

9.85 Cognition in Infancy and Early Childhood

Finish Methods -- Perception

Today

- Questions --
 - **Meltzoff and Borton**: What is cross-modal integration and what does it tell us about what the world is like for a baby?
 - **Yellow**: What is perceptual tuning and why is it important?
- Upcoming deadlines -- critical response due in class next session
- 2-page proposal due in class session 9
- Finish methods -- Perception

“What’s it like to be a baby?”

- Babies as Martians
 - Big heads
 - Big eyes
 - Take over our lives
- “Blooming, buzzing confusion”?

Smell

(Borrowed slide -- psych.mcmaster.ca/2e03/PerceptualDevelopmentI.ppt)

Figure removed due to copyright restrictions.

Figure 1 Representative examples of facial expressions of awake newborns exposed to 10 s anise odor stimuli. Schaal, Benoist, Luc Marlier, and Robert Soussignan. "Human Foetuses Learn Odours from their Pregnant Mother's Diet." *Chemical Senses* 25, no. 6 (2000): 729-37.

Taste: Steiner, Glaser, Hawilo & Berridge (2001)

Borrowed slide -- psych.mcmaster.ca/2e03/PerceptualDevelopmentI.ppt)

New World Monkey: Up - Down Protrusion to Sweet Vs. Bitter

Tongue Protrusion

G.-H. Tamarin infant *C.-T. Tamarin infant* *W.T.-E. Marmoset*

Sweet (Up) Up Sweet Up Sweet Infant Hominoid Tongue Protrusions to Sweet

Bitter (Down) Down Bitter Down Bitter Sweet Curl

Orangutan infant *Human newborn*

Gape (to Bitter) **Middle Face (Aversion to Bitter)** **'Smile' (to Sweet)**

Orangutan infant *Human newborn* *Human newborn*

G.-H. Tamarin *Rhesus monkey* Eye squinch & Nose wrinkle

Orangutan *Chimpanzee* Grimace

Orangutan infant *Chimpanzee*

Touch/Smell/Taste

- Tactile stimuli
 - Neonates and pain?
 - Anesthesia in infancy (Anand & Hickey, 1992)
- Sugar and pain
 - facial expressions, much less
 - EEG and spinal cord responses (Sept, 2010, Lancet) identical

Smell

- At five days will turn towards a pad soaked with breast milk.
- At eight days will selectively turn towards mother as opposed to another mom.

Hearing

- Newborns recognize their mother's voice -- suck at rate that will permit hearing mother's voice over alternative.
- Neonatal audition -- Cat in the Hat study (Casper and DeSpence, 1986).
- Recognition even when story read by a stranger.
- Can hear voices at 25 weeks in utero

Hearing

- Preference for
 - the human voice over other sounds of similar pitch and intensity
 - for sounds within the human voice range to sounds outside the human voice range
 - for female voices over male voices
 - (partially because prefer and can hear higher frequency sounds)
 - their own language vs. other languages
 - infant-directed over adult-directed speech
 - **your hearing?**

Serbo-Croatian language phonology

Table removed due to copyright restrictions.

See: http://en.wikipedia.org/wiki/Serbo-Croatian_language#Phonology

Hearing

- Until approximately 8-months of age, infants can hear phonemic distinctions in other languages not present in their own.
- Although acoustic signal is continuous, phonemic distinctions are categorical.
- Brief exposure “keeps the window open” for babies (but only if it’s interactive). Perceptual tuning.
- Also by 9-months prefer “possible” nonsense words in their own language (zw and vl are legal in Dutch not English; English-speaking babies prefer English words).

Hearing

- Infants also develop a sensitivity to prosody -- English-speaking 9-month-olds (but not 6-month-olds) have a preference for **strong/weak** accents (**baby, mommy**) over weak/**strong** on novel words.
- Shows up in music preferences too (Western adults cannot distinguish changes in nonisochronous Balkan rhythms -- Western 12-month-olds can).
- **Balkan music**

Development of visual acuity

Acuity improves rapidly over the first year but children are slightly nearsighted until 3.

How far can a baby see?

Figure removed due to copyright restrictions.

Source: <http://psych.ucalgary.ca/PACE/VA-Lab/Marcela/Pages/page35a.html>.

Acuity at birth
is much worse
than adults'.
(20/800 = what
you see at 800
feet is what
neonates see
at 20 feet)

Contrast sensitivity

Figure removed due to copyright restrictions.

