UNIVERSITY OF SOUTH CAROLINA

Infant Attention to "Realistic" Video: An Attention Development Perspective

Media Exposure and Child Development
NIH, January 2018
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University of South Carolina

http://jerlab.psych.sc.edu/jerpdf/MediaExposure2018.pptx

Funding

- NICHD R01/R37/R01 HD18952, Development of sustained attention. Lisa Freund was the PO for ??? Years. Now it is Kathy Mann Koepke.

Collaborators: Undergrads, graduate students, post-doc, faculty, research assistants

- Richards, J.E., & Cronise, K. (2000). Extended visual fixation in the early preschool years: look duration, heart rate changes, and attentional inertia. Child Development, 72, 602-620
- Pimpek, T.A., Kikorian, H.L., Richards, J.E., Anderson, D.R., Lund, A.R., & Stevens, M. (2010). Video comprehensibility and attention in very young children. Developmental Psychology, 46, 1283-1293.
- Richards, J.E., & Anderson, D.R. (2004). Attentional inertia in children's extended looking at television. Advances in Child Development and Behavior, 32, 163-212
- Richards, J.E. (2010). The development of attention to simple and complex visual stimuli in infants: Behavioral and psychophysiological measures. Developmental Review, 30, 203-219.
- Xie, W., & Richards, J.E. (2017). The relation between infant covert orienting, sustained attention and brain activity. Brain Topography, 30, 198-219. DOI: 10.1007/s10548-016-0505-3
- Guy, M.W., Zieber, N., & Richards, J.E. (2016). The cortical Development of Specialized Face Processing in Infancy. Child Development. doi: 10.1111/cdev.12543
- Guy, M.W., Richards, J.E., Tonnsen, B., & Roberts, J.E. (2017). Neural correlates of face processing in etiologically-distinct 12-month-old infants at high-risk of autism spectrum disorder. Developmental Cognitive Neuroscience.

Collaborators: Dan Anderson—Children's attention to TV

Overall summary of extended visual fixation and attention to video programs

- Ages: infants 3, 4.5, 6, 9, 12, 18, 24 months
- Methods: Watching children's video programs, or video programs + distractibility
- Videos: Sesame Street, "Follow that Bird"; geometric-patterns synchronized with music; Blues Clues; Teletubbies; Elmo's World; Richard Scarry
- Dependent variables: Fixation, "attentional inertia", heart rate measures of attention
- Conclusions:
  - From age 3 mo. to about 12 mo., minor effects of video program on extended fixations. Neural development of several "core attention systems" affecting fixation and attention. Development of brain systems for attending to the environment and likely social brain development. Synchronized audio-visual stimuli elicit most attention
  - 18 and 24 months--Comprehensible and age-appropriate stimuli elicit extended fixations and heart rate indicating attention engagement.

Variation in type of video patterns presented

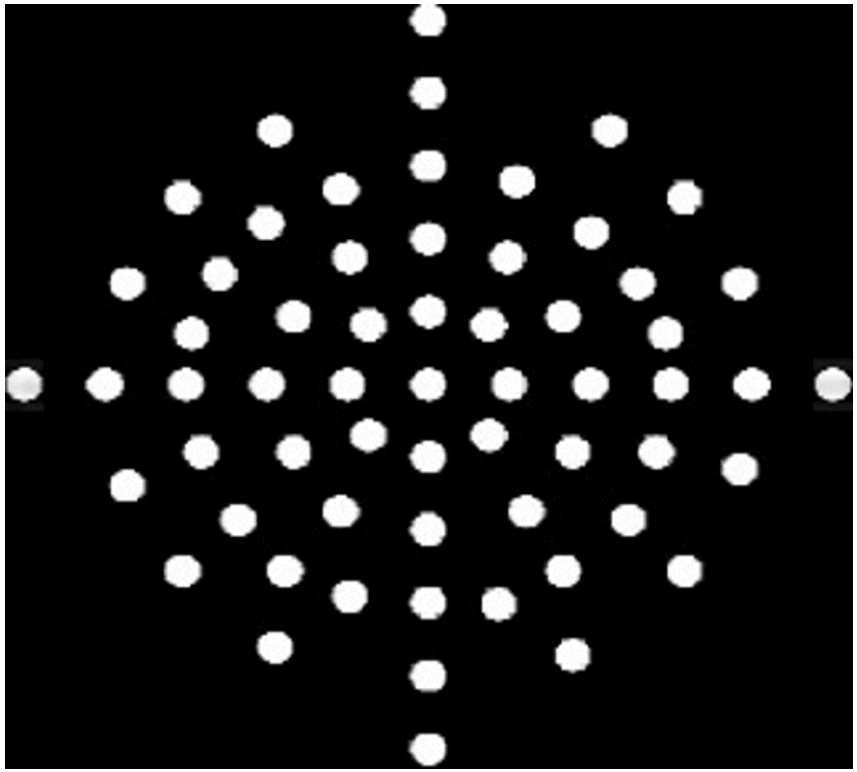
- Comprehensible (comprehensible, age-appropriate)
  - Sesame Street “Follow that Bird” movie
  - Sesame Street “Sesame Street 25th Birthday: A Musical Celebration”
  - Teletubbies
  - Elmo’s World—English language version (but Mandarin timing?)
  - Elmo’s World—Mandarin language version (mixed results)
- Incomprehensible (incomprehensible, age-inappropriate)
  - Synchronized black-white geometric patterns synchronized with audio “wav” files
  - Sesame Street “Follow that Bird” with reverse speech (individual words reversed)
  - Sesame Street “Follow that Bird” with commercial Spanish sound track (mixed results)
  - Richard Scarry—The Busy World of Richard Scarry Episode 41
  - Blues Clues
  - Teletubbies with randomized scene sequences
  - Teletubbies with reverse speech (individual words reversed)

Video: Sesame Street 25th anniversary dancing

- Do you like it?
- Two year olds (and infants at ALL ages) like it.

Video: computer-generated (CG) black and white geometric patterns with synchronized audio-wav files

- Do you like it?
- 6 and 12 month olds pay the same attention to this as Sesame Street “Follow that Bird”; at 18 months they prefer FTP over the CG stimuli.



