Origins and Evolution of Language
Week 3: Intention and structure in animal communication

Kenny Smith

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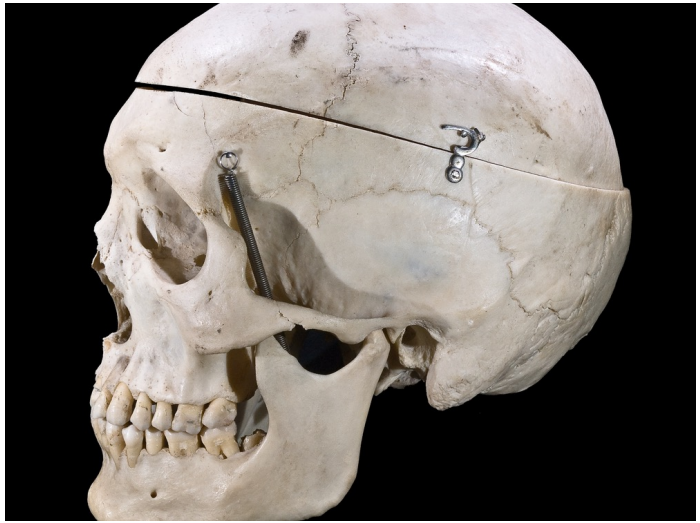
Strike dates

February: 1st, 9th, 10th, 14th, 15th, 16th, *21st, 22nd, 23rd*, 27th, 28th
March: 1st, 2nd, 16th, 17th, 20th, 21st, 22nd

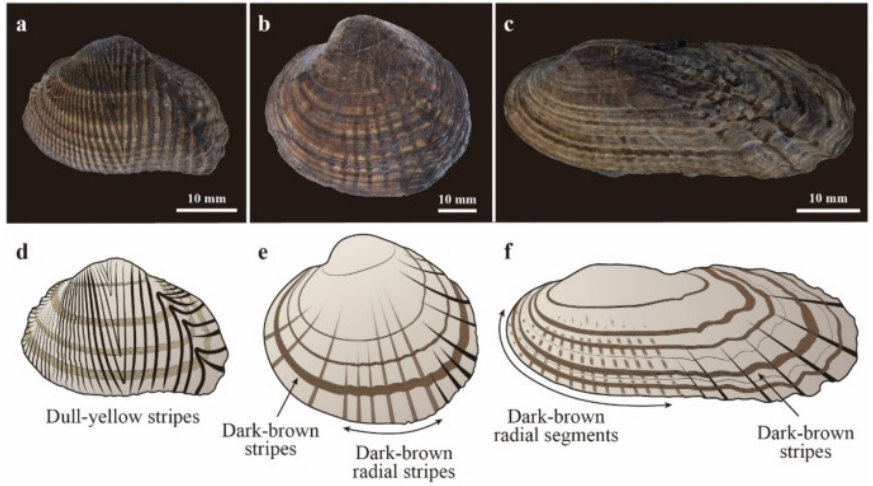
Week 3: Wednesday
Week 4: Thursday, Friday
Week 5: Tuesday, Wednesday, Thursday
(Flexible learning week: Tuesday, Wednesday, Thursday)
Week 6: Monday*, Tuesday, Wednesday, Thursday
Week 7: No strikes
Week 8: Thursday, Friday
Week 9: Monday, Tuesday, Wednesday
Week 10: No strikes

Red = missing lecture Blue = missing tutorial

From last week: example of spandrels



https://www.smithsonianmag.com/smart-news/chin-stroking-mystery-why-are-humans-ony-animals-with-chins-180957997/

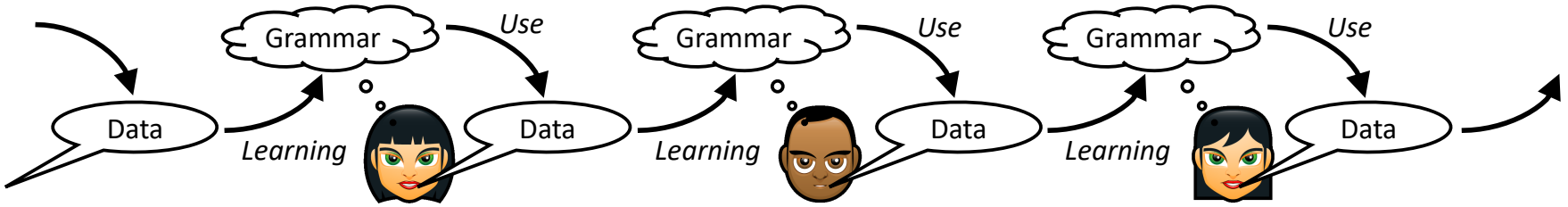


Example from Gould, S. J., & Lewontin, R. C. (1979). The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme. *Proceedings of the Royal Society of London B, 205,* 581-598.

Plan for today

- Brief summary of Fitch chapter 4
- Spotlight on **intentional** communication in primates
- Spotlight on **structure** in primates and birds
- Spotlight on **learned communication** in primates and birds

Reminder: Learning, use, and language design



- Language is passed from person to person by **learning**
- People learn from language as it is **used in communication**
- Language **evolves** in response to its learning and use
- Structure allows language to learnable yet communicatively powerful

Rather than us being adapted for language, language has adapted to us

Reminder: What's required for this to happen?

