

Aspects of laughter

- **Humour, sarcasm, irony**

privilege to adolescents and adults

**children and animals have no sense of
humour**

.....

- **acoustic aspects of laughter (vocal timbre)**

- **evolutionary aspects of laughter**

Pathological laughter:

- Pseudobulbar affect

Spontaneous and enduring burst of laughter (and crying) caused by neural degeneration in **cortico-subcortical** motor pathways

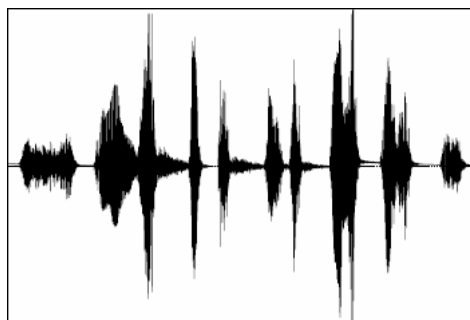
Electrocortical stimulation:

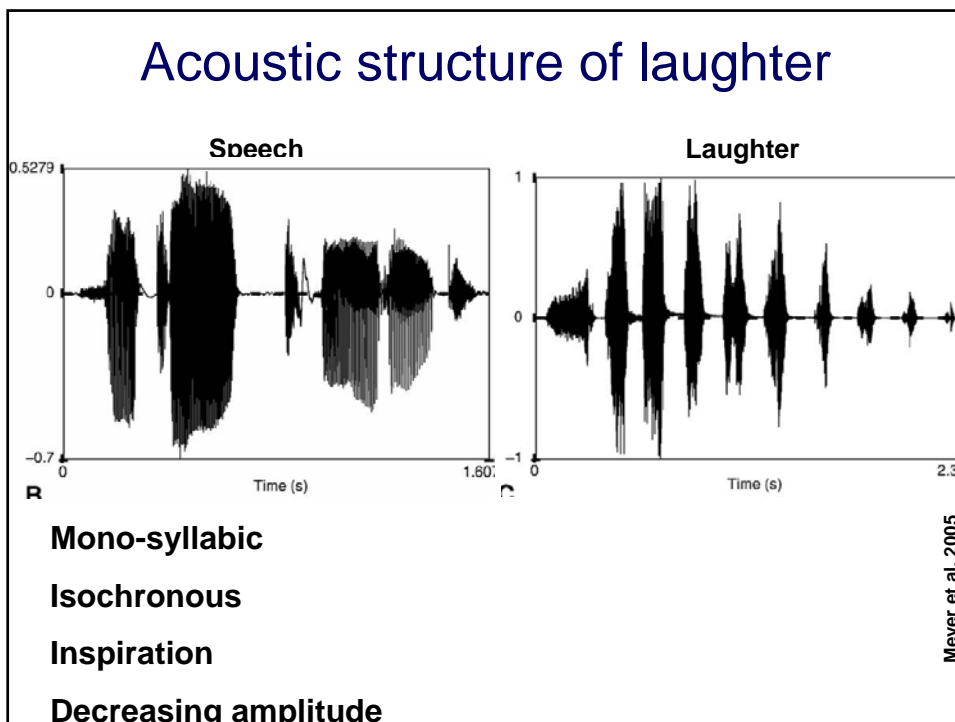
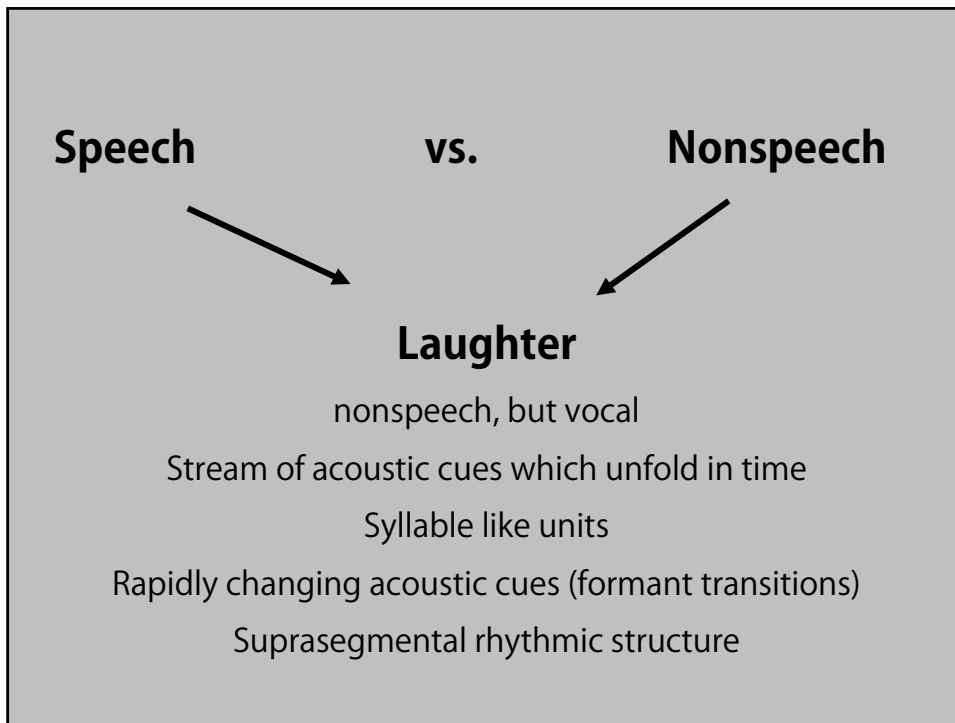
Fried et al. (1998): one patient, peri-surgical stimulation of **supplementary-motor area**