Video: Shown in English (comprehensible) and with backward speech (incomprehensible)

Development of attention in the first 12 months "neuroscientific model"

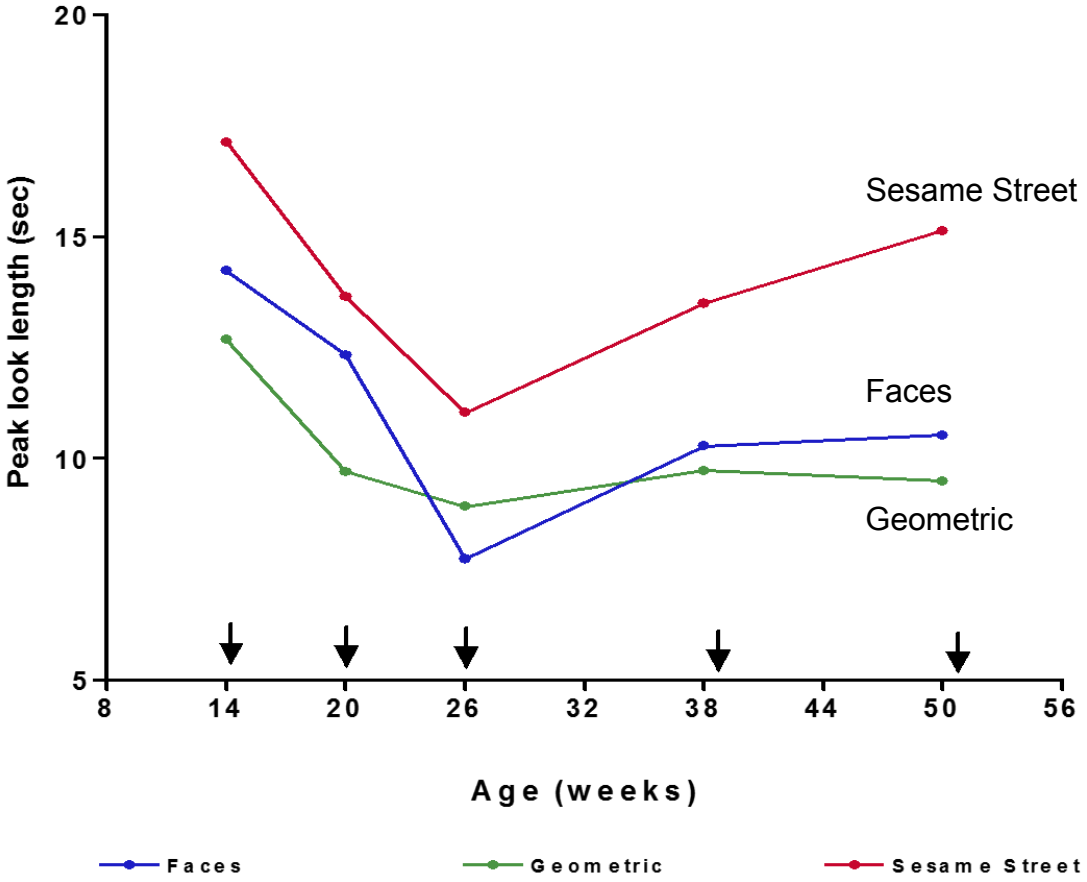
- Changes in the first 12 months in brain areas supporting basic attention processes
- Orienting, peripheral stimulus sensitivity (spatial cueing, IOR), smooth pursuit tracking
- Memory, eye gaze perception and joint attention, perceptual narrowing.
- Extended development of sustained attention and attention engagement (and HR measurement)
- Changes in particular areas of brain important for social interaction (e.g., development of N290-FFG) that may affect video processing.
- This model:
  - Links the changes in infant attention to the changes in brain networks.
  - Summarizes recent empirical evidence showing the effects of infant sustained attention on the development of other cognitive functions.

Decrease in fixation duration through 6 months

- Colombo, J. (2002). Infant attention grows up: The emergence of a developmental cognitive neuroscience perspective. *Current Directions in Psychological Science, 11*(6), 196-200. DOI: 10.1111/1467-8721.00199

- Courage, M.L., Reynolds, G.D., & Richards, J.E. (2006). Infants' visual attention to patterned stimuli: Developmental change and individual differences from 3- to 12-months of age. *Child Development, 77*, 680-695.

Changes in the length of infants' longest looks at combined stimulus types



- Fixation duration to "Sesame Street 25th Birthday …" and other stimuli (Courage, Reynolds, & Richards, 2006)
- There may be overall preference for audio-visual stimuli with multiple characters, motion, etc.—found in the "Sesame Street" movie, "Follow that Bird". However, even with these stimuli there often is the decreasing look length.
- Note: Arrows indicate age at testing.

Development of Attention—Extended fixations and attention through 2 years

- Experiments with 6, 12, 18, 24 month old children
- Children on parents lap (or in chair) watching video stimuli on video monitor
- Video recording of fixation and off-line observer judgments "Looking toward video monitor", "Looking away from video monitor"
- Recording of heart rate as a measure of "sustained attention"
- Average look duration, distribution of looks, "attentional inertia"
- Extended heart rate changes during "looking toward monitor"
- Conclusions:
  - Extended visual fixations are an index of attention engagement
  - Changes in extended HR-defined sustained attention develops to comprehensible
  - Same responses to organized video movie and geometric/sounds at 6 and 12 mo.
  - Extended attention engagement to organized comprehensible stimuli at 18 and 24 mo.