Social learning,
vocal learning

Mitteilungsbedürfnis
and mindreading

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Social learning,
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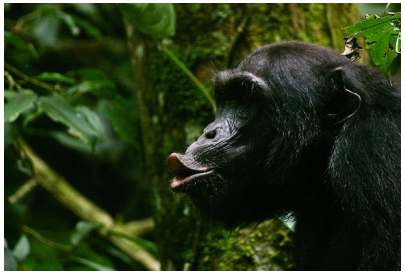
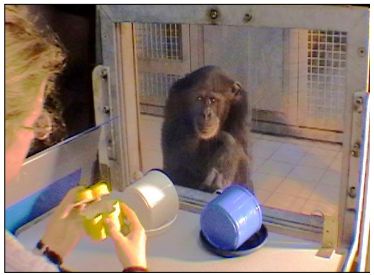
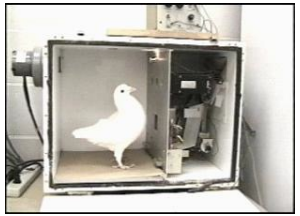


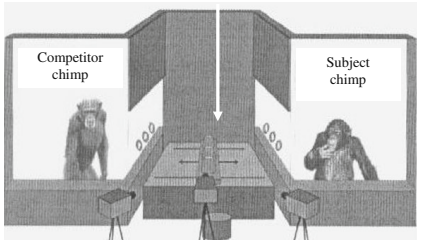


Summary of Fitch Chapter 4

Non-humans have rich mental lives…

- Concepts and categories
- Memory and planning
- Hierarchically-structured behaviours
- Tool use
- Knowing what others know
- …





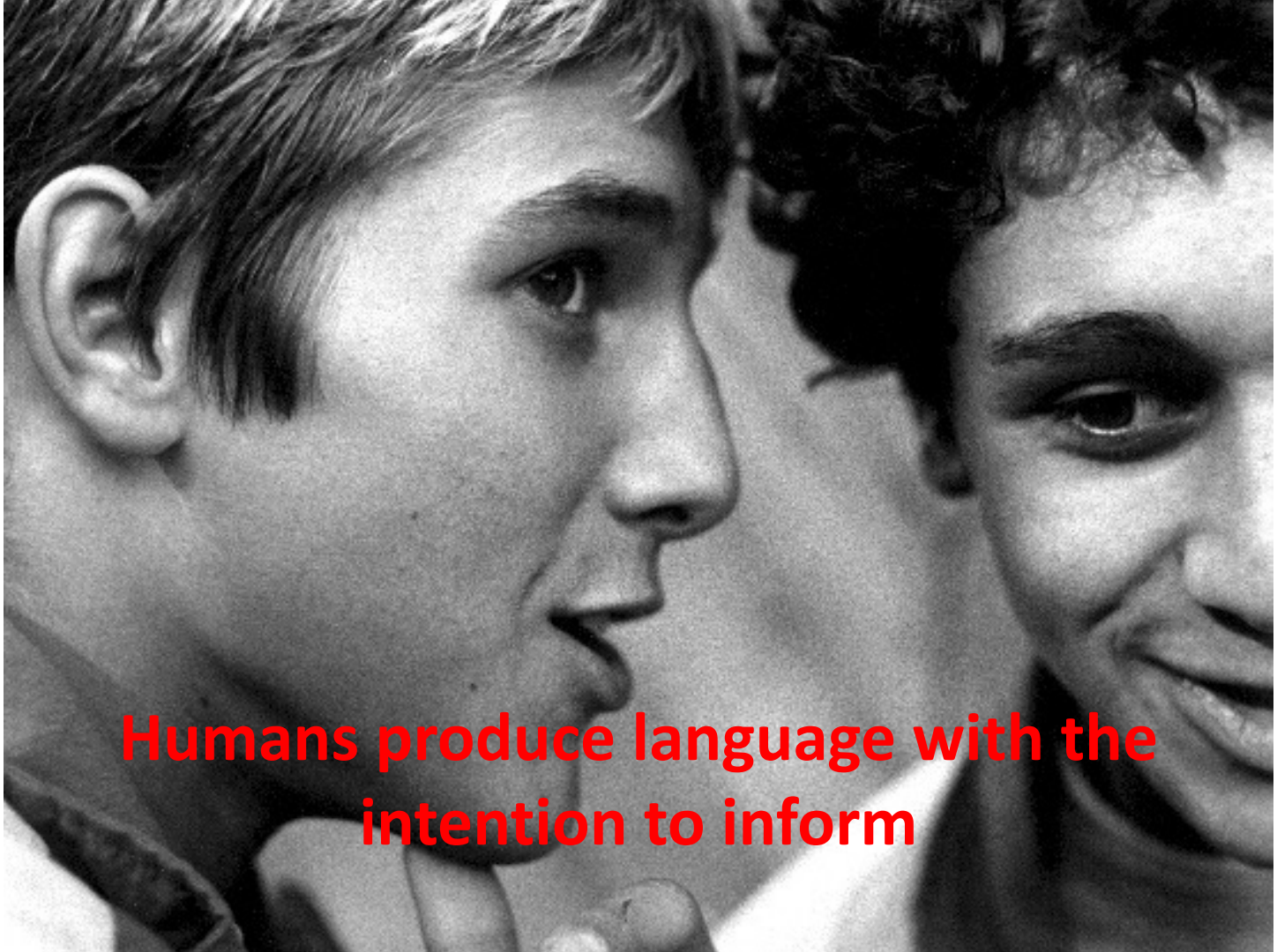
Alex the parrot

Pepperberg, I. M. (2000). *The Alex Studies: Cognitive and Communicative Abilities of Grey Parrots*. Boston, MA: Harvard University Press

