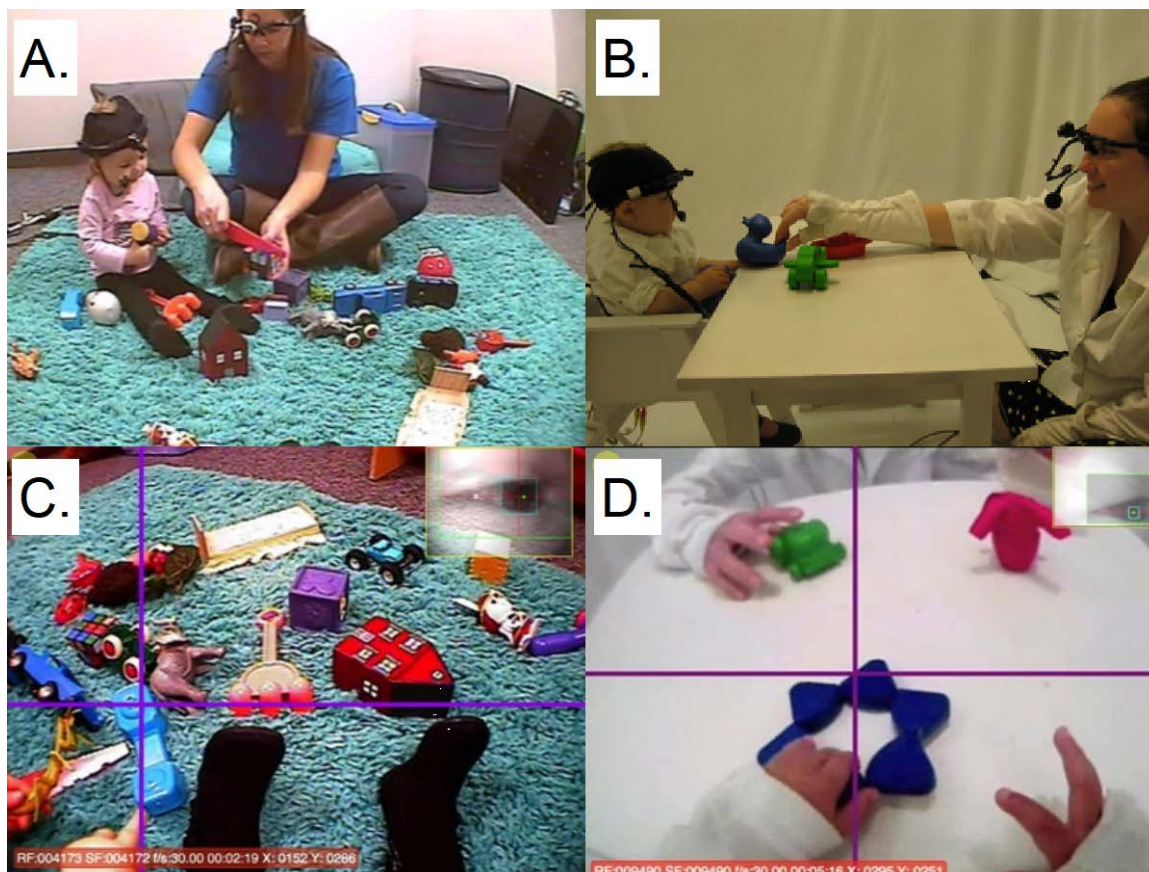
# Gaze during toy play



# Gaze during book reading



# Distribution of looks



The distribution of looks to objects appears similar across diverse toy play contexts and appears stable for individual children in different contexts—Drew Abney