Source: <http://psych.ucalgary.ca/PACE/VA-Lab/Marcela/Pages/page35a.html>.

Smallest detectable difference between light and dark
bars of grating

Color

- newborn: weak (only red vs. white) or color discrimination (Adams, 1989, 1995)
- other colors by 2-3 months (Adams & Courage, 1994; Atkinson, 2000; Teller & Bornstein, 1987)

Marketing boon -- from this ...



Image by MIT OpenCourseWare.



Image by MIT OpenCourseWare.

To this ...

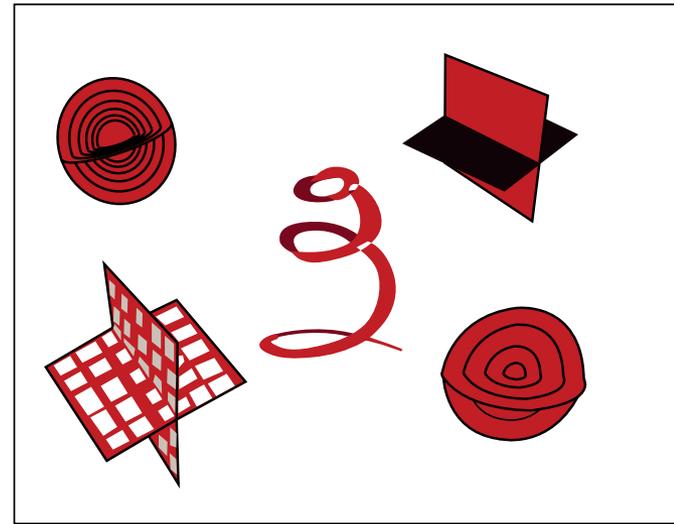


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Color categorization

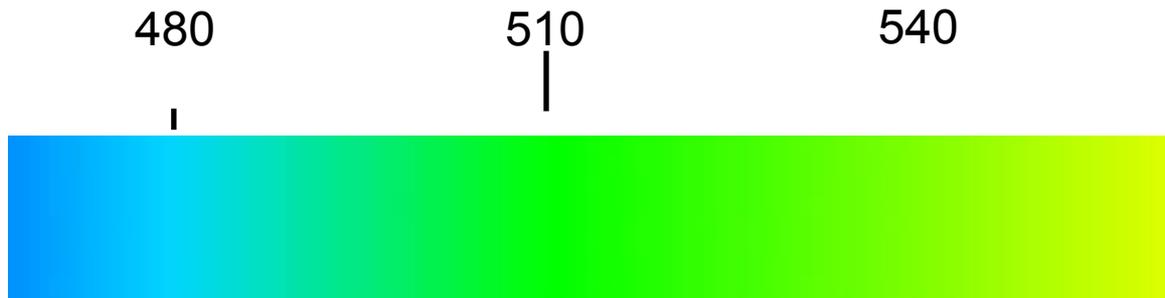


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Infants habituated to 510-nm light

Then either 480-nm or 540-nm light was presented

Dishabituation only occurred for the 480-nm light

4-month-old infants categorize colors like adults do

Bornstein, Kessen, and Weiskopf (1976)

Vision -- form and orientation

- Newborns

Figure removed due to copyright restrictions.
Fig 1.6 in Bremner, Gavin, and Alan Fogel, eds. *Handbook of Infant Development*. Blackwell Publication, 2001. ISBN: 0631212345.

Vision -- form and orientation

Figure removed due to copyright restrictions.
Fig 1.8 in Bremner, Gavin, and Alan Fogel, eds. *Handbook of Infant Development*. Blackwell Publication, 2001. ISBN: 0631212345.

3 -month-olds habituated to L preferred novel vertical lines; to R preferred novel horizontal lines₃₁

Vision -- depth perception

- *“For those of a creationist bent, one could note that God must have loved depth cues, for He made so many of them”* (Yonas & Granrud, 1985, p. 45).

Vision -- depth perception

- *“For those of a creationist bent, one could note that God must have loved depth cues, for He made so many of them”* (Yonas & Granrud, 1985, p. 45). [parallax](#)

Size constancy



Images: United States Mint

Texture gradient



Image: Flickr. [terren in Virginia](#). CC-BY.