There is no „centre of laughter“ in the brain

Laughter: Definition & Function

- Affective loaded stimulus
- social function for interactive communication
- Simple acoustic structure comprising vocal and rhythmical information





fMRI study

Nonvocal sounds => initial steps of auditory analysis

Laughter

Rhythm (Isochrony)

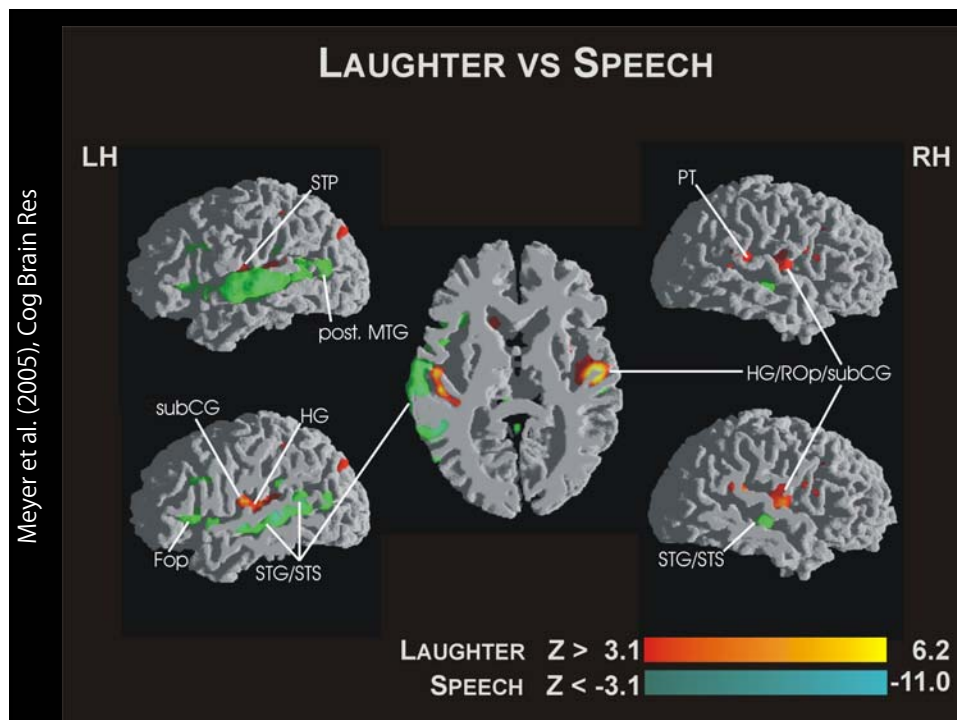
Vocal timbre but no linguistic processing

