

Vocal and Visual Communication

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Origin of Language



A Royal Question

„Are human beings – when solely relying on their natural abilities – able to invent speech? And by which means would they be able to achieve such an invention?“

Royal Academy of Science,
Berlin 1769



Origin of Language



„Where else would an investigation begin if not with an inquiry into the differences between the animals and man?“

Johann Gottfried Herder, 1772

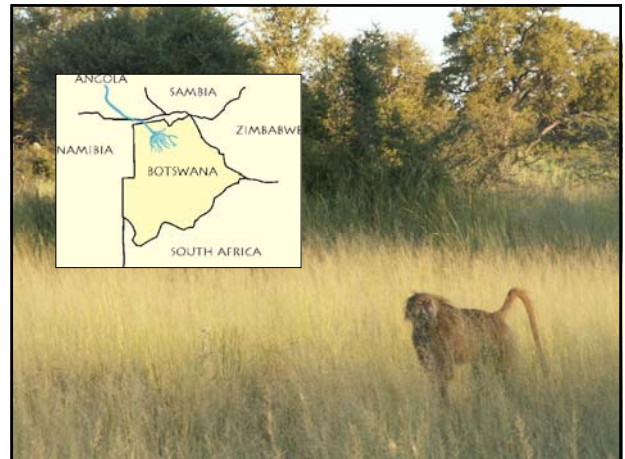
Reconstruction



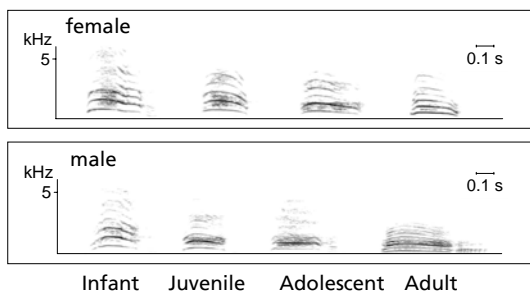
Issues

- Semantics (Referential Signaling)
- Arbitrary Sound-Meaning Relationship
- Syntax
- Displacement in Space and Time
- Learning
 - Sound production
 - Sound comprehension

Sound Production

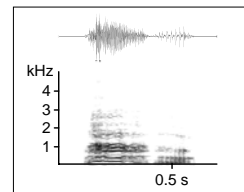


Development of Acoustic Structure

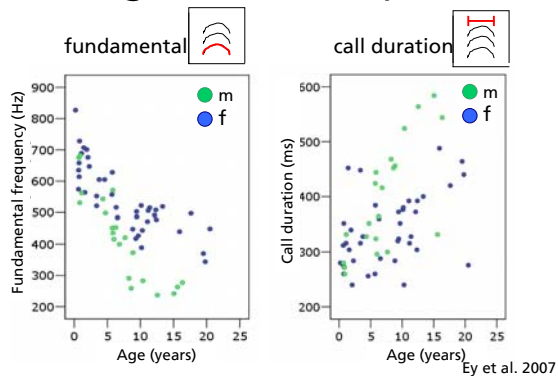


Acoustic Analysis

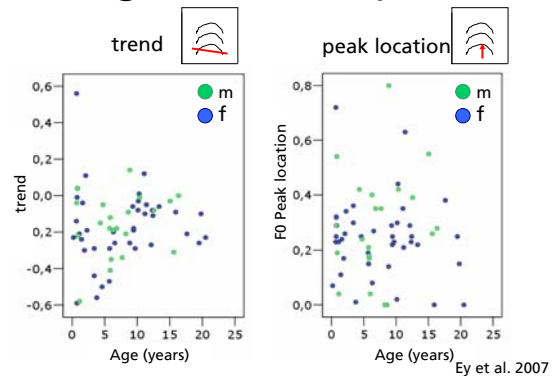
1. Digitize
2. FFT
3. Acoustic variables
 - Fundamental frequency
 - Call duration
 - Modulation
 - Tonality
 -
4. Statistical Analysis



