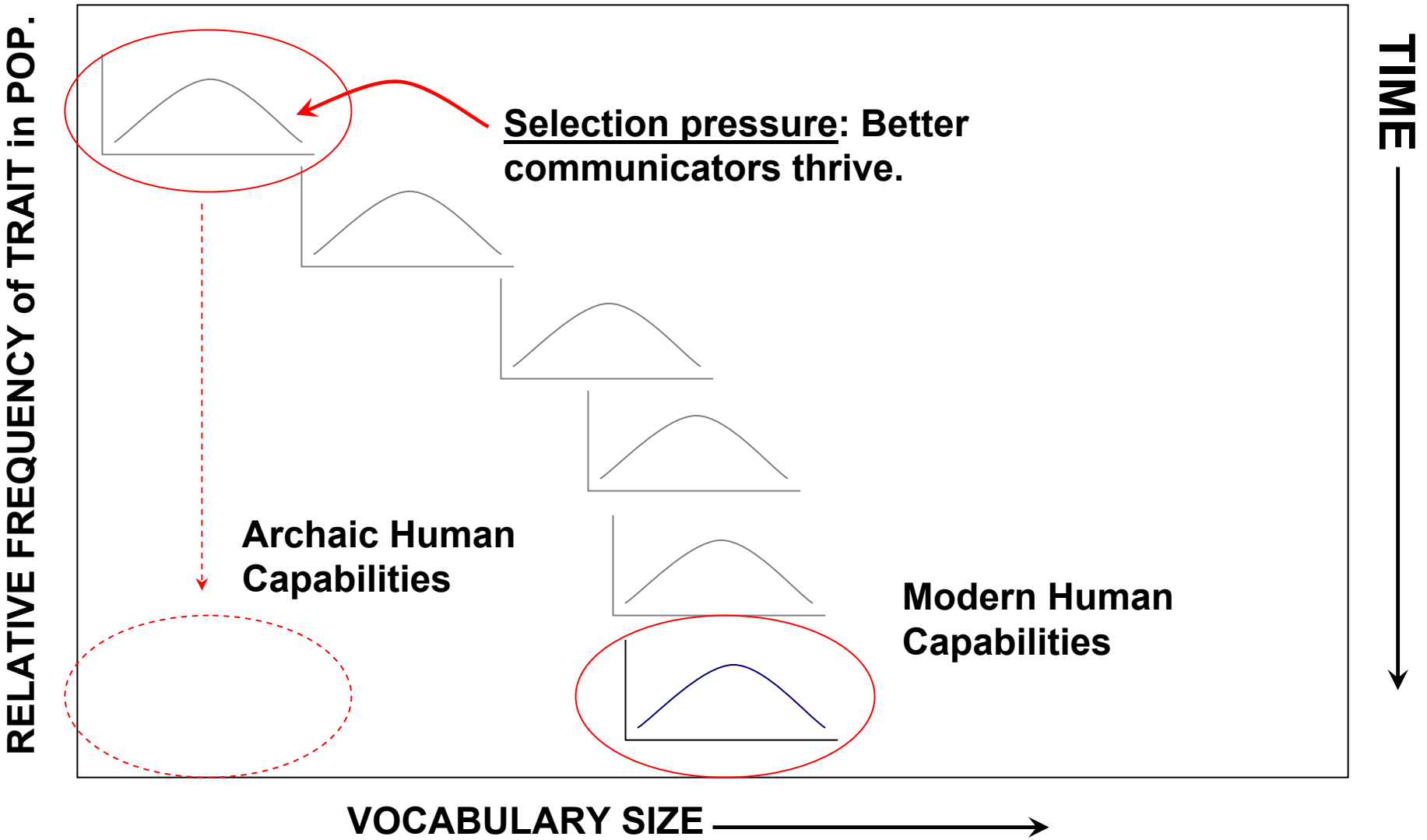
Human vs Other Animal Communication

Lecture Goals

- Work through solid examples of how a communication system might evolve via natural selection;
- Examine a few types of communication systems that are known to be instinctive (genetically specified);
- Contrast animal and human communication systems.