Motion parallax

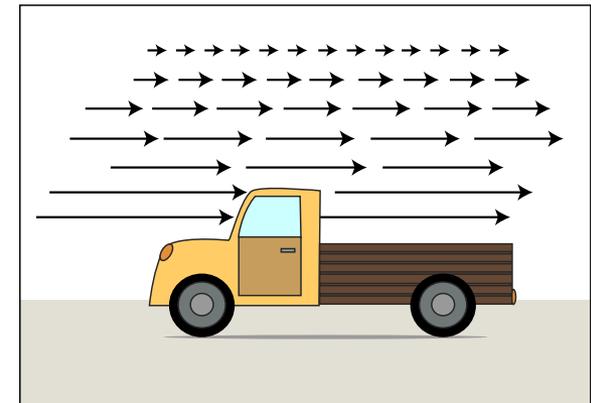
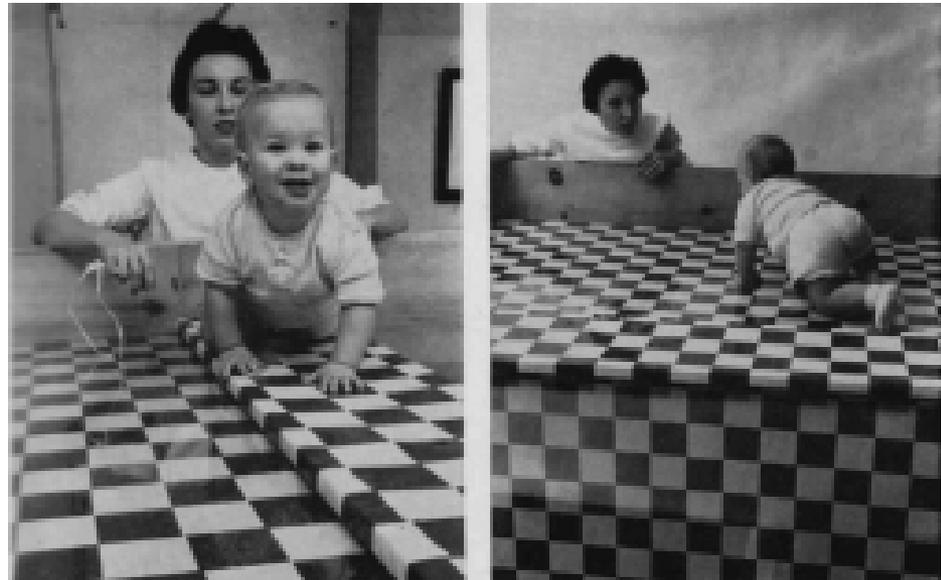


Image by MIT OpenCourseWare.

Depth perception: Infants can use changes in texture gradient, size constancy, motion parallax as depth indicators before 6 months



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Binocularity

Stereopsis -- ability to use the disparity between the eyes as a cue to depth ... to do this, you have to be able to fuse the images from your left and right eye together. Infants can't do this until about 3.5 months.