Ontogenetic Development



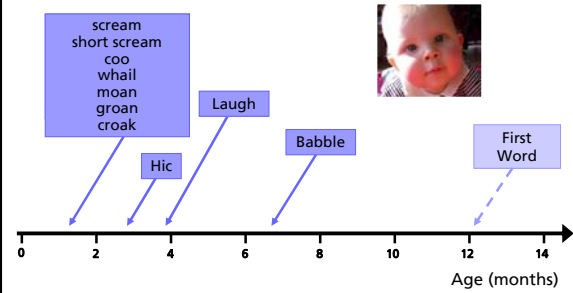
Ontogenetic Development



Ontogenetic Development

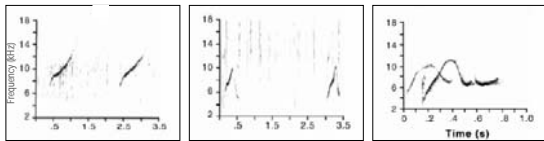
- Call structure genetically determined
- Variation with size and hormonal status
- Neurobiological Control
 - No voluntary control over vocal behaviour
 - Only onset and possibly call duration can be altered
 - No imitation

Development



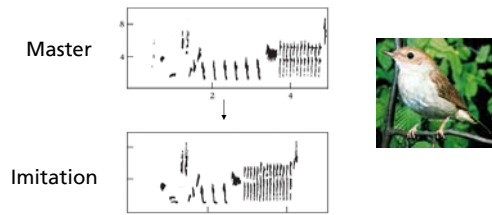
from Scheiner 2004

„whistle matching“ in dolphins



Janik 2000

Song learning



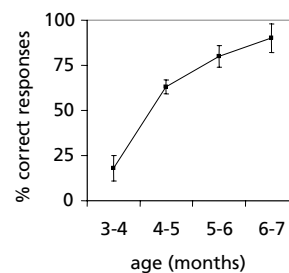
Todt & Hultsch

Production - Comprehension



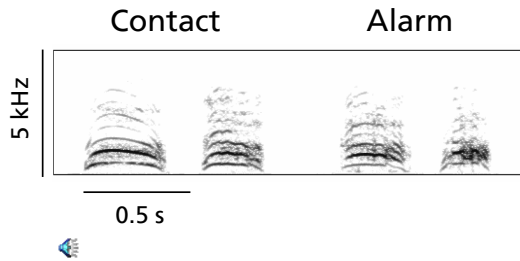
Ontogenetic Development

Infant vervet monkey responses to alarm calls



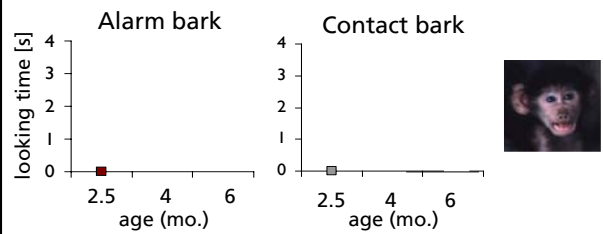
Seyfarth & Cheney 1986

Chacma Baboon Barks



Ontogenic Development

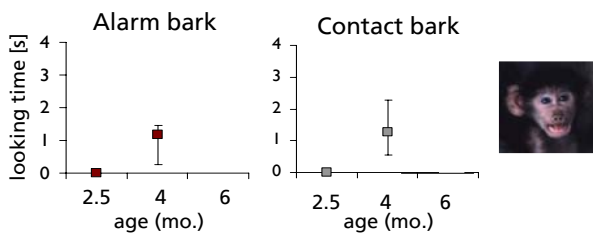
Infant baboon responses



Fischer et al. 2000

Ontogenic Development

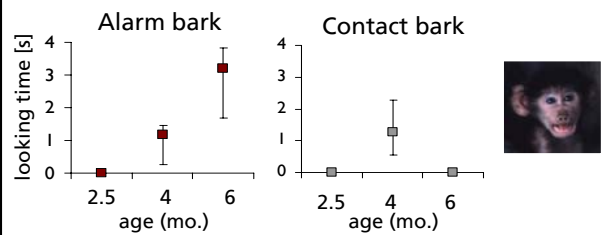
Infant baboon responses



Fischer et al. 2000

Ontogenic Development

Infant baboon responses



Fischer et al. 2000

Early call discrimination

- previous studies: infants competent at 6 mo.
- ‚cognitive watershed‘ or demanding task?
- test individual recognition
- Barbary macaque infants are off mothers from early age on