Infant attention to “realistic” video

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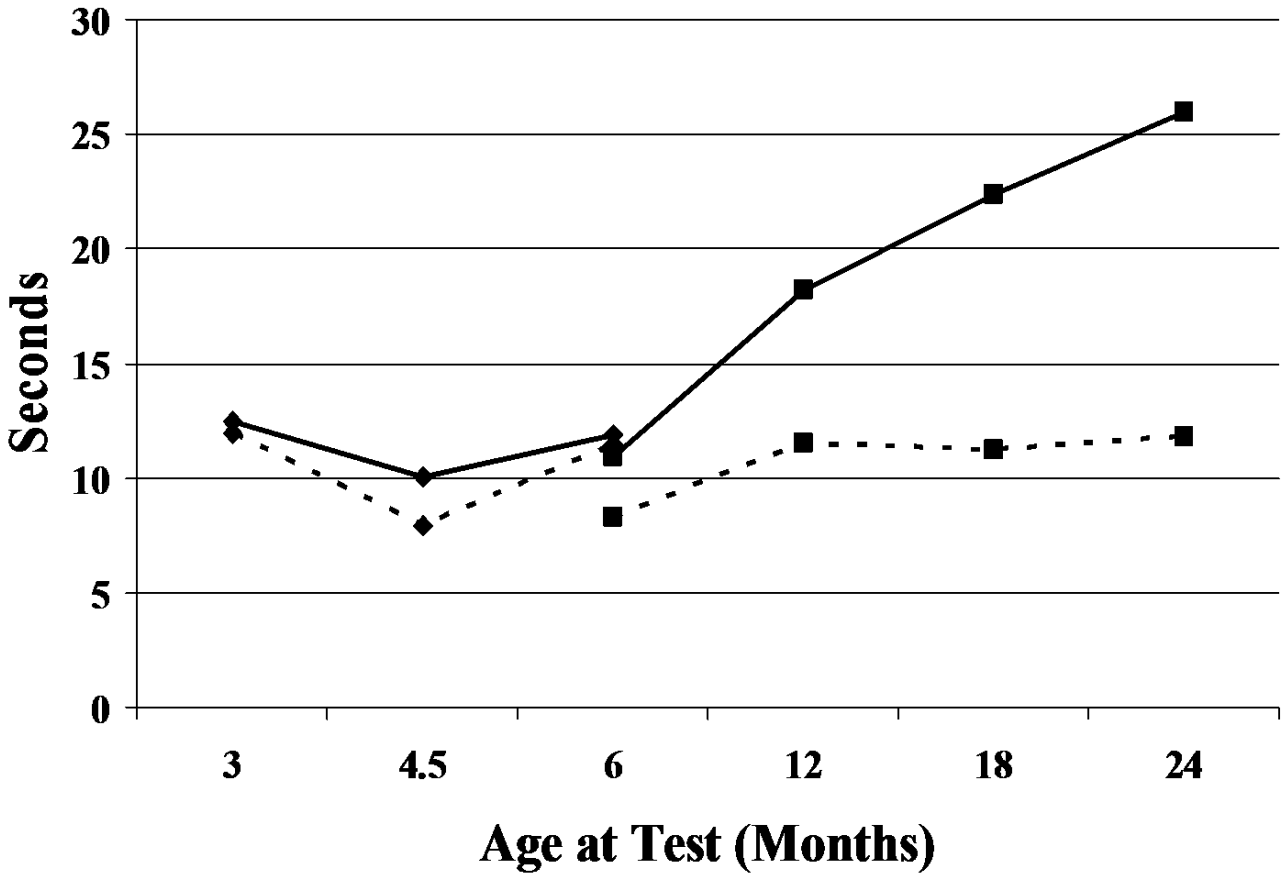
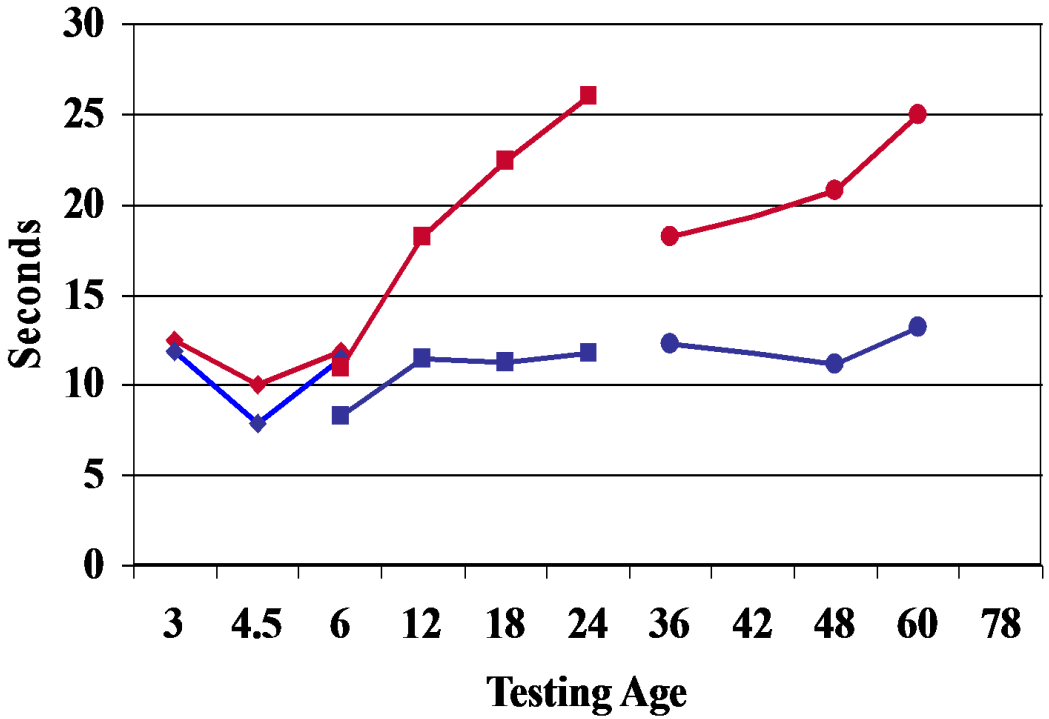
- Richards, J.E., & Anderson, D.R. (2004). Attentional inertia in children’s extended looking at television. *Advances in Child Development and Behavior, 32*, 163-212
- Richards, J.E. (2010). The development of attention to simple and complex visual stimuli in infants: Behavioral and psychophysiological measures. *Developmental Review, 30*, 203-219.
- Richards, J.E., & Stevens (revising). Central stimulus comprehensibility and distractibility in young children.
- Richards, J.E., & Stevens (2018). Television program comprehensibility and distractibility in 24 month children. *International Conference on Infant Studies,* Philadelphia, PA.
- Crawley, A.M., Anderson, D.R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposure to a single episode of the television program Blue’s Clues on the viewing behaviors and comprehension of preschool children*. Journal of Educational Psychology, 91*, 630–637.

Average look duration for comprehensible (solid lines) and incomprehensible (dashed lines) stimuli



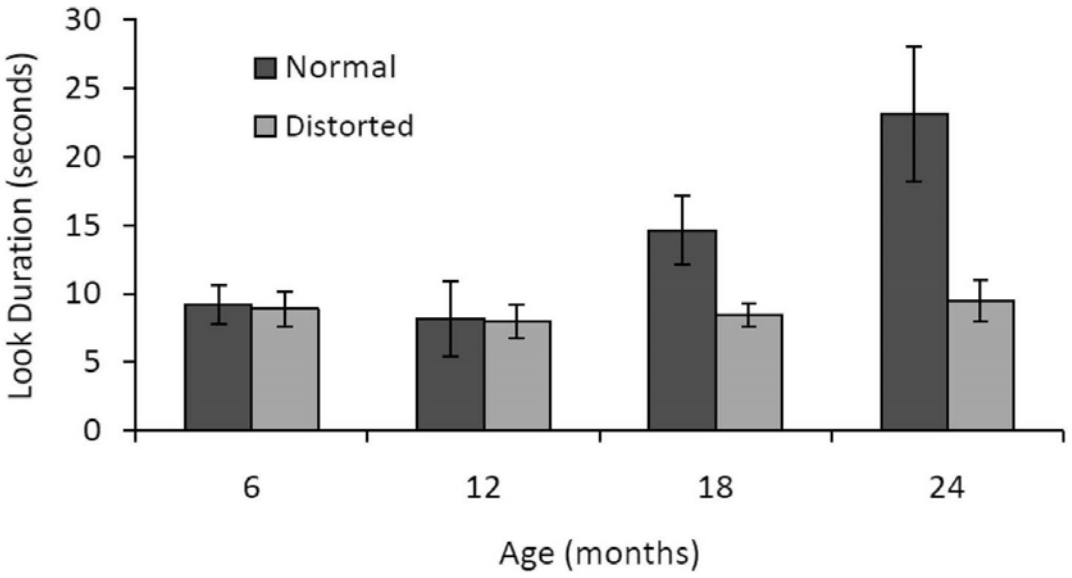
Data for Ages 3 to 6 months (Diamond Markers) = Richards & Gibson, 1997
Data for Ages 12 to 24 months (Square Markers) = Richards & Cronise, 2000

Average look duration for comprehensible (red lines) and incomprehensible (blue lines) stimuli