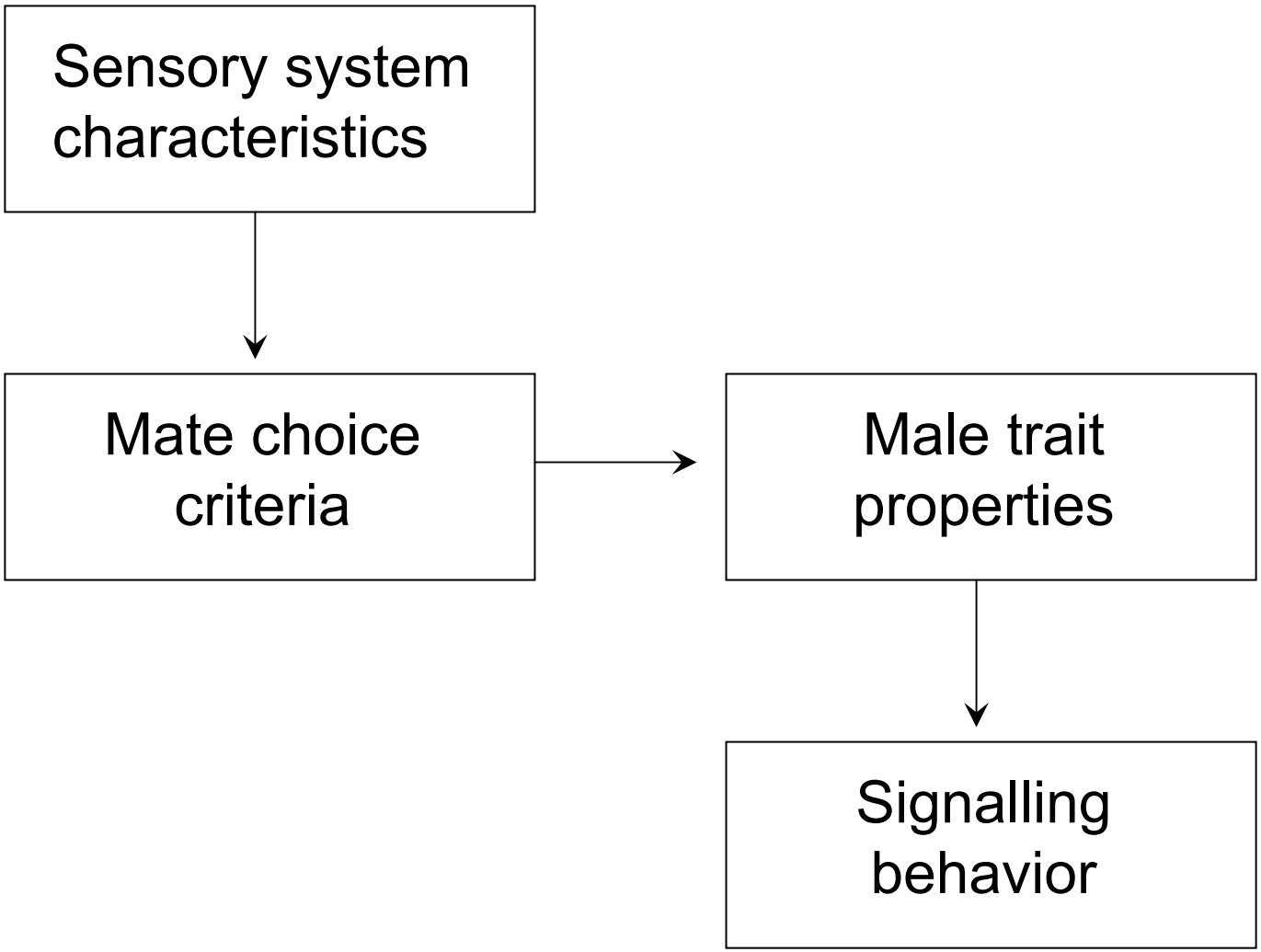
Variation & Selection



Animal Communication Systems

- Function:
  - Warning systems
  - Territorial defense
  - Advertising for mates
    - Sexual selection
    - Sensory Exploitation Hypothesis (Ryan, 1990)
      - Swordtail fish
      - Spring peepers