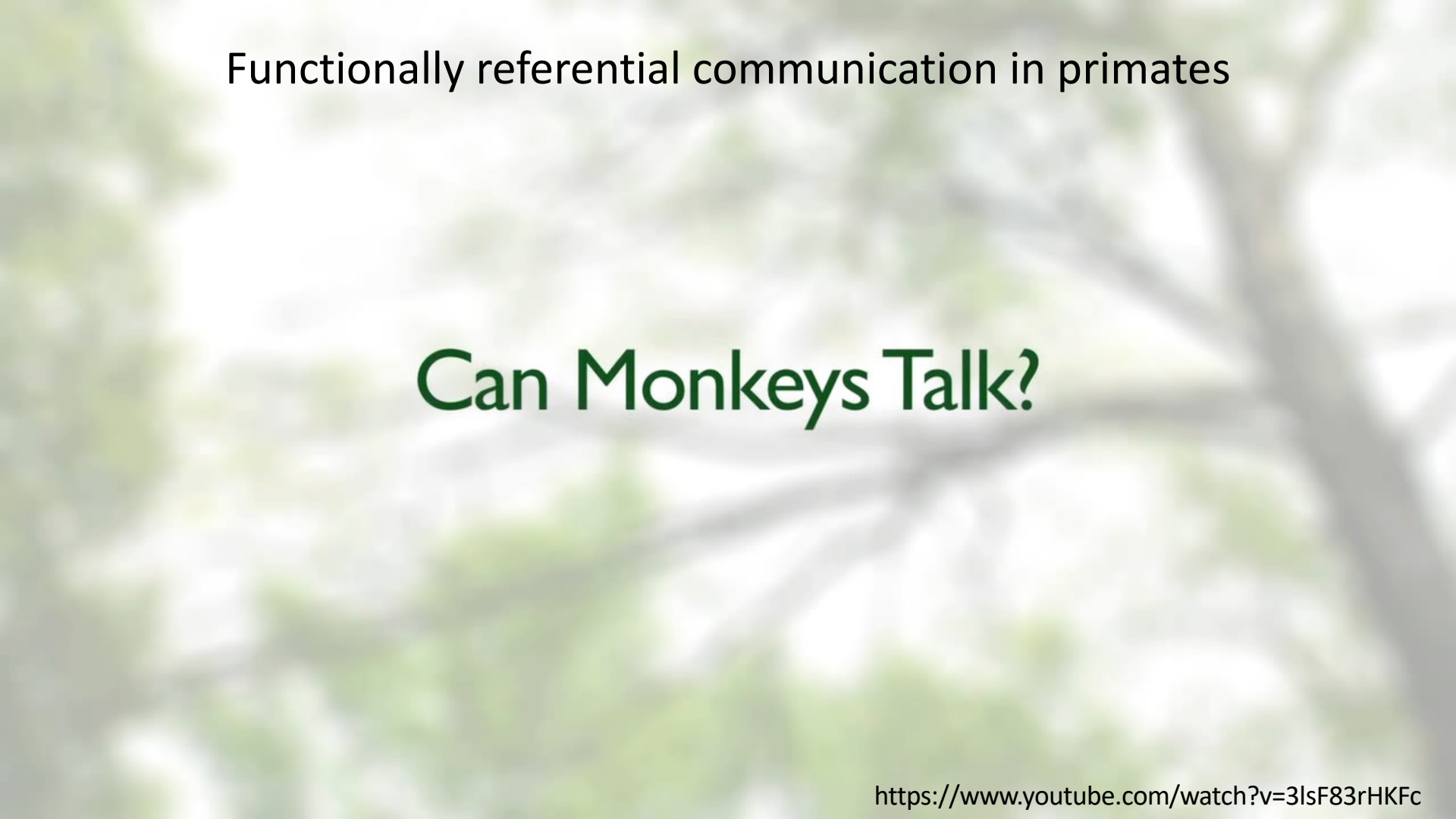
…but their communication systems seem *relatively* restricted

- ‘Innate’ signal repertoires
  - Particularly among primates
  - But see this week’s tutorial, and later today
- Functionally referential
  - But not intentional (?)
- Complex vocalisations
  - But not in primates
  - And not subserving meaning