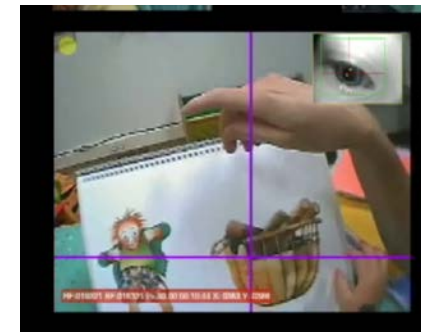
# Child Gaze



Active  
3D



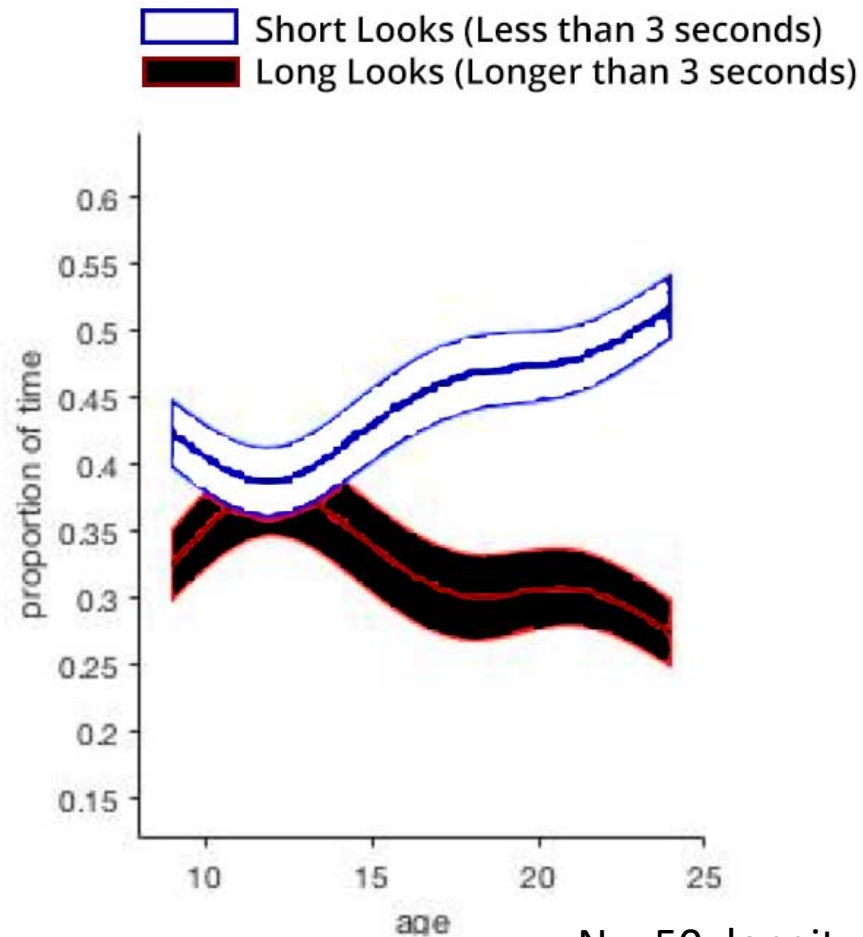
Looking  
listening



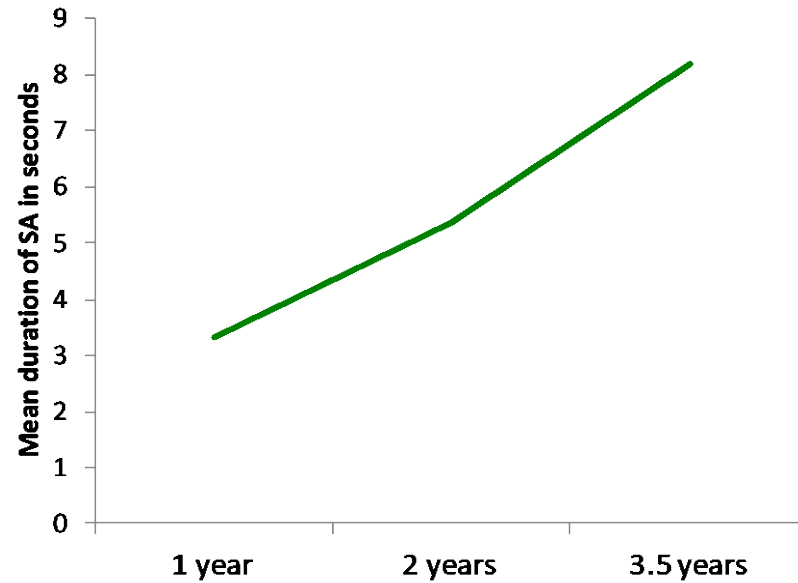
# So, sustained looks to an individual object in a 3-dimensional world

- Predict learning, in task and future
  - Supported by physically holding objects
  - Supports joint attention (and is supported by joint attention) with a social partner
- But book reading –which is not supporting sustained attention–is a good experience for infants and children and is related to many good outcomes.