Sensory Exploitation Hypothesis



Pre-Existing Sensory Bias

Swordtail fish example (Basolo, 1990)

Fact:

Females prefer long-swordtailed males.

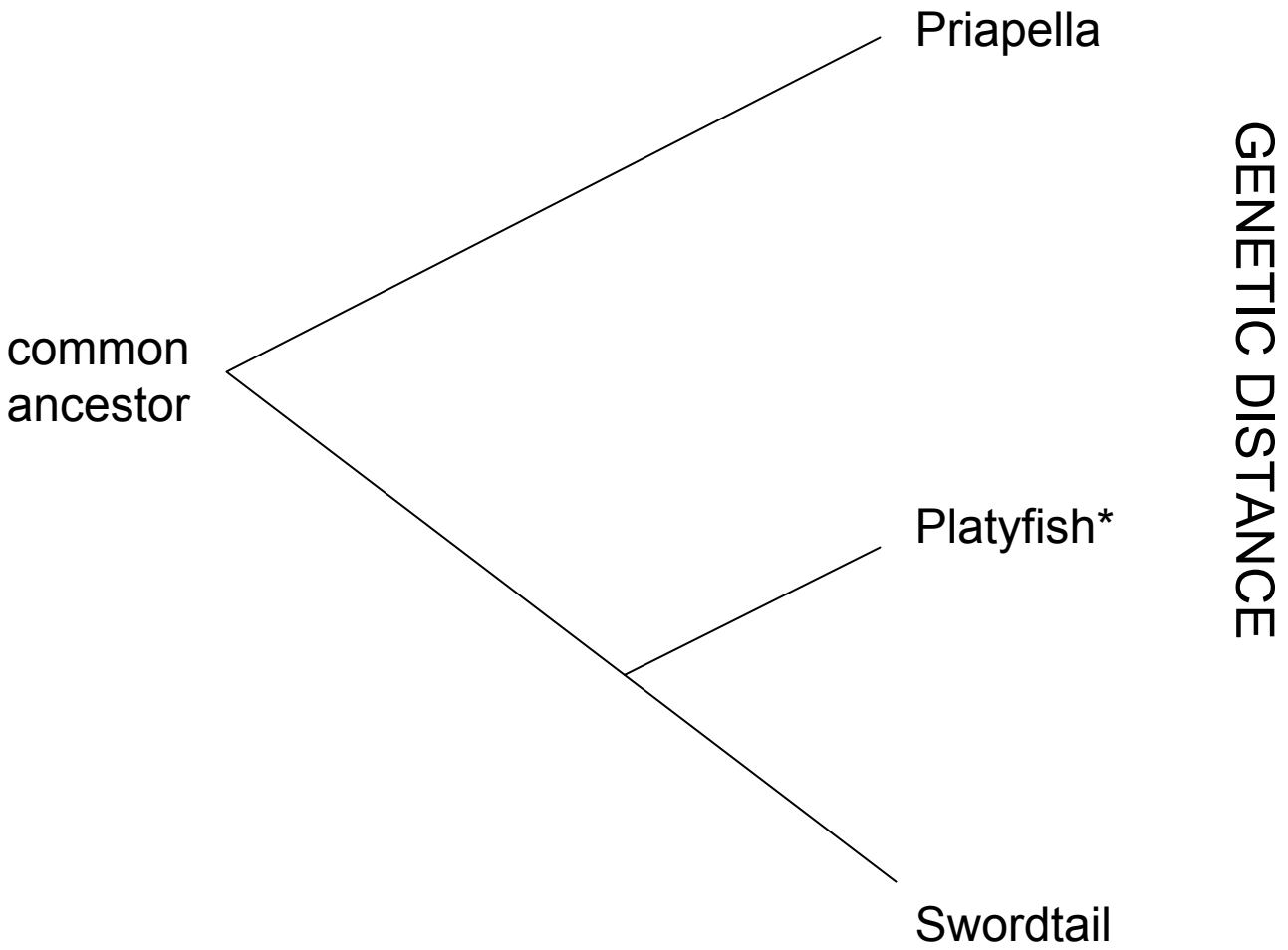
Hypothesis:

Pre-existing (female) bias driving the evolution of swords?

Test:

Female preference for swords in closely related species without swords.

Cladogram (kinship relations)



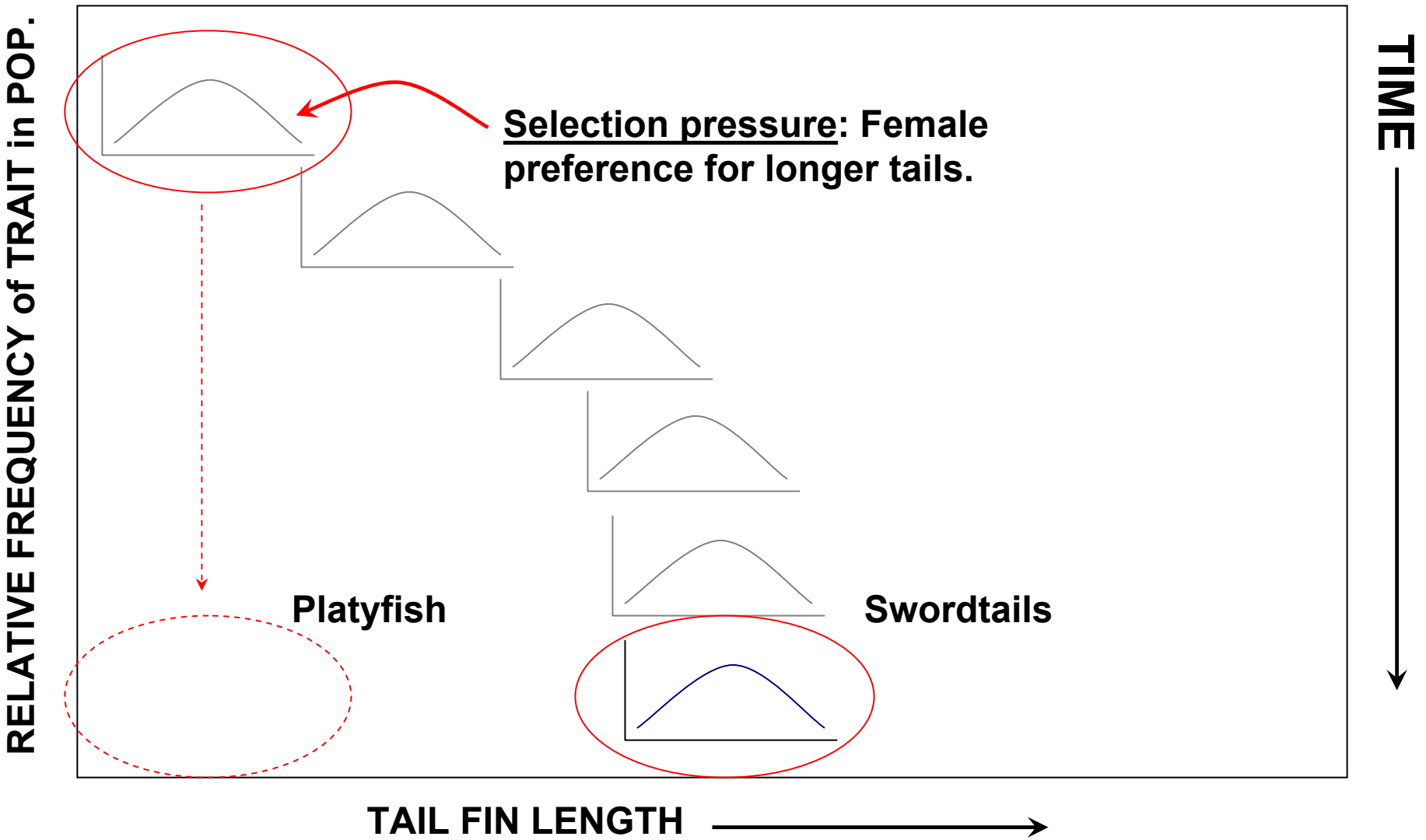
Swordtail Experiment (Basolo, 1990)