Intentional communication in primates


Humans produce language with the intention to inform

Functionally referential communication in primates



https://www.youtube.com/watch?v=3lsF83rHKFc

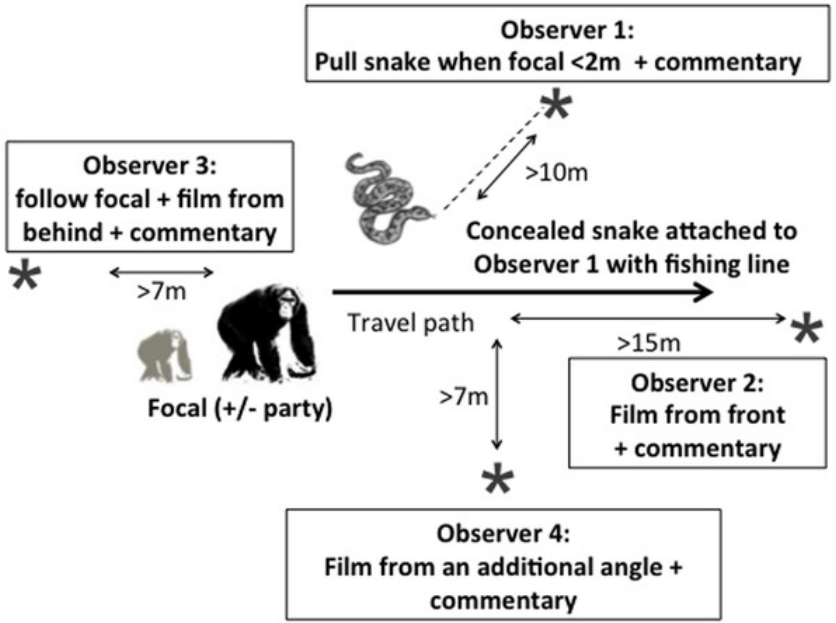
Absence of intentional communication in macaques?

- Mothers and infants
- **Ignorance condition**: Mother knows something, infant doesn't
  - Presence of food, predator
- **Knowledge condition:** They both know it
- **Mothers' vocalizations didn't differ between conditions**

Cheney, D., & Seyfarth, R. (1990). Attending to behaviour versus attending to knowledge: examining monkeys' attribution of mental states. *Animal Behavior, 40,* 742-753.

Intentional communication in chimpanzees?

- Wild chimps
- Surprised with snake model, either alone or in part of group
  - Presence of others matters?
  - Gaze-alternation?
  - Persist until others safe?



Schel, A. M., Townsend, S. W., Machanda, Z., Zuberbühler, K., & Slocombe, K. E. (2013) Chimpanzee Alarm Call Production Meets Key Criteria for Intentionality. *PLoS ONE, 8*, e76674

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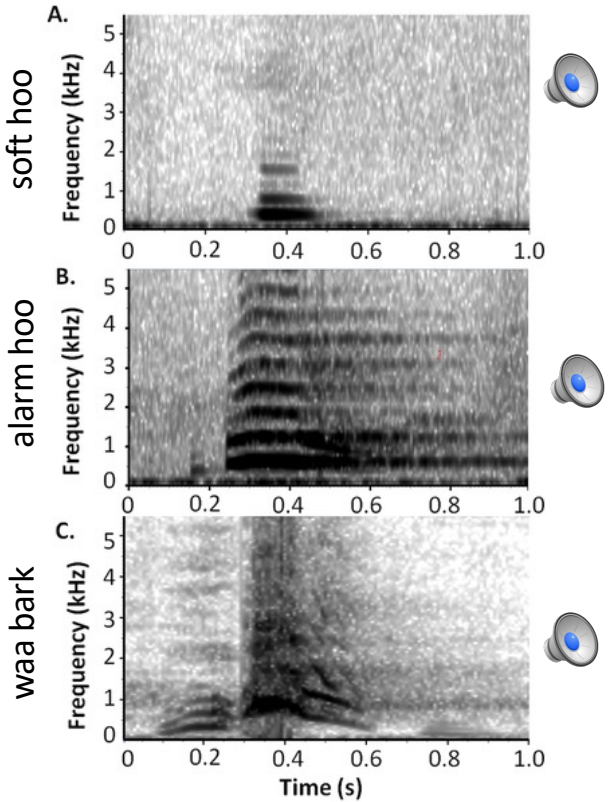

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Structure in primate and avian communication

Learning in primate and avian communication

Reminder: structure in language

Inventory of meaningless units (10s)