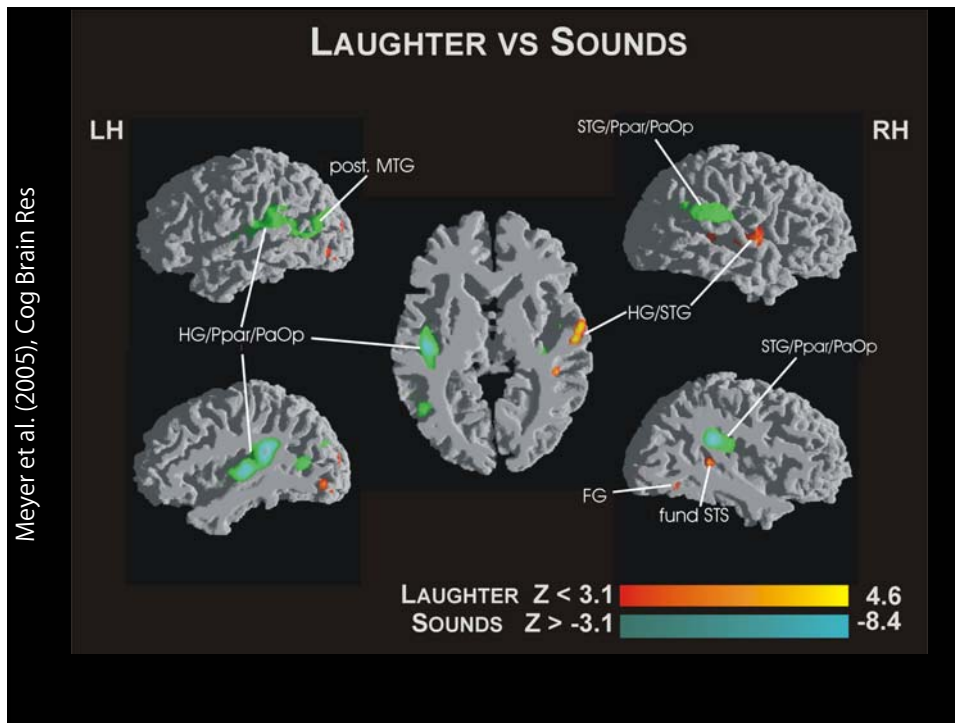
~right perisylvian cortex

Fluent Speech

=> complex linguistic analysis

~left perisylvian cortex





Results:

Laughter:
peri-auditory (pSTG):
acoustic and vocal suprasegmental cues

somatosensory (subCG): chest vibrations
premotor (ROP): laryngeal control

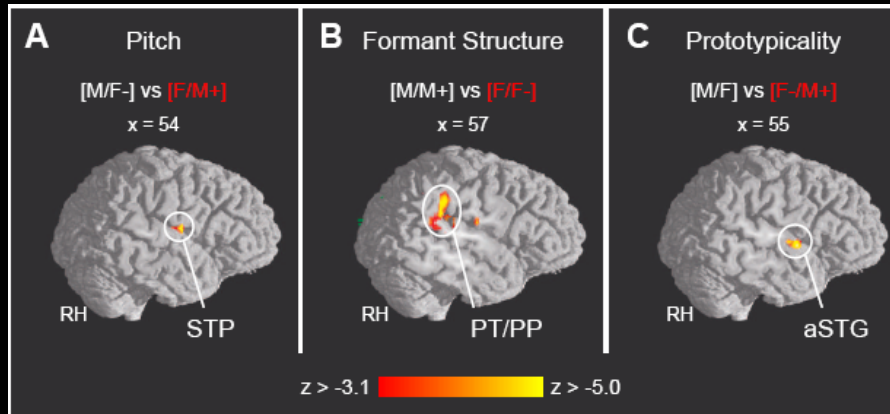
Predominantly in the **right hemisphere**

Perception of laughter = **no „emotional“ responses !!**

Laughter => fusiform gyrus (**imagery of faces**)

Laughter is „contagious“ (overlap between perceptive and expressive circuits)

Sex, voice and the right hemisphere



Lattner, Meyer, Friederici (2005), Hum Brain Mapp

Rhythmical perception during auditory processing

Metric sentences

Die Grute tiemt die friese Triefel.

x |X x| |X x| |X x| |X x|

= jamb

Fleimern wird die pseute Graste?

X x| |X x| |X x| |X x|

= trochee

Der klüsige Flister beliesert den Fretale.

x | X x x| |X x x| |X x x| |X x x|

= dactyl

Non-metric sentences (e.g.)

Die Hirkeit kangt den leden Dolkiler?

x X x |X x |X x |X x x

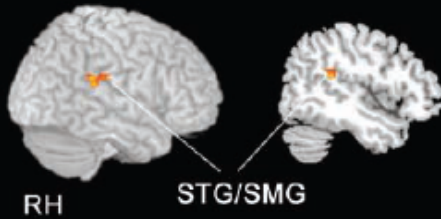
Das Sumpol horbert die fombige Psautheit.