1. Male platyfish were surgically implanted with swords
2. Swords were visible (yellow&black) or Invisible (transparent)
3. Platyfish female preference was measured

RESULT:

Female platyfish prefer males with visible swords over those with transparent swords.

Variation & Selection



Spring Peeper Mating Call

Wilczynski et al., 1984; Brenowitz et al. 1984

- Male advertisement call (in breeding chorus) = 2,895 Hz
- Male's best hearing at 3,580 Hz
- The male can barely hear himself call!

Why?

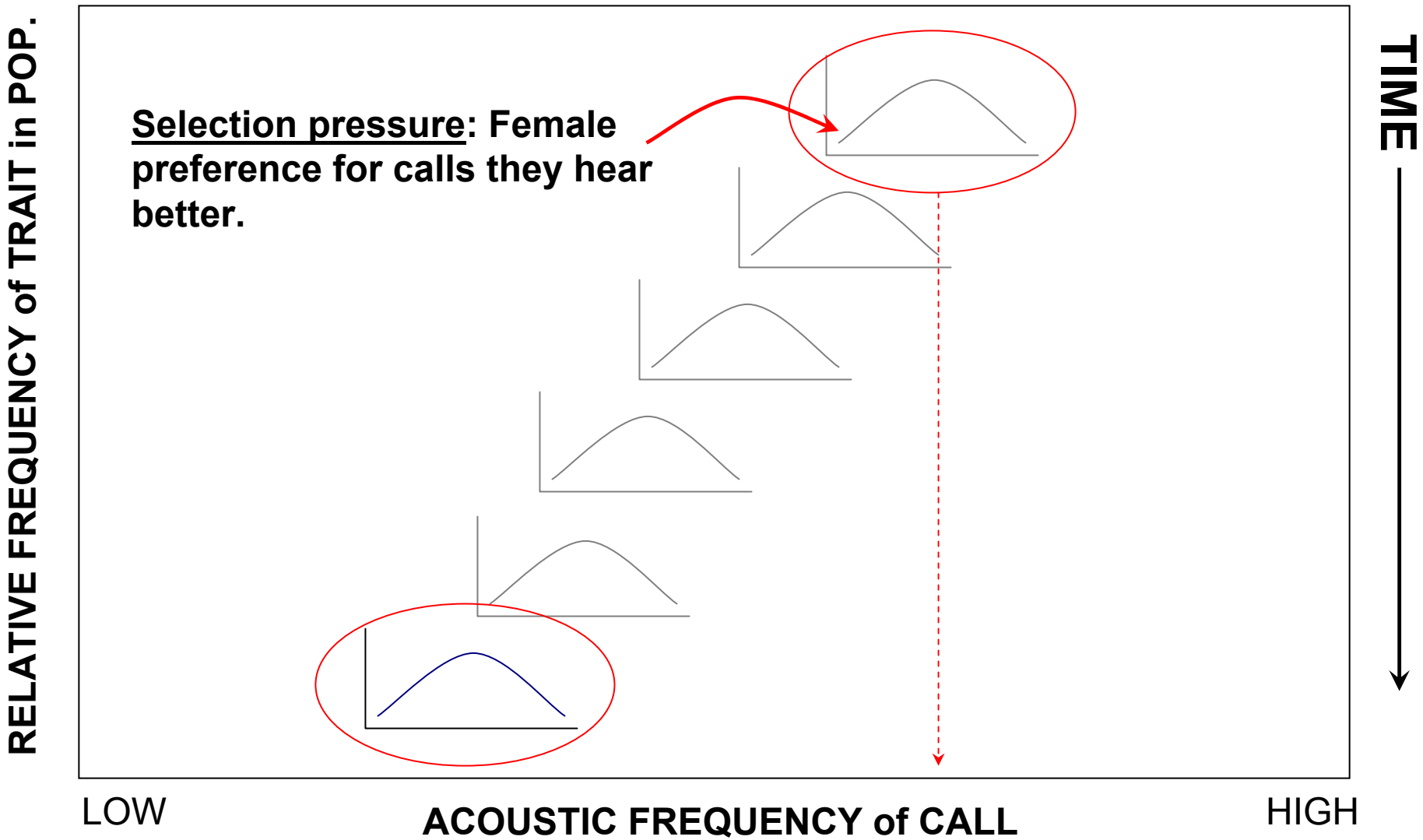
Spring Peeper Hearing

Wilczynski et al., 1984; Brenowitz et al. 1984

- Hearing organ tuned to particular Hz
- Tuning dependent on body size
- Female is larger than male
- Female best hearing at 2,939 Hz
- Male best hearing at 3,580 Hz

Male call (2,895 Hz) tuned to female hearing!

Variation & Selection



Human vs Animal Communication

- Animal communication
  - Advertising, defense, warning systems
- Human communication
  - Assumption in both Nature and Nurture explanations of linguistic structure is that form follows function.
    - What was it first used for???
    - What is it now used for???

Language vs Animal Communication Systems

Hockett's (1966) Design Features

- Derived through comparison with other animal communication systems;
- Meant to distinguish language from these other systems.

"The design-features… are found in every language on which we have reliable information, and each seems to be lacking in at least one known animal communicative system..."

Hockett's Design Features

1. Communication mode
2. Rapid Fading
3. Interchangeability
4. Feedback
5. Specialization
6. Semanticity
7. Arbitrariness
8. Discreteness
9. Displacement
10. Productivity
11. Cultural transmission
12. Duality
13. Prevarication