p t d s ð k g ɔ ə a …

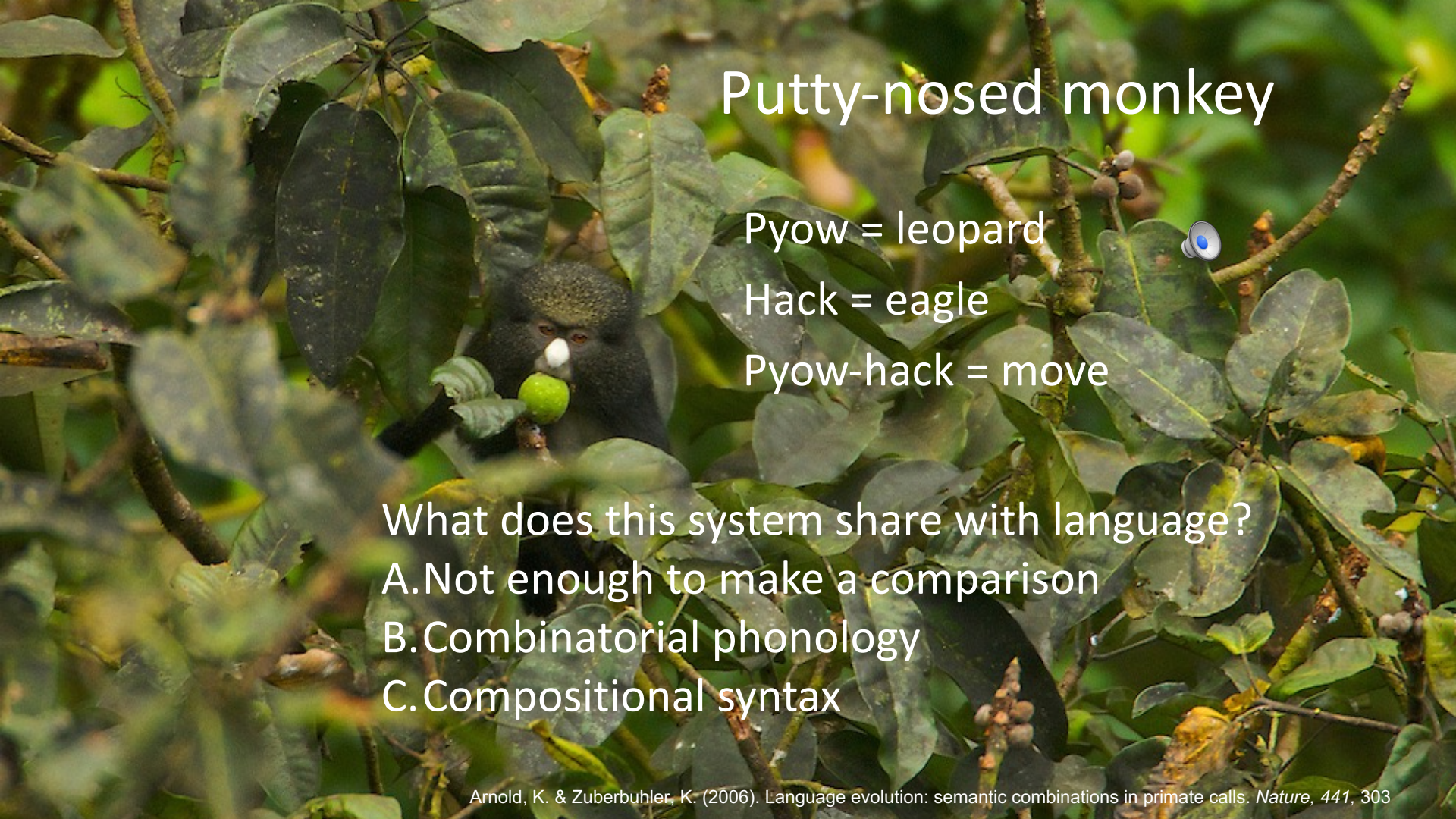
Inventory of meaningful units (1000s)

ə	ðə	-əd	dɔg	kat	ðat	spɔt	…
(a)	*(the)*	*(past tense)*	*(dog)*	***(cat)***	*(that)*	*(spot)*	

Inventory of meaningful sentences (∞)

the cat spotted the dog
a dog spotted the cat
a cat spotted the dog
the dog spotted the cat
the cat spotted the cat that spotted a dog
the dog spotted the cat that spotted the dog
…

Song in gibbons



Putty-nosed monkey

Pyow = leopard

Hack = eagle

Pyow-hack = move

What does this system share with language?

A. Not enough to make a comparison

B. Combinatorial phonology

C. Compositional syntax

Arnold, K. & Zuberbuhler, K. (2006). Language evolution: semantic combinations in primate calls. *Nature, 441,* 303

Campbell's monkey

Leopard alarm

Eagle alarm

Boom = not urgent

What does this system share with language?

A. Not enough to make a comparison

B. Combinatorial phonology

C. Compositional syntax

Zuberbühler K (2002) A syntactic rule in forest monkey communication. *Animal Behaviour, 63*, 293–299.