x X x | X x x |X x x |X x

Rhythm and speech

Metrical vs. nonmetrical sentences

A Explicit processing



Right posterior auditory cortex

Geiser, Zaehle, Jancke, Meyer (2008), J Cog Neurosci

Vocalization in apes and monkeys

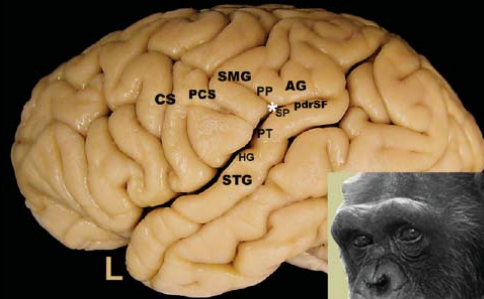
Macroscopic Neuroanatomy

Vocal apparatus

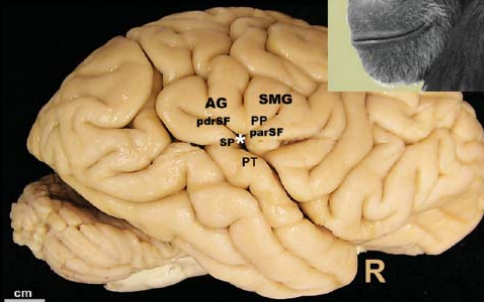
Rhythm



Comparable anatomy of perisylvian cortex

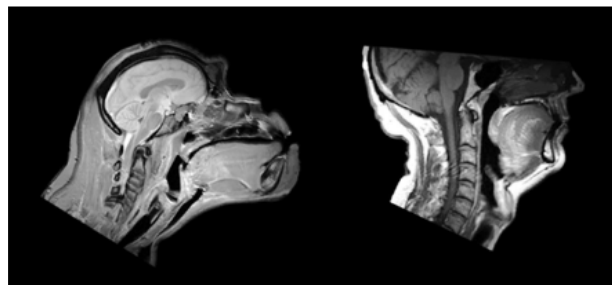


Leftward macroscopic asymmetry of frontal operculum and Sylvian fissure

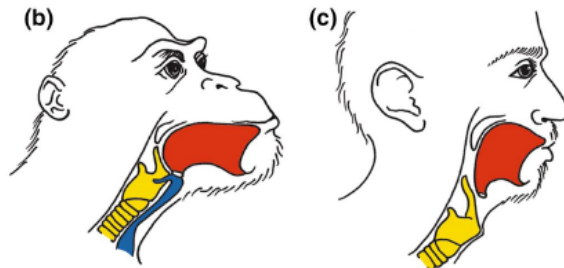


Descent of larynx in man

Apes have „human-like“ larynx suitable for production of „laughter-like“ vocalizations.



Vocal tract is different (no expression of vowels)



Vocalization in apes and monkeys

Macroscopic
Neuroanatomy

Vocal apparatus

Limited understanding of
intonational patterns

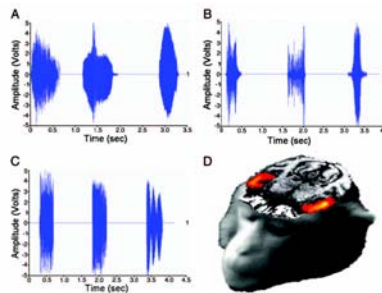
No sense of music



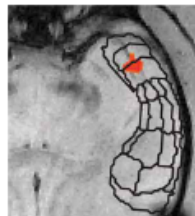
www.utsc.utoronto.ca/petito/ape.html

Monkey Brain Imaging

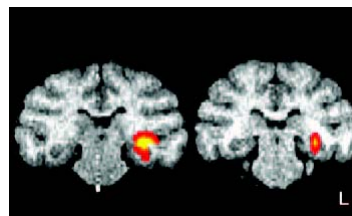
- Bilateral supratemporal plane > species-specific calls
- No clear lateralization
- Voice-sensitive area
(Petkov et al. 2008)
- Sensitive to voices of individuals (cortex) and to affective load (subcortical limbic system)