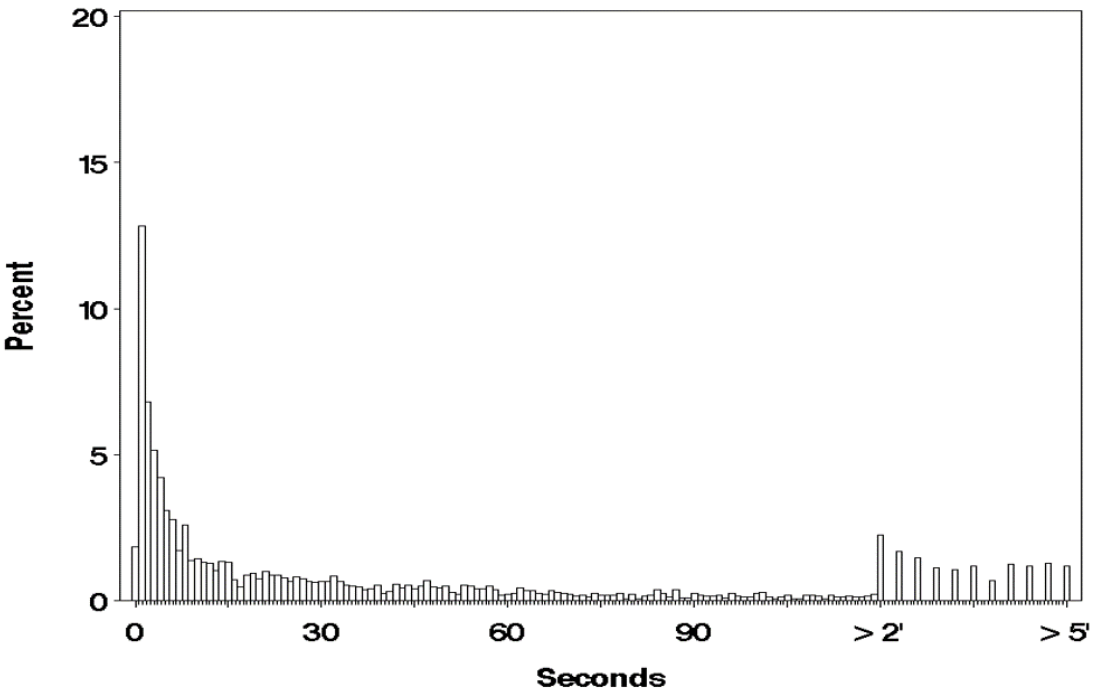
- Data for Ages 3 to 6 months (Diamond Markers) = Richards & Gibson, 1997
- Data for Ages 12 to 24 months (Square Markers) = Richards & Cronise, 2000
- Comprehensible Stimuli Data for 36 to 60 months (Circle Markers) = Crawley et al, 2001
- Incomprehensible Stimuli Data for 36 to 60 months (Circle Markers) = Anderson et al., 1981, Hawkins et al., 1991

Means and standard errors for look durations for normal and distorted stimuli by age



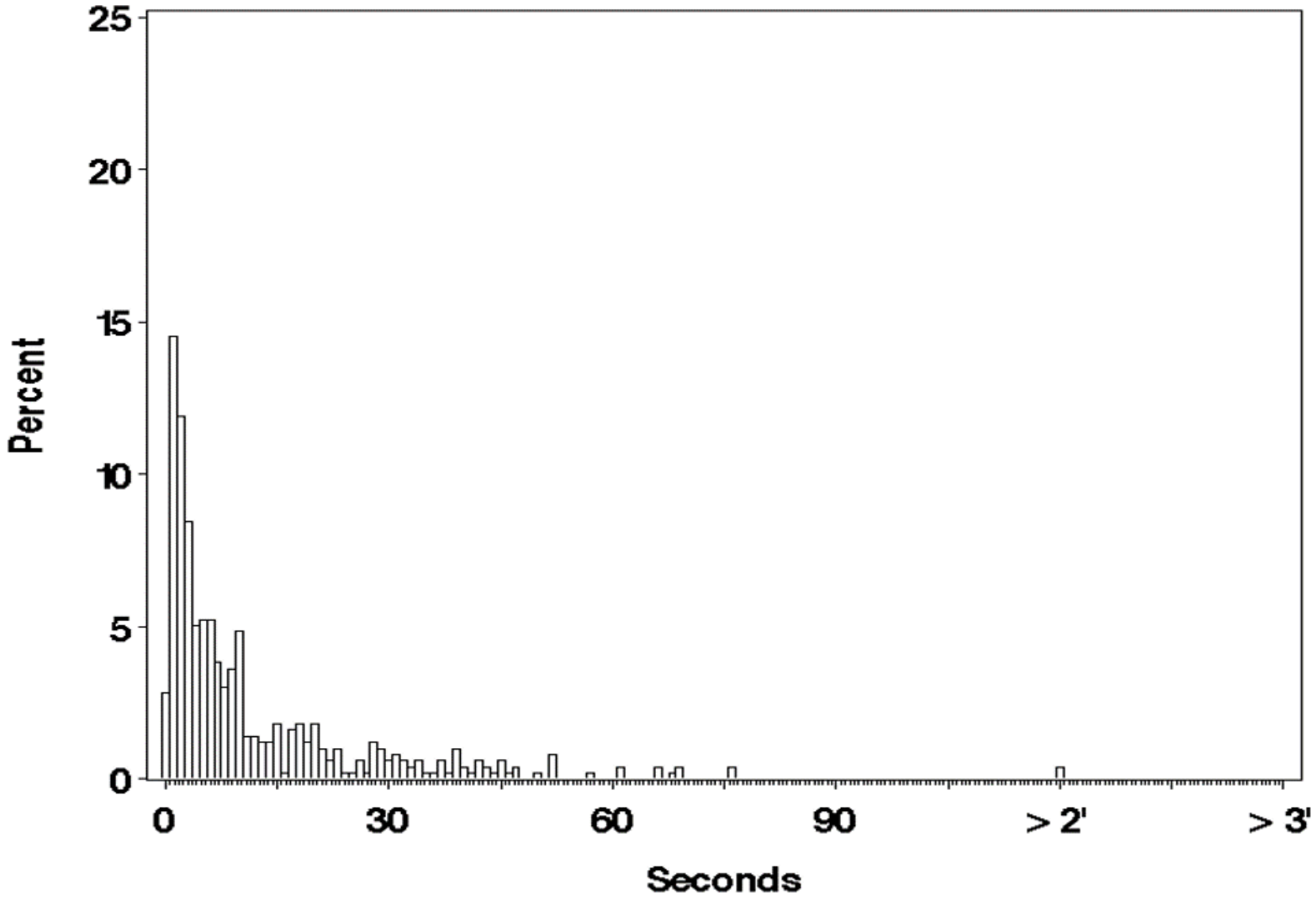
- Look Duration for Teletubbies vs Teletubbies-Random/ Teletubbies-Reverse Speech
- In this study there was no difference in the comprehensible and incomprehensible versions. In this case, “incomprehensible” versions were commercial movie videos, so in the prior study at 12 months the difference was between a “video” and the “CG” stimuli.
- The increase in fixation to the comprehensible stimuli increase from 18 to 24 months
- Pimpek, Kikorian, Richards, Anderson, Lund, & Stevens, 2010