Southern pied babblers

Alert call

Recruitment call

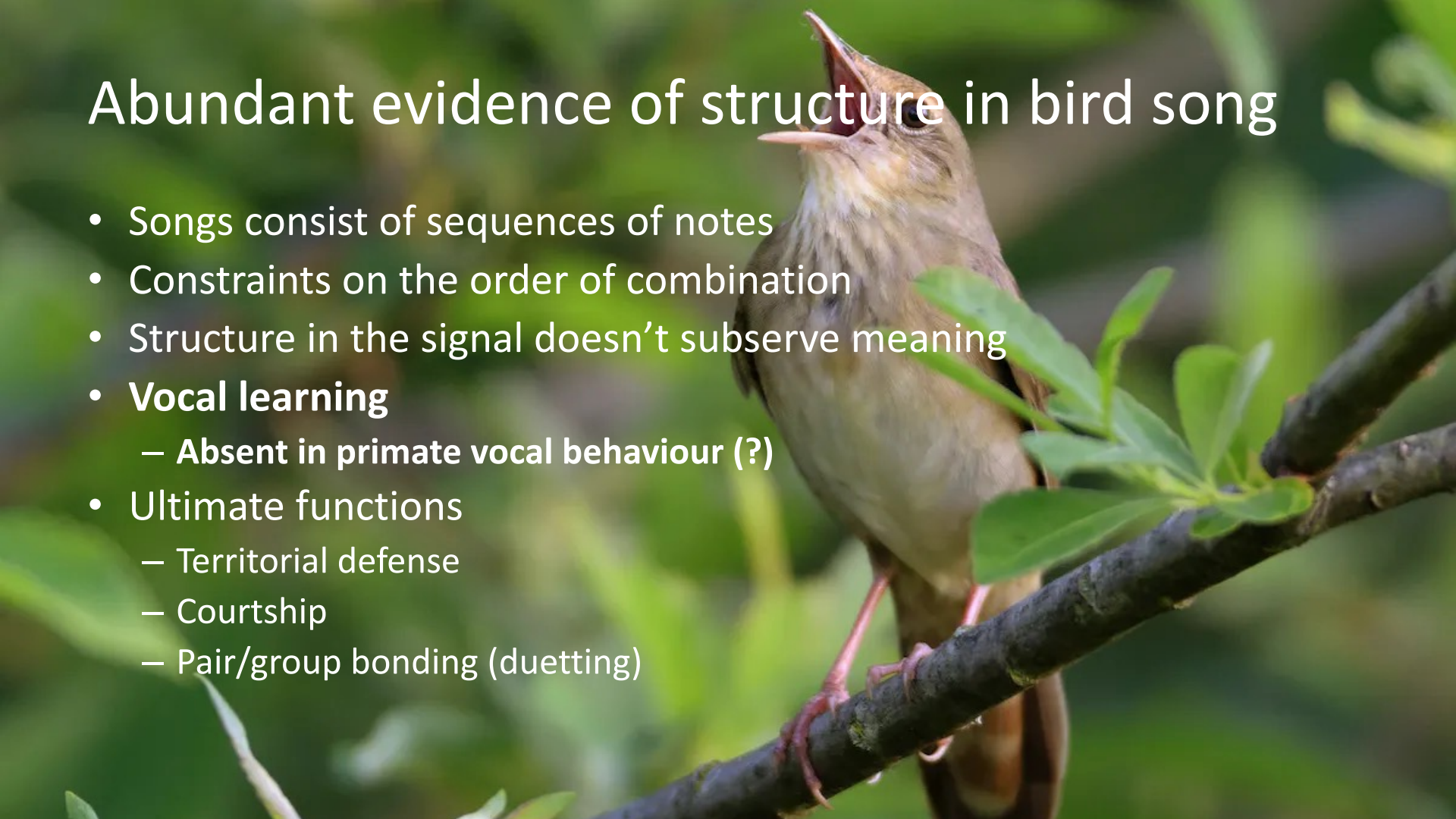
Alert call + recruitment call = mob predator

A. Combinatorial?
B. Compositional?

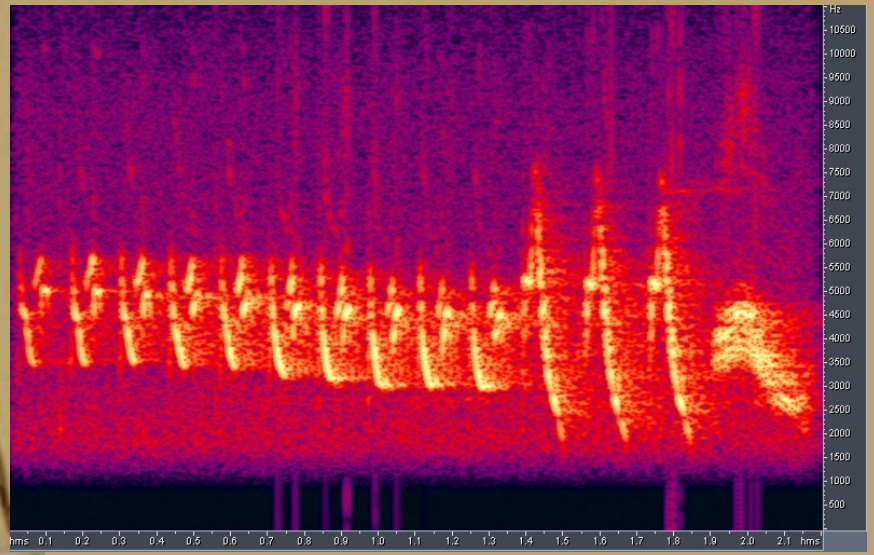
Engesser, S., Ridley, A. R., & Townsend, S. (2016). Meaningful call combinations and compositional processing in the southern pied babbler. *Proceedings of the National Academy of Sciences, USA,113*, 5976-5981.