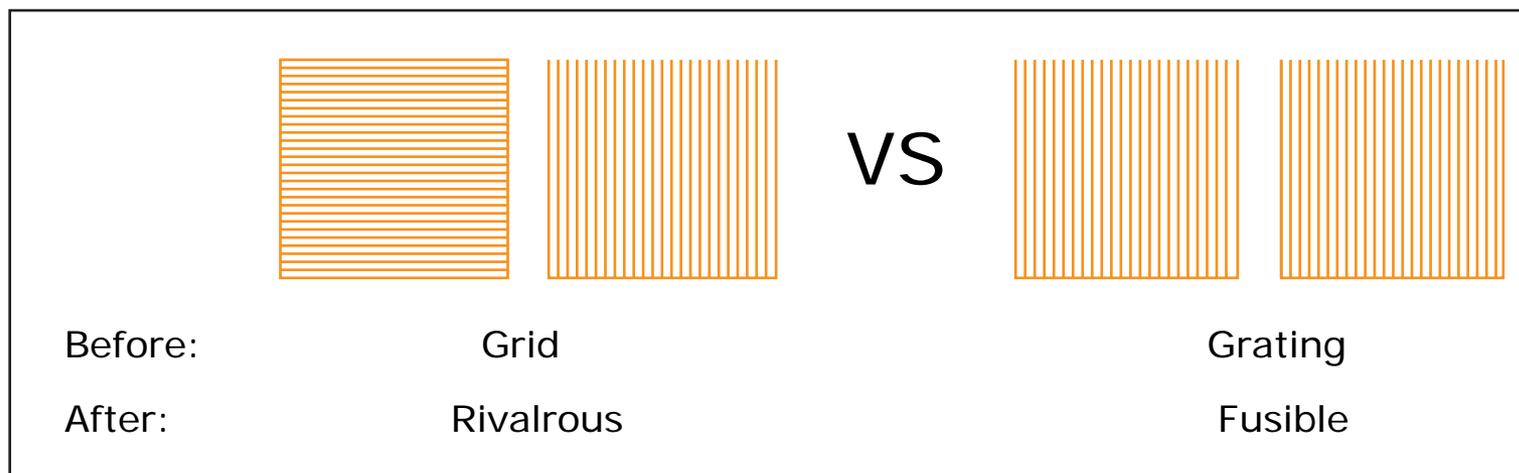


Image by MIT OpenCourseWare. Taken from Shimojo, Shinsuke, Joseph Bauer Jr., Kathleen M. O'Connell, et al. "Pre-stereoptic binocular vision in infants." *Vision Research* 26, no. 3 (1986): 501-510.

Sudden shift from ~100% preference for orthogonal to ~100% preference for parallel at about 3.5 months!

Shimojo, Bauer, O'Connell & Held (1986)

Vision -- depth perception

- Sensitivity to cues like shadows and perspective develops later.
- 7 but not 5-month-olds reached for “nearer” object (with extended shadow) when viewed monocularly.
- 7 but not 5-month olds reached for “nearer” cylinder.

Figure removed due to copyright restrictions. Please see: Fig 1.3. *Handbook of Infant Development*. Edited by Gavin Bremner and Alan Fogel. Blackwell Pubpublication, 2001. ISBN: 0631212345.

Tracking and scanning

- Newborns will track a moving object if it's large enough and moves slowly.
- Newborns begin by scanning the edges of things -- older older infants will track details.

Figure removed due to copyright restrictions.

Figure 5.6. Fogel, Alan, and Gail Melson. "Facial Scanning Patterns." *Child Development: Individual, Family, and Society*. West Publishing Company, 1988, p. 158. ISBN: 0314258698.

* Recognition

Figure removed due to copyright restrictions.

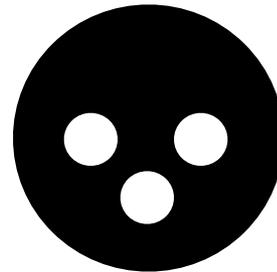
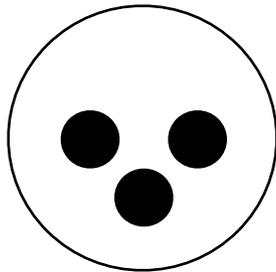
4 day old infants reliably preferred mother's face when all information was present (Pascalis, 1995).

0-4 mo: unable to make this discrimination if mother wears a scarf around her head.

Older: can recognize mother using interior features only.

Preference for faces? Or preference for face-like stimuli?

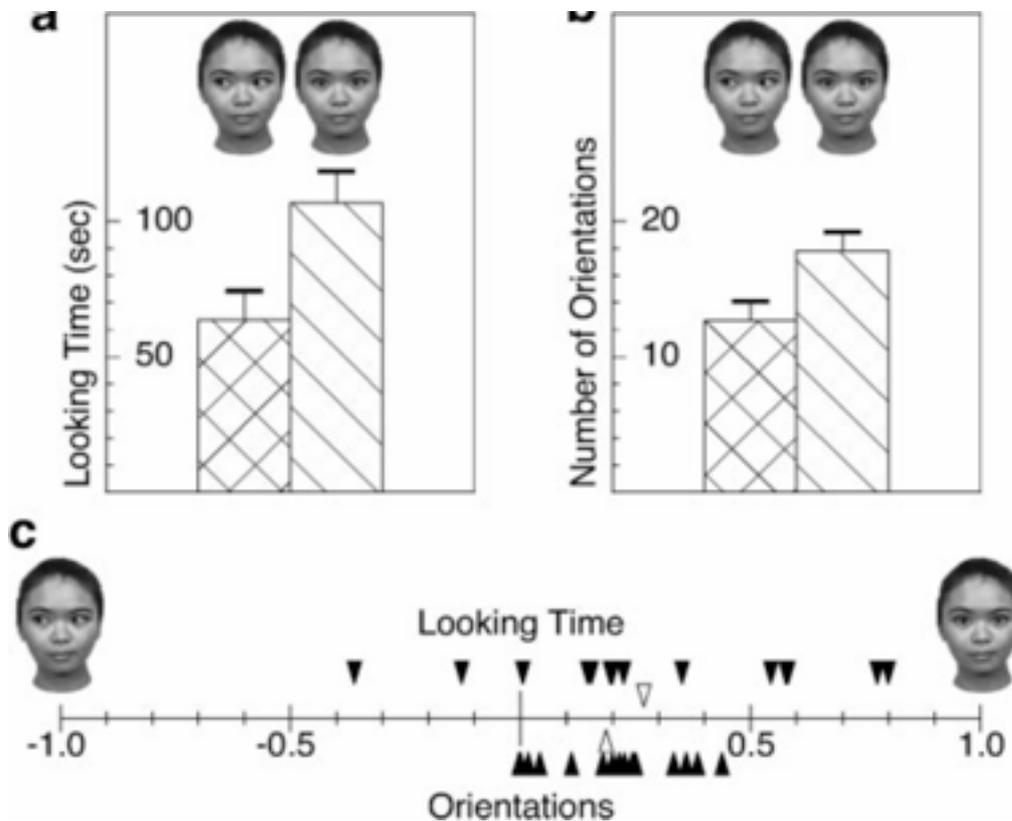
- Newborns look longer at faces than non-faces (including scrambled faces).
- Direction of contrast matters