14. Reflexiveness
15. Learnability

Design Features 1-5

1. Mode of communication: vocal-auditory, tacticle-visual, or chemical-olfactory
2. Rapid Fading: Message does not linger in time or space after production.
3. Interchangeability: individuals who use a language can both send and receive any permissible message within that communication system.
4. Feedback: users of a language can perceive what they are transmitting and can make corrections if they make errors.
5. Specialization: the direct-energetic consequences of linguistic signals are usually biologically trivial; only the triggering effects are important.

Design Features 6-10

6. Semanticity: there are associative ties between signal elements and features in the world; in short, some linguistic forms have denotations.
7. Arbitrariness: there is no logical connection between the form of the signal and its meaning.
8. Discreteness: messages in the system are made up of smaller, repeatable parts; the sounds of language (or cheremes of a sign) are perceived categorically, not continuously.
9. Displacement: linguistic messages may refer to things remote in time and space, or both, from the site of the communication.
10. Productivity: users can create and understand completely novel messages.

Design Features 11-15

11. Cultural transmission: the conventions of a language are learned by interacting with more experienced users.
12. Duality (of Patterning): a large number of meaningful elements are made up of a conveniently small number of meaningless but message-differentiating elements.
13. Prevarication: linguistic messages can be false, deceptive, or meaningless.
14. Reflexiveness: In a language, one can communicate about communication.
15. Learnability: A speaker of a language can learn another language.