Abundant evidence of structure in bird song

- Songs consist of sequences of notes
- Constraints on the order of combination
- Structure in the signal doesn't subserve meaning
- **Vocal learning**
  - **Absent in primate vocal behaviour (?)**
- Ultimate functions
  - Territorial defense
  - Courtship
  - Pair/group bonding (duetting)



Chaffinch song



Structure of chaffinch song (British)

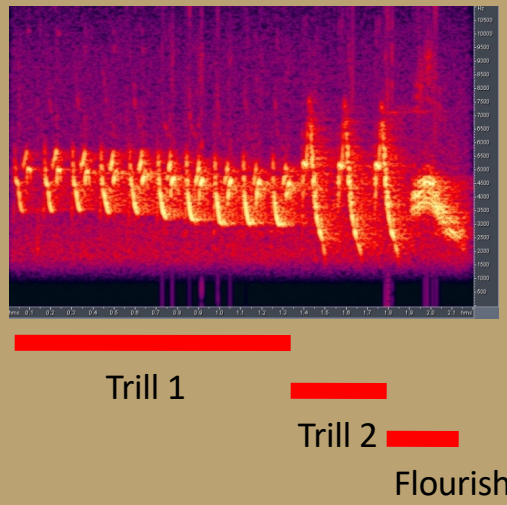
Each bird has 1-6 song types

- Mean 2-3

Order of notes in each song fixed

2-5 trill phrases, followed by a flourish

- Trill: sequence of 2 or more near-identical units
  - Number of repetitions can vary
- Flourish: no repetition
- Transitional notes: single notes between trill phrases
- Re-use of notes
  - Different songs may share, e.g., a flourish



Slater, P. J. B., & Sellar, P. J. (1986). Contrasts in the Songs of Two Sympatric Chaffinch Species . *Behaviour, 99,* 46-64.
Slater, P. J. B., Clements, F. A., & Goodfellow, D. J. (1984). Local and regional variations in chaffinch song and the question of dialects. *Behaviour, 88,* 76-97.

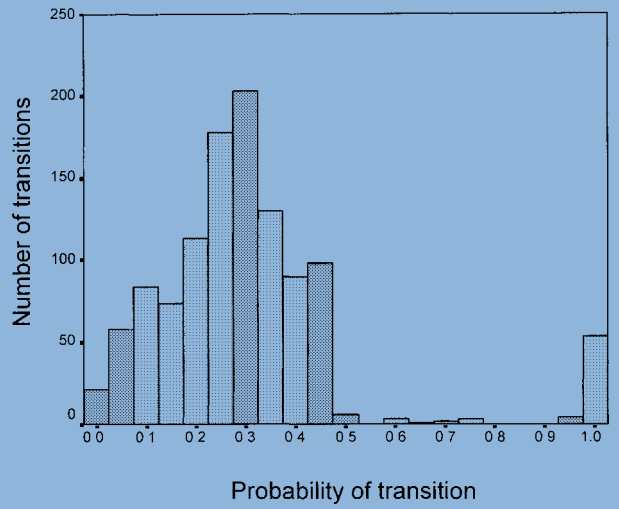
Willow warbler song

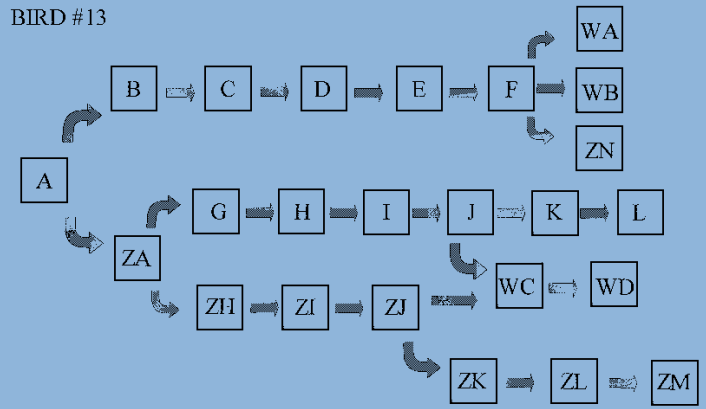
> 100 songs for some birds

- Repertoire size varies

Mix of predictable and less predictable transitions

- A simple grammar





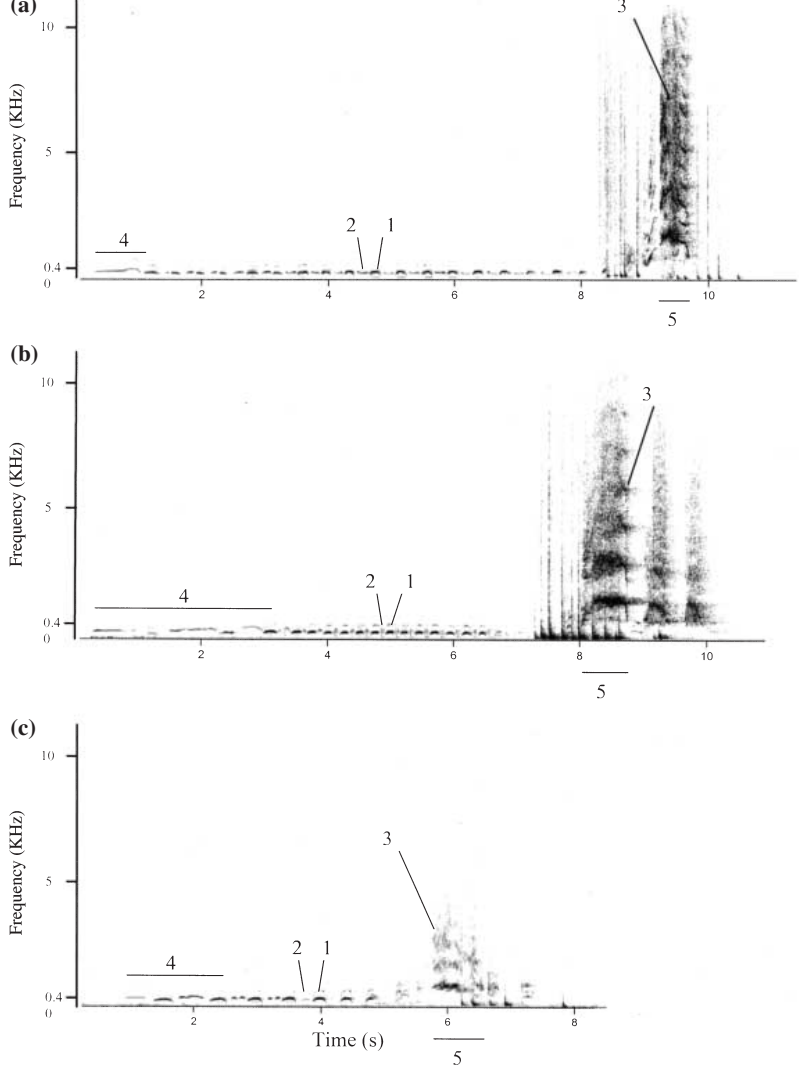
Gil, D., & Slater, P. J. B. (2000). Song organisation and singing patterns of the willow warbler, *Phylloscopus trochilus*. *Behaviour, 137,* 759-782.


