

Communication



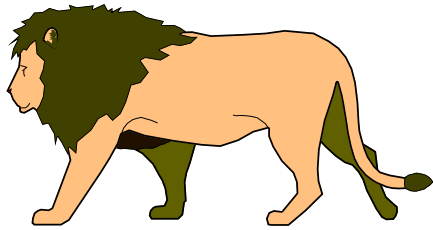
Communication

“Action by one animal that alters the behavior of another animal in a way that is adaptive to one or both participants”



Requires some degree of intentionality

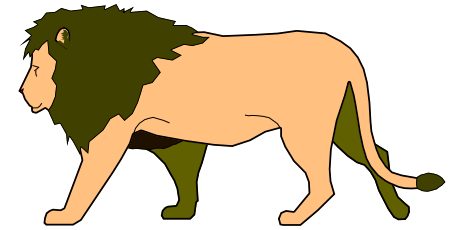
Signals



receiver



signal



sender



Signal = manifestation
of communication