Look distribution (toward vs. away from TV) for adults watching Seinfeld episode

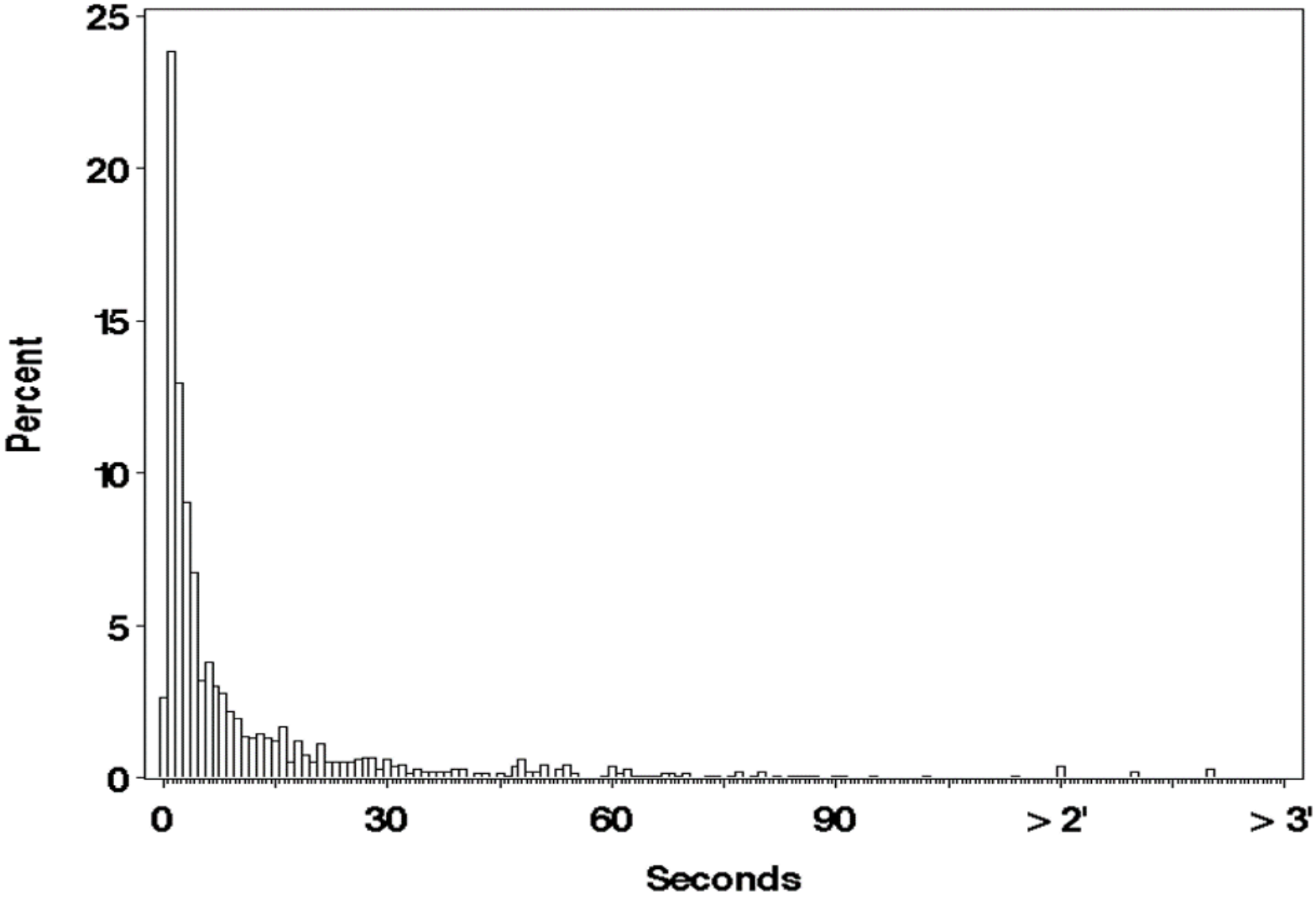


- Lognormal distribution—high frequency of short looks and a few long looks. Richards & Anderson, 2004
- The extended fixations (> 60 s) actually take up the majority of looking time.
- The main difference in the "comprehensible" and "incomprehensible" stimuli are the lower frequency of the extended looks in the incomprehensible stimuli.
- "Attentional inertia" (Dan Anderson) increasing attention engagement over the course of a look leading to a resistance to distraction by peripheral stimuli.
- Our own distraction work suggests indistractibility is due to "response bias" toward the center stimulus. Sustained attention is described as control over looking toward the target of interest.

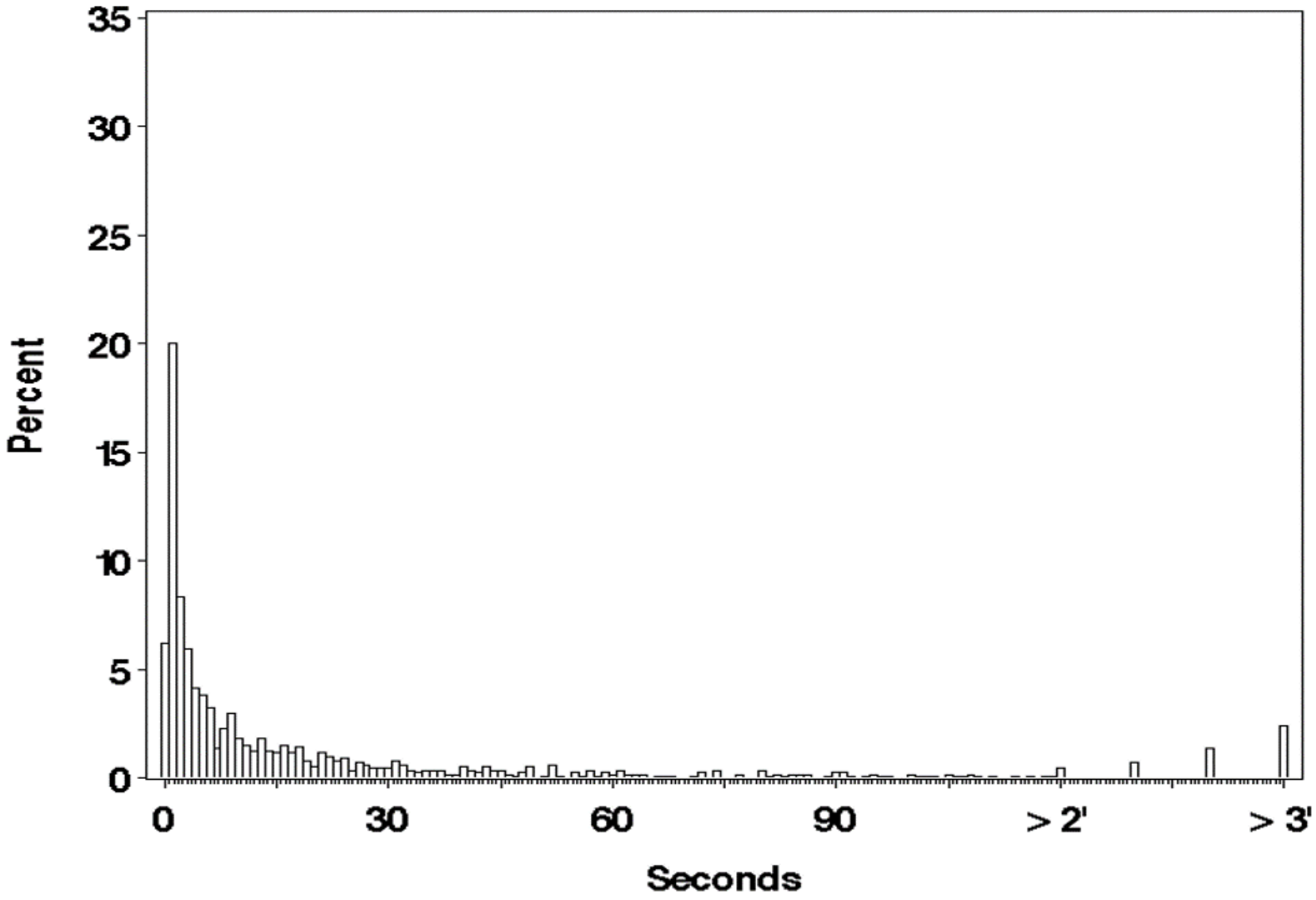
Look distribution (toward vs. away from TV) for 3-month-olds watching Sesame Street