Jane Goodall

Suggestive evidence for learned vocalizations in chimpanzees?

Pant hoots of chimpanzees vary between neighbouring groups

Crockford, C., Herbinger, I., Vigilant, L. & Boesch, C. (2004). Wild Chimpanzees Produce Group-Specific Calls: a Case for Vocal Learning? *Ethology,110,* 221—243.



Crockford et al. (2004): pant hoots of neighbouring groups differ in (e.g.):

- Length of intro (4)
- Peak frequency of screams (3)
- Duration of climax (5)

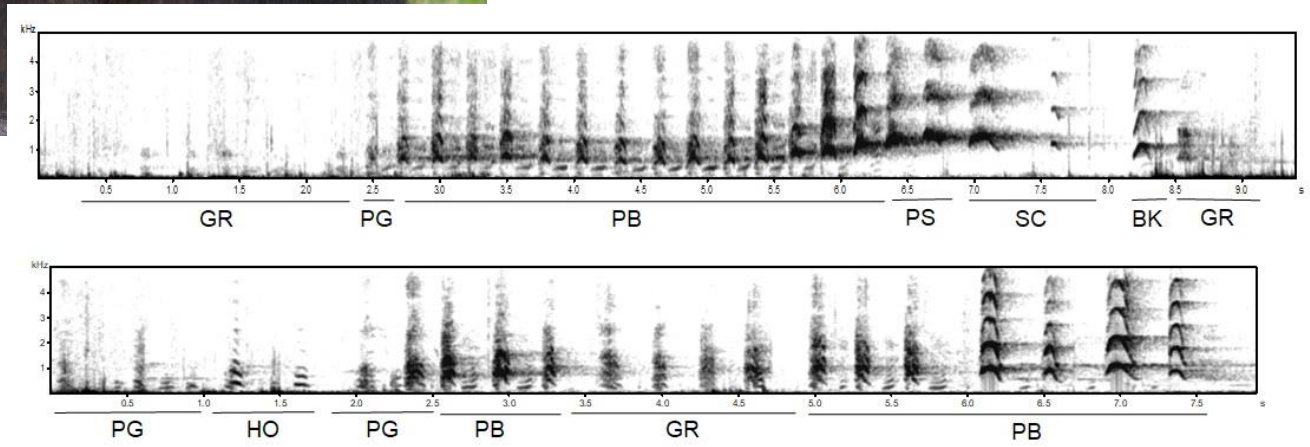
But Desai et al. (2022) fail to replicate in Gombe National Park

- Substantial inter-individual differences, small sample sizes

Crockford, C., Herbinger, I., Vigilant, L. & Boesch, C. (2004). Wild Chimpanzees Produce Group-Specific Calls: a Case for Vocal Learning? *Ethology,110,* 221—243.

Desai, N. P., Fedurek, P., Slocombe, K. E., & Wilson, M. L. (2022). Chimpanzee pant-hoots encode individual information more reliably than group differences. *American Journal of Primatology, 84,* e23430.

A lot is not known about call combinations in chimpanzees!



Girard-Buttoz, C., Zaccarella, E., Bortolato, T., Friederici, A. D., Wittig, R. M., & Crockford, C. (2022). Chimpanzees produce diverse vocal sequences with ordered and recombinatorial properties. *Communications Biology, 5,* 410.

Summary of today

- Intentional communication
  - Rare in primates, present in chimpanzees (maybe??)
- Structured communication
  - Rare and limited in primates, present in chimpanzees (maybe??), common in songbirds
  - Generally structure not subserving meaning
- Learned communication
  - Rare in primates, present in chimpanzees (maybe??), common in songbirds
  - Relationship between vocal learning and structure?

Next up

- Tutorial on comparative psychology of communication (looking ahead to vocal learning)
  - What's the right comparison species?
- Next lecture: human evolution, cumulative non-linguistic culture in humans and other animals