# Looks to objects when playing with toys: two different developmental trajectories. Different functions (both important?)



N = 50, longitudinal study

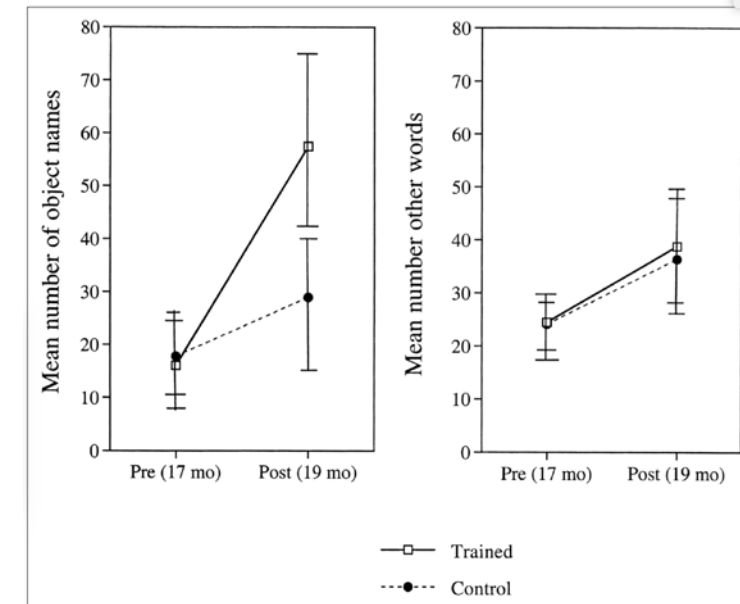
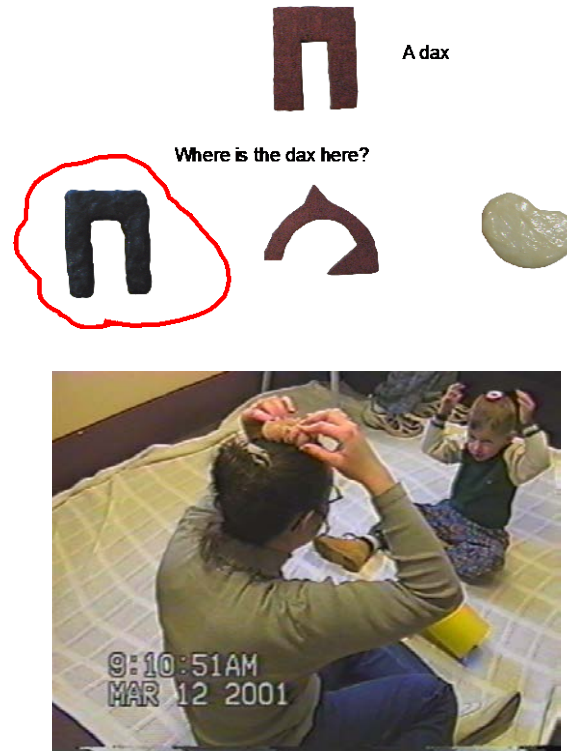


# Children have a lot to learn, need many different kinds of experiences

- Where does digital media fit in this?
  - like books –symbols
  - not always social, but contingent
  - good for some forms of learning not others