Gil-da-Costa et al. 2004

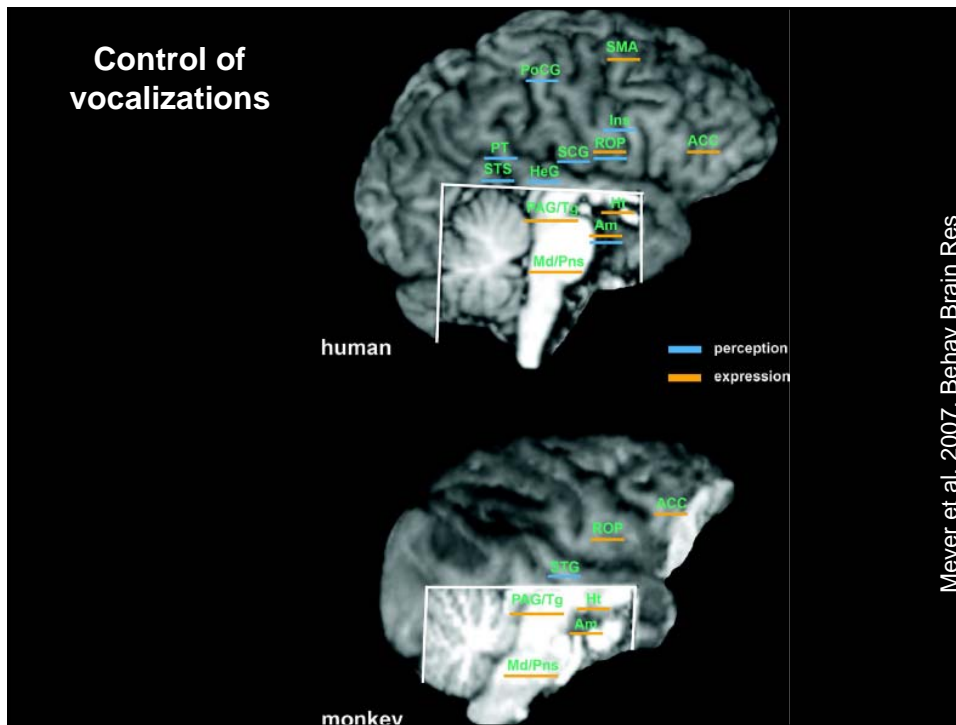


Monkey #1 n = 189 trials



Petkov et al. 2008

Gil-da-Costa et al. 2004



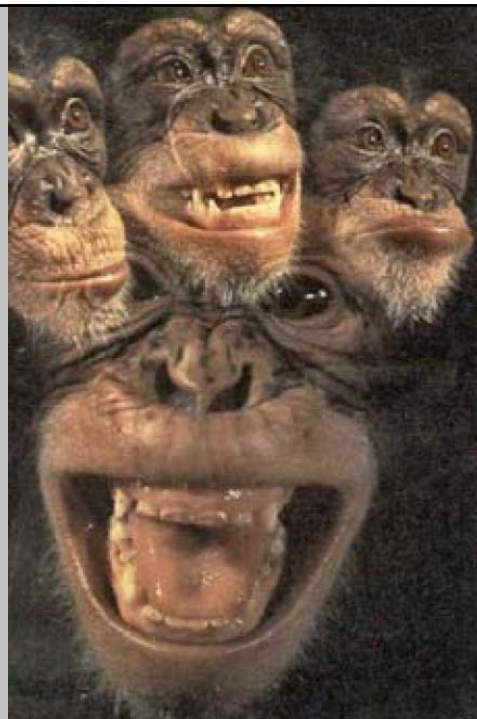
... there is monkey laughter ???

- Darwin described „laughing-like“ vocalization in chimps

- 80% of human laughter not related to humour but social control

- Apes' grin face similar to human grin face

- open mouth, reitering vocalization, bare teeth



With courtesy of Jürg Kesselring

The nonacoustic aspects of laughter

- **Theory of affect induction** (Owren & Bachorowski 2003):
 - Manipulation of affect, arousal and attention of social partners
 - preferred behavioural pattern of subdominant individuals
 - facilitates social cooperation, communication and attachment

„Laughing“ in nonhuman primates

- Van Hooff (1972): Relation between vocal and facial expression, similar to humans

Origin of laughter =>
aggressive postures
(initiation and
coordination of attack)



- „**grin face**“ => analog of human smiling
- Observed in subdominant apes as disarming strategy
- => evolutionary ancestral device of human laughter.

Summary

- Evidence for affectively loaded vocal communication in humans and apes

Humans => under cortical control

Apes and monkeys => primarily under subcortical control

- „**Grin face**“ => Application in socially similar contexts and are considered to support similar (identical) purposes.
- Apes are proficient in identifying **rhythm** in human speech and **vocal timbre** and species-specific calls
- Perisylvian architecture and laryngeal tract similar to human anatomy

- **Why do humans laugh**
- **(while apes do not) ?**

Evolution of language and handedness

(accompanying and replacing oro-facial, brachio-manual gestures)

complex **frontal lobe system**

(neural basis for social control)

mirror neuron system

(neural basis for the emergence of dialogue based communication)