*Face Tracking by Newborns

Figure removed due to copyright restrictions. Turati, C., F. Simion, et al. "Newborns' Preference for Faces: What is Crucial?" *Developmental Psychology* 38 (2002): 875-82.

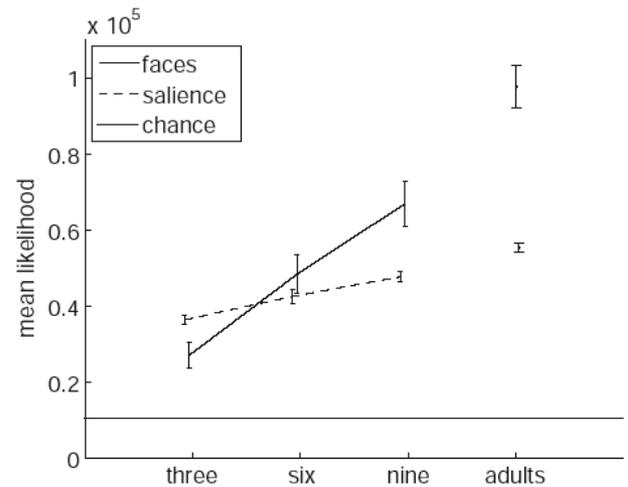
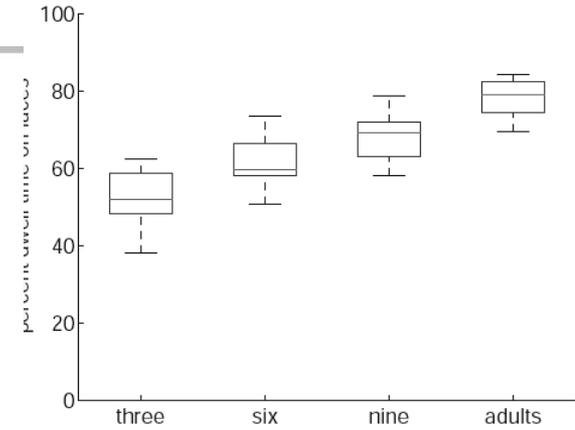
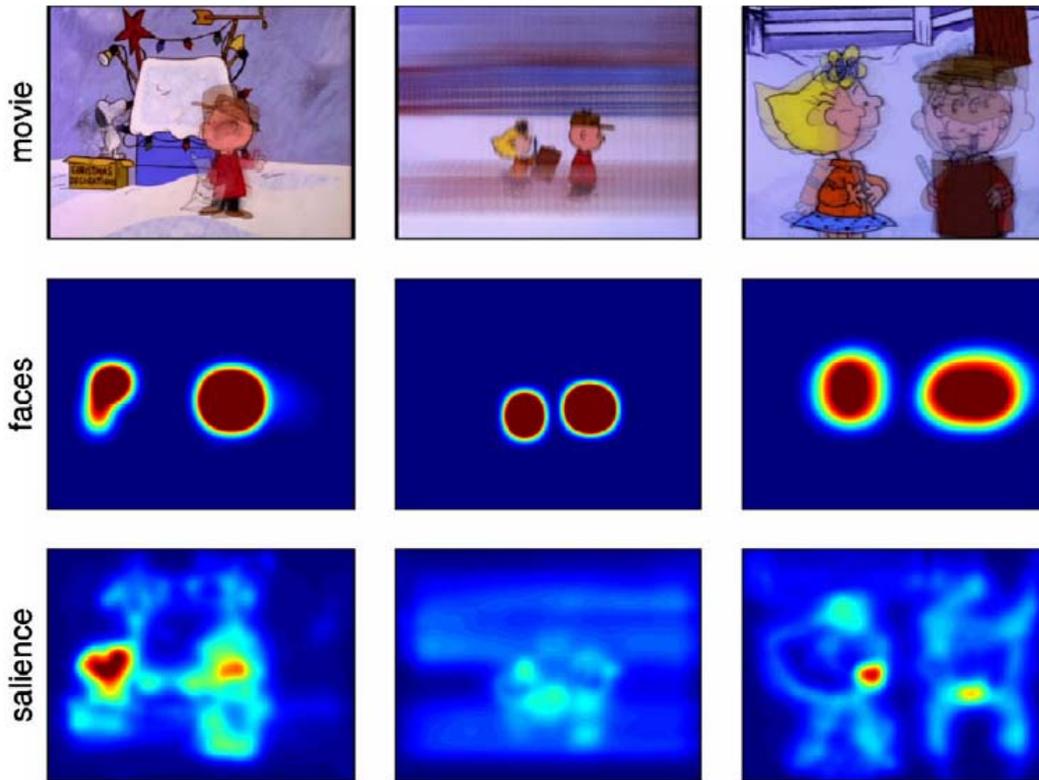
Nonetheless, infant detect subtle differences in eye direction at birth