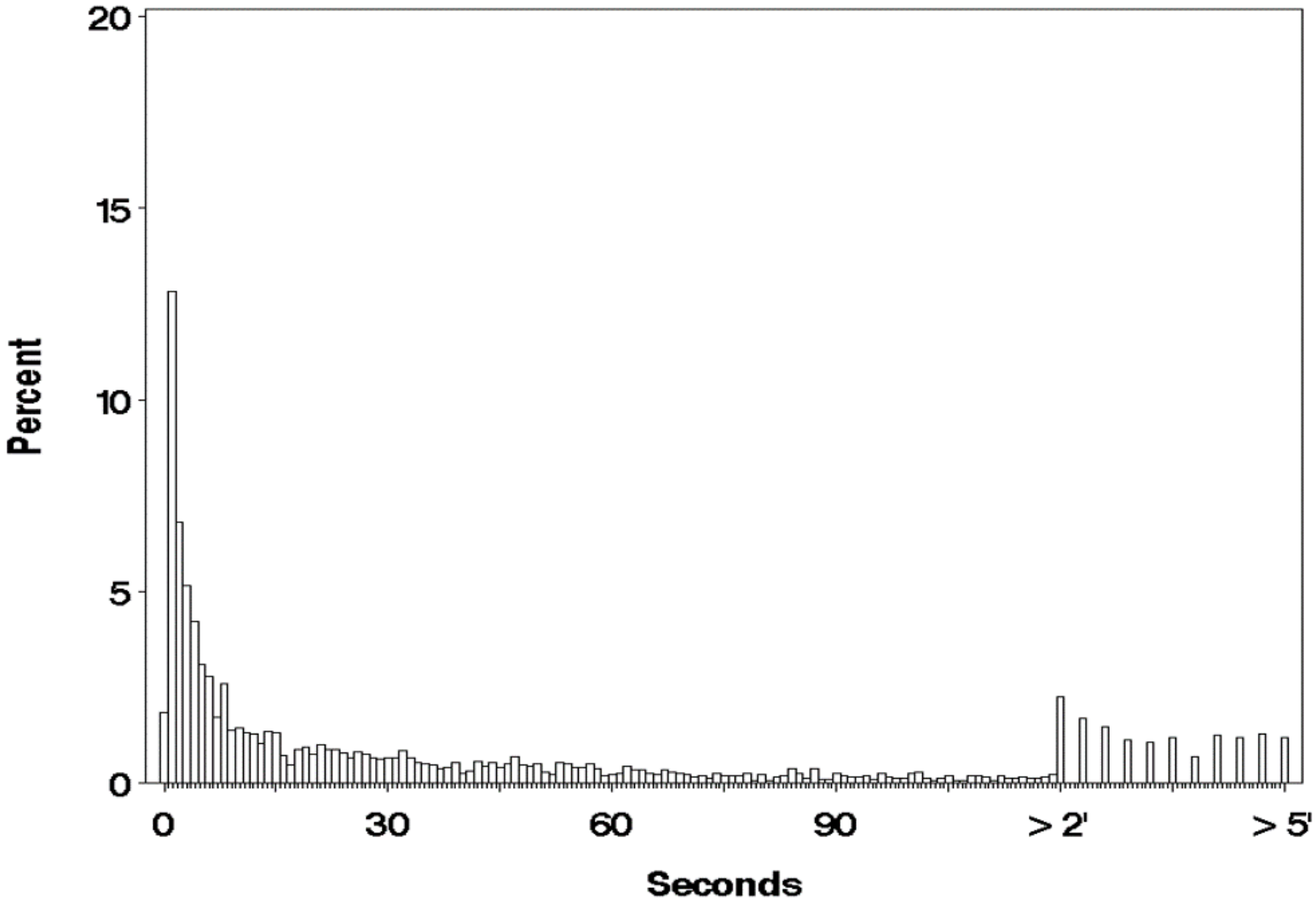
Look distribution (toward vs. away from TV) for 2-year-olds watching sesame street