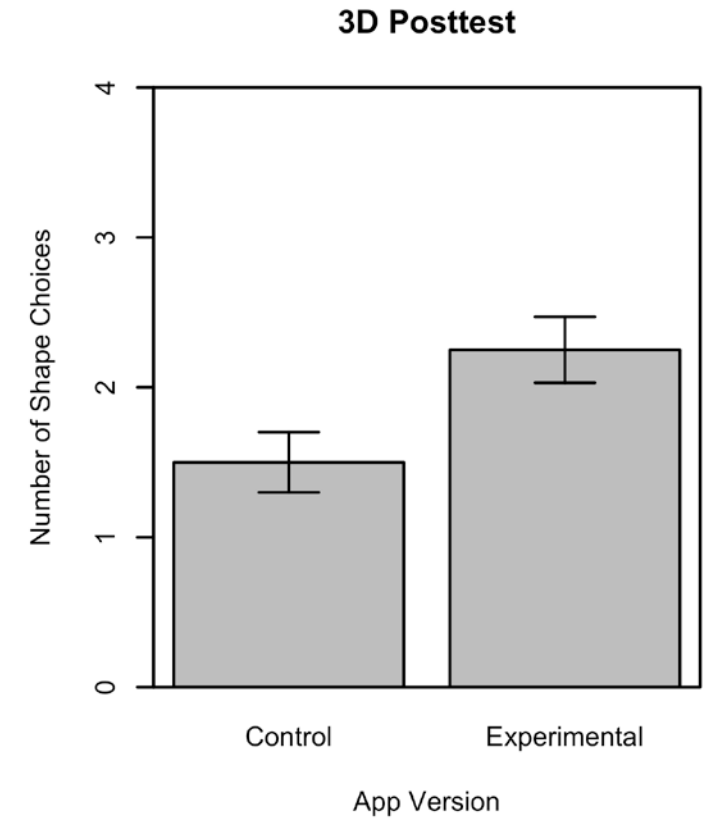
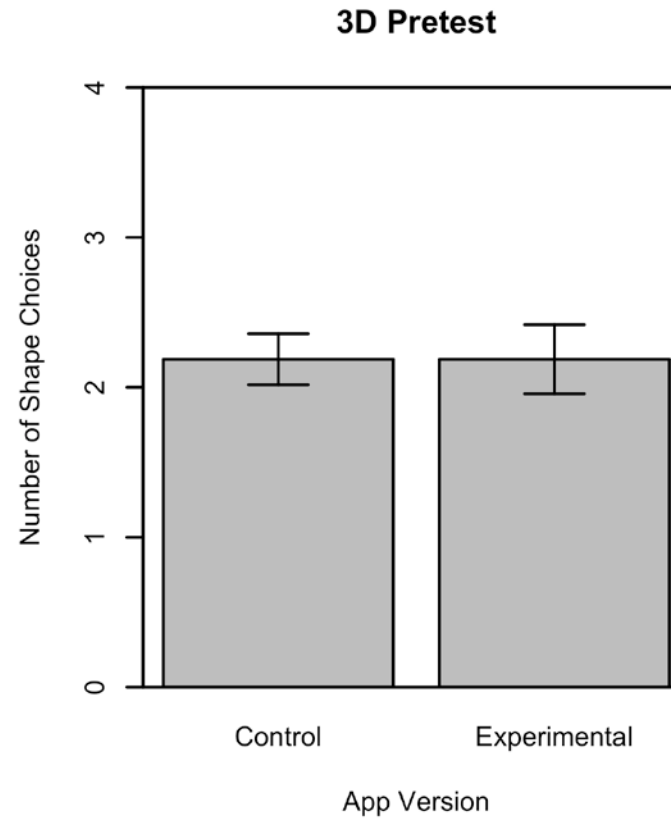
# Children's experience facilitates learning

- Experience in learning object names tunes children's attention to the properties relevant for naming—in this case, to the property of shape—and thus facilitates the learning of more object names. Data show increase in vocabulary size, by parental report, from the beginning ("Pre") to the end ("Post"). Children in the training group showed an average increase of 41.4 object names—that is, a 256% increase—in their productive vocabularies over this 8-week period, whereas children in the baseline condition showed a mean increase of only 13.8 object names (78%). Children in the training and baseline groups did not differ in their acquisition of other words. In sum, the training made children better learners of object names in their everyday lives.



# Additional work

- Kwan, Blake, Carvalho, Smith
  - 1 week, 2D ipad training
  - 1 month out reliable MCDI differences
  - Randomized control double blind n=100



# How to think about defining a research agenda for studying infant's and children's use of digital media and effects on development?

- **Basic descriptors:** How much use, what kind of use, when and where, how fits with other activities? How this changes with development.
- **Populations studies** for all the reasons we heard.
- **Underlying mechanisms:**
  - the mechanisms engaged by digit media use and how they are changed by that use
  - how functional networks in the brain form as a function of different kinds of tasks: how 3D play with blocks, digital media form different functional consortiums of skills
  - how these component abilities --developed potentially through many different tasks fit together.

**Development and experience emerges in effects in real time at scales of fractions of seconds repeated and with over time aggregated effects on development**