Farroni et al., 2002

But don't try this at home ...

M.C. Frank et al. / Cognition xxx (2008) xxx-xxx



Vision -- faces

Adults and 9-month olds distinguished only individual human faces

Six-month-olds distinguished individual primate faces.

“Perceptual tuning”

Pascalis, et al., 2002 Science

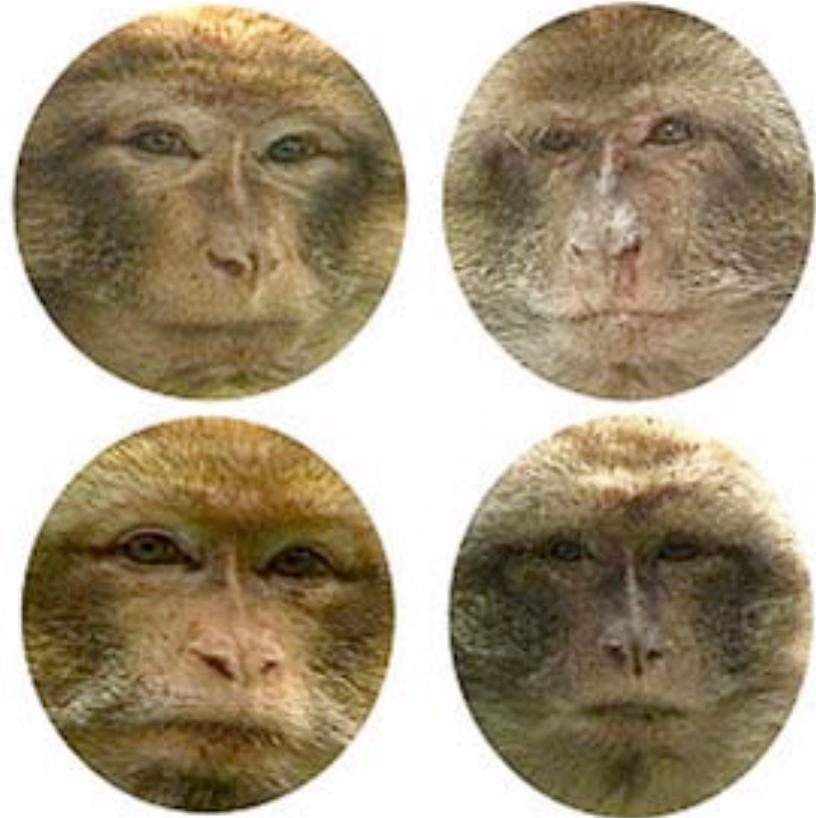


Fig 1. Pascalis O, Scott LS, et al. "Plasticity of Face Processing in Infancy." *Proceedings of the National Academy Science* 102, no. 14 (2005): 5297-300. Epub 2005 Mar 24. Copyright 2005 National Academy of Sciences, U.S.A. Used with permission.

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