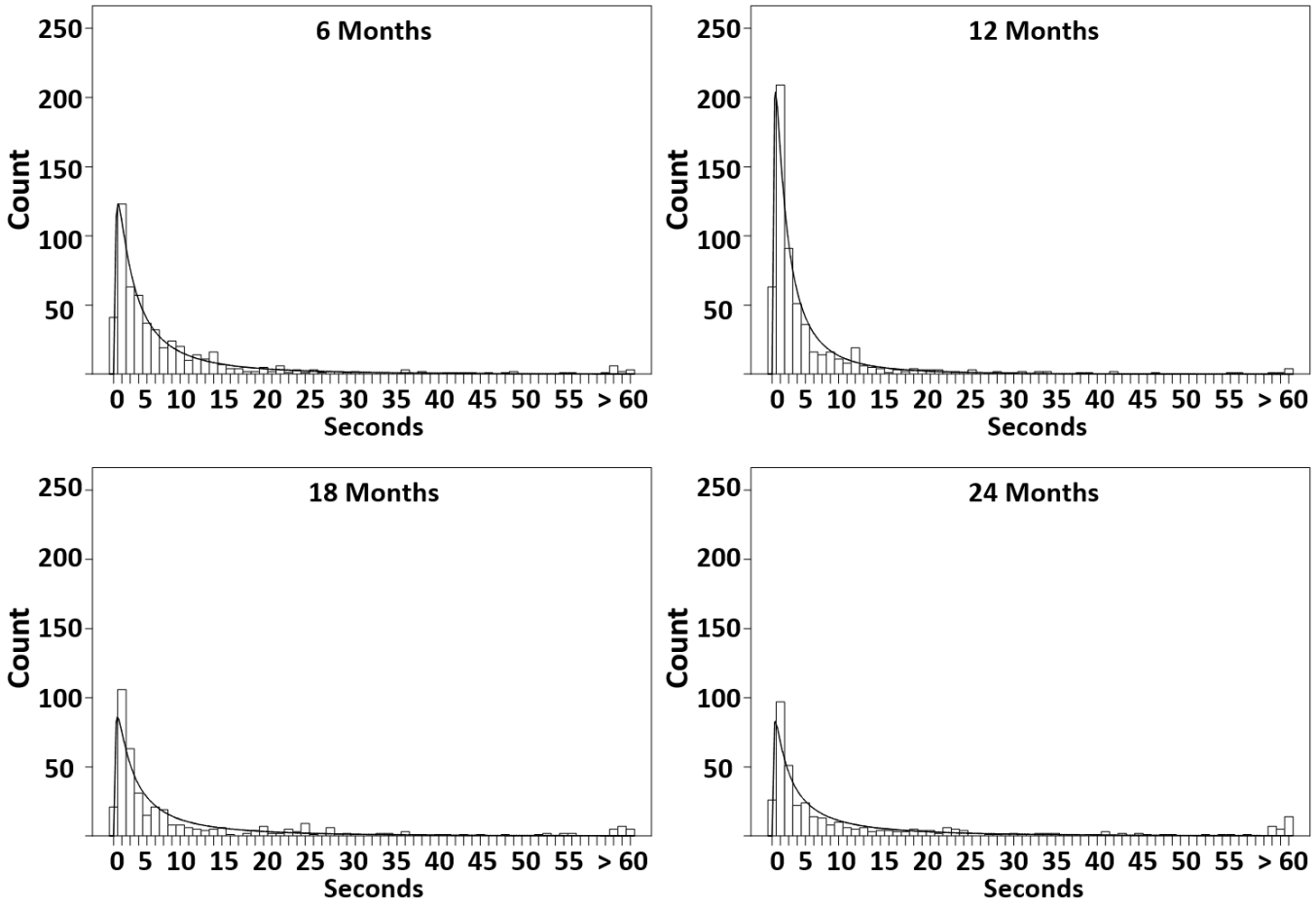
Look distribution (toward vs. away from TV) for 5-year-olds watching blues clues



Look distribution (toward vs. away from TV) of comprehensible stimuli for adults

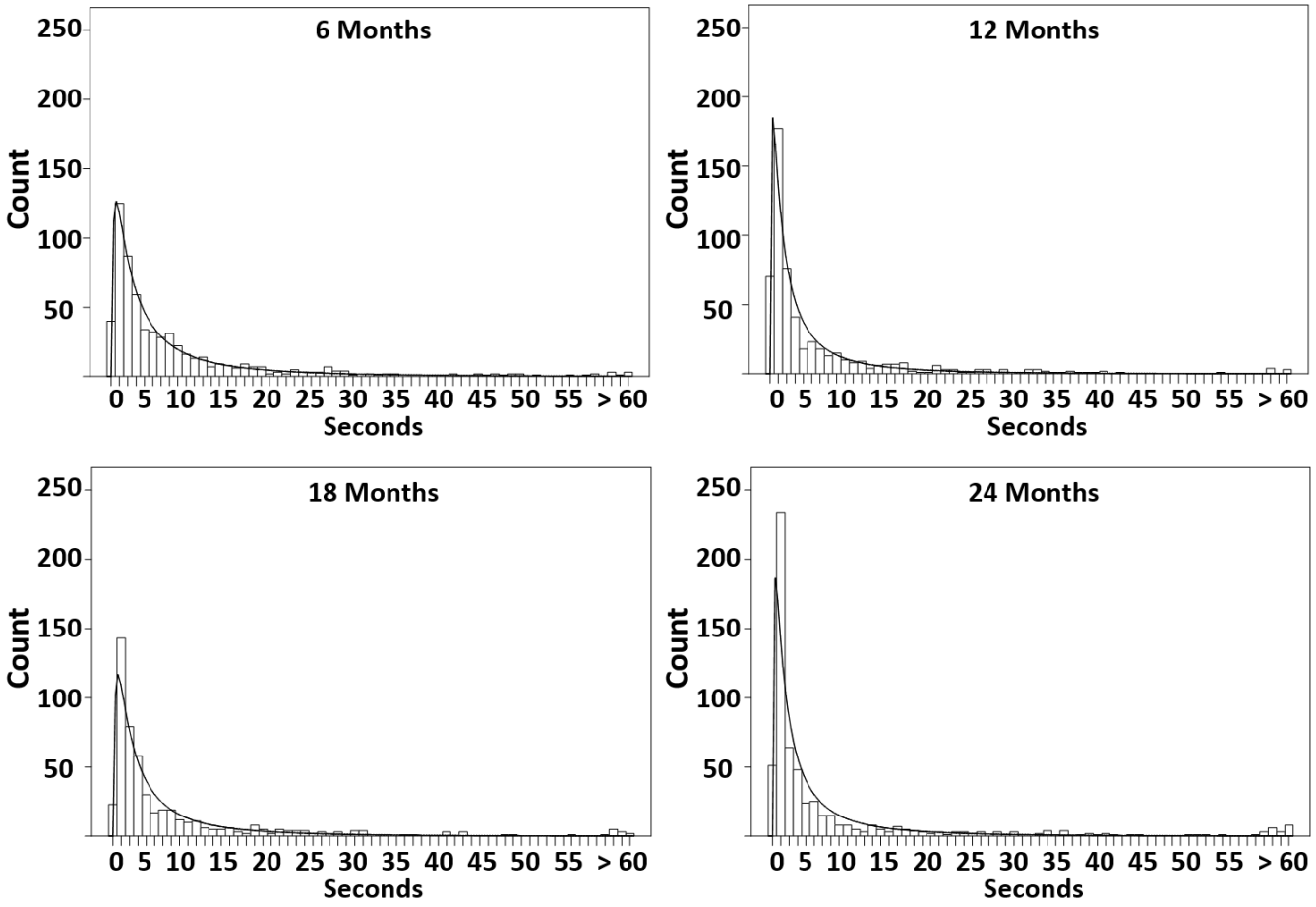


Look distribution for comprehensible stimuli for children watching Teletubbies



Note increase in extended looks and decrease in short looks as age increases (Pempek et al, 2010)

Look distribution for incomprehensible stimuli for children watching Teletubbies



Note decrease in extended looks and increase in short looks as age increases (Pempek et al, 2010)

Development of Attention—Extended fixations and attention through 2 years (revisited)

- Experiments with 6, 12, 18, 24 month old children
- Children on parents lap (or in chair) watching video stimuli on video monitor
- Video recording of fixation and off-line observer judgments "Looking toward video monitor", "Looking away from video monitor"
- Recording of heart rate as a measure of "sustained attention"
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Development of Attention—Extended fixations and heart rate changes