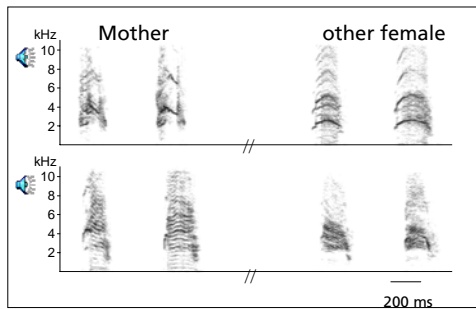
Fischer 2004

Study Site

„La Forêt des Singes“ at Rocamadour, France

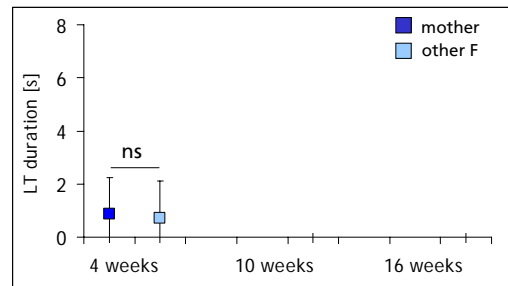


Playback-Stimuli



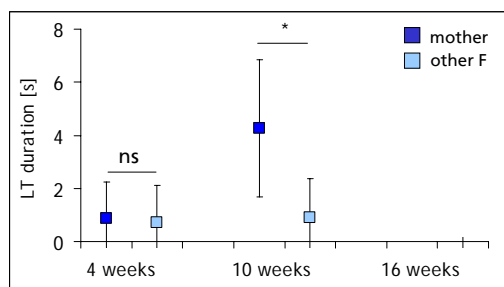
Maternal calls were used as controls for other infants

Development of responses



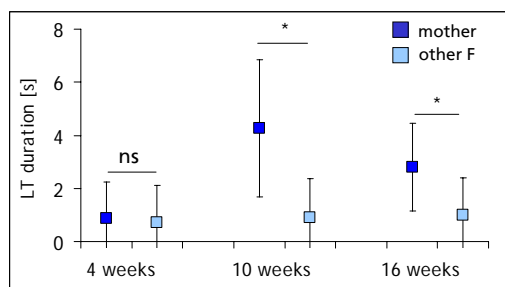
Fischer 2004

Development of responses



Fischer 2004

Development of responses



Fischer 2004

Summary Comprehension

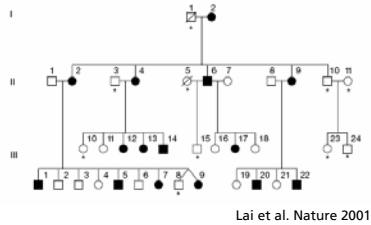
- 2-step process
 - attend
 - discriminate
- Both maturation and learning play a role
- Type of call and experience important
- Referential signaling: listener does all the work
- Open ended
- Shared with other taxa, e.g. dogs
- Sounds important source of information for survival

Conclusion

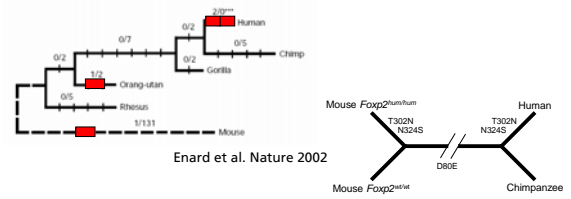
- Vocal production in nonhuman primates (and many other mammals) constrained
- Dichotomy despite strong links between perception and production systems
- Challenge to understand constraints as well as natural selection pressures
- Possible constraints
 - FOXP2?
 - Social cognition

Identification of the FOXP2-Gene

- KE Family (3 generations)
- More than half of the members have severe deficits in language production



Molecular Evolution FOXP2 Gene



- Construction of mice with FOXP2^{hum} variant
- Assess vocal behaviour – compare it to wildtype and heterozygous individuals
- With Enard, Pääbo, Hammerschmidt et al.

Social Cognition?



- 10 min break