Not Unique to Language

1. Mode: vocal-auditory, *e.g.,* monkeys, cats, birds…
2. Rapid Fading: see above
3. Interchangeability: see above
4. Feedback: *e.g.*, increasing call loudness with ambient noise.
5. Specialization: *cf.,* dog panting
6. Semanticity: *e.g.*, vervet calls
7. Arbitrariness
8. Discreteness

Vervet Alarm Calls

Snake! VervetSnakeAlarm.aif

Look down! Mob the snake!

Leopard! VervetLeopardAlarm.aif

Run up into the nearest tree!

Eagle! VervetEagleAlarm.aif

Look up! Run into the bushes!

Not Unique to Language

1. Mode: vocal-auditory, *e.g.,* monkeys, cats, birds…
2. Rapid Fading: see above
3. Interchangeability: see above
4. Feedback: *e.g.*, increasing call loudness with ambient noise.
5. Specialization: previous examples, *cf.,* dog panting
6. Semanticity: *e.g.*, vervet calls
7. Arbitrariness: also
8. Discreteness: *e.g.*, tree frogs (whine+(N chucks), where whine = species, chuck = individual)

Unique to Language?

9. Displacement: Kanzi (Savage-Rumbaugh)
10. Productivity
11. Cultural transmission
12. Duality
13. Prevarication
14. Reflexiveness
15. Learnability

Kanzi (Bonobo)

Talking to himself at the keyboard.

Telling the researcher where he wants to go to next.

Unique to Language?

9. Displacement: Kanzi (Savage-Rumbaugh)
10. Productivity: Brown Thrasher, novel songs, novel meaning?
11. Cultural transmission: Sparrow dialects (Marler), Humpback whales Humpback.wav
12. Duality:
13. Prevarication
14. Reflexiveness
15. Learnability

Unique to Language?

9. Displacement: Kanzi (Savage-Rumbaugh)
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12. Duality: Hierarchical structure AND different meaning? Cotton-top tamarins (Hauser) tamarin_call.aif
13. Prevarication
14. Reflexiveness
15. Learnability

Unique to Language?

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10. Productivity: Brown Thrasher, novel songs, novel meaning?
11. Cultural transmission: Sparrow dialects (Marler), Humpback whales
12. Duality: Hierarchical structure AND different meaning? Cotton-top tamarins (Hauser)
13. Prevarication: Bird song (M. Dawkins)
14. Reflexiveness: Human
15. Learnability: Sparrows (viz the dialects mentioned above)

	Crickets	**Bee dancing**	**Western Meadowlark**	**Gibbon calls**	**Signing apes**	**Language**
Vocal-auditory	Auditory, not vocal	No	**Yes**	**Yes**	No	**Yes**
Rapid fading	**Yes,** repeated	?	**Yes**	**Yes,** repeated	**Yes**	**Yes**
Interchangeability	Limited	Limited	?	**Yes**	**Yes**	**Yes**
Feedback	**Yes**	?	**Yes**	**Yes**	No	**Yes**
Specialization	**Yes?**	?	**Yes**	**Yes**	**Yes**	**Yes**
Semanticity	No?	**Yes**	In part	**Yes**	**Yes**	**Yes**
Arbitrariness	?	No	If semantic, yes	**Yes**	Largely **yes**	**Yes**
Discreteness	Yes?	No	?	**Yes**	**Yes**	**Yes**
Displacement		**Yes,** always	?	No	**Yes**	**Yes,** often
Productivity	No	**Yes**	?	No	Debatable	**Yes**
Cultural transmission	No?	Probably not	?	?	Limited	**Yes**
Duality of patterning	?	No	?	[Cotton-top tamarin: **Yes**]	**Yes**	**Yes**
Prevarication					**Yes**	**Yes**
Reflexiveness					No?	**Yes**
Learnability					**Yes**	**Yes**

Evolution of Language

- What functional pressure gave rise to language?
  - Hunting, Extended parenting, Social complexity?
  - Did this/these pressures select for certain linguistic structures? (nature)
  - Did this/these pressures select for other abilities, and did linguistic complexity piggy-back on these abilities? (nurture)