- Recording of heart rate as a measure of “sustained attention”
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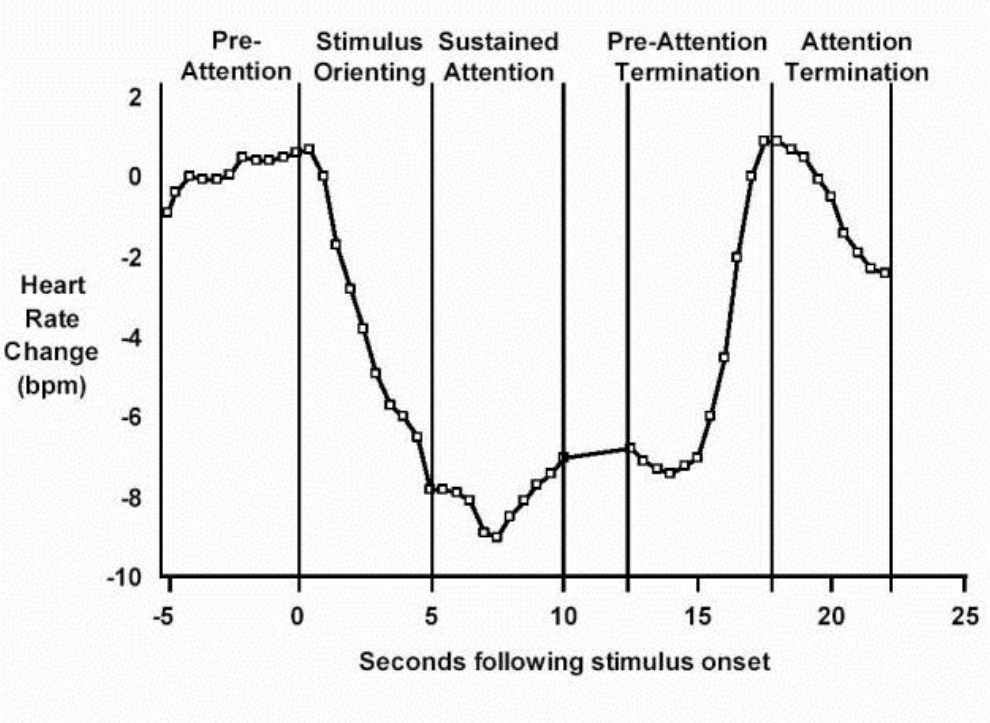
Extended fixations and heart rate changes: Our “model preparation”

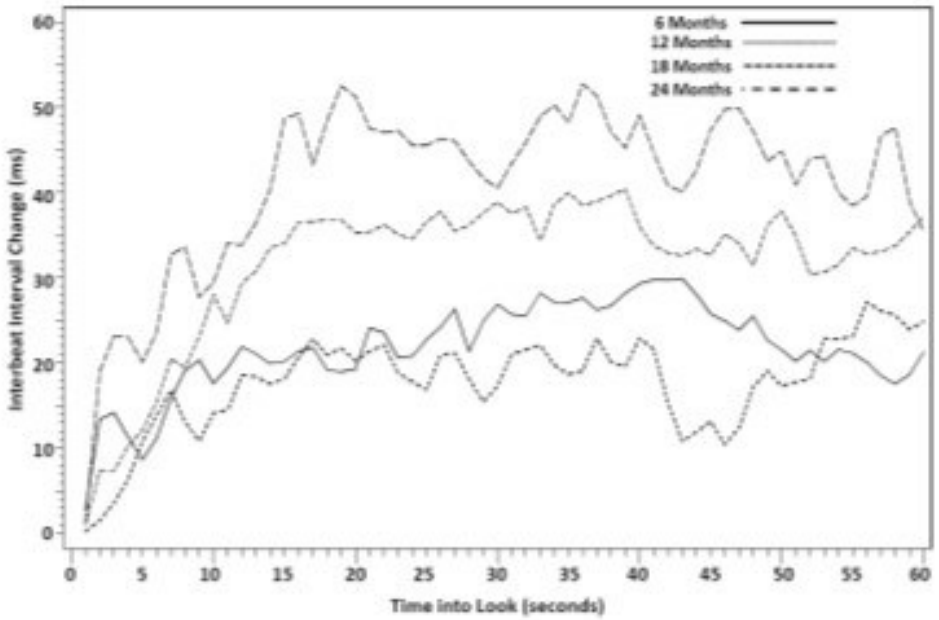
Rachel Keen: The way to the brain is through the heart….



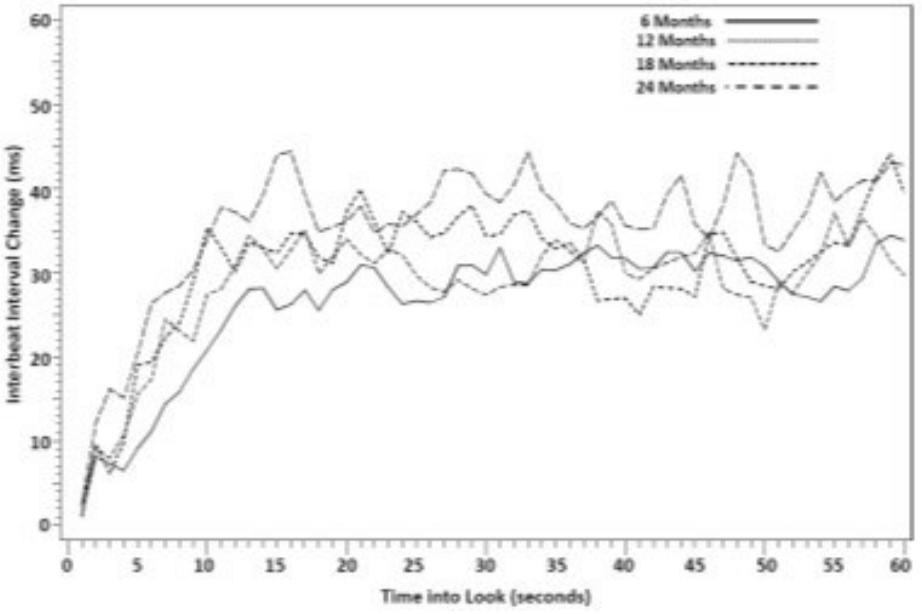
- Heart-rate defined sustained attention: Changes in HR, deceleration is an index of “sustained attention”
- Sustained attention is the period of time in which the infant is engaged in information processing of the stimulus. Many psychological aspects of infant cognition are “energized” by sustained attention.
- My hypothesis is that the HR changes are a real time index of the cholinlergic and/or noradrenergic neurotransmitter systems.
- When attention is engaged these systems flood the brain with neurotransmitters, and several of the information processing systems in the cortex then act more efficiently.

Extended heart rate to video, Teletubbies, normal and distorted

Normal



Distorted



Pempek, Kikorian, Richards, Anderson, Lund, & Stevens, 2010

Development of Attention—Extended fixations and attention through 2 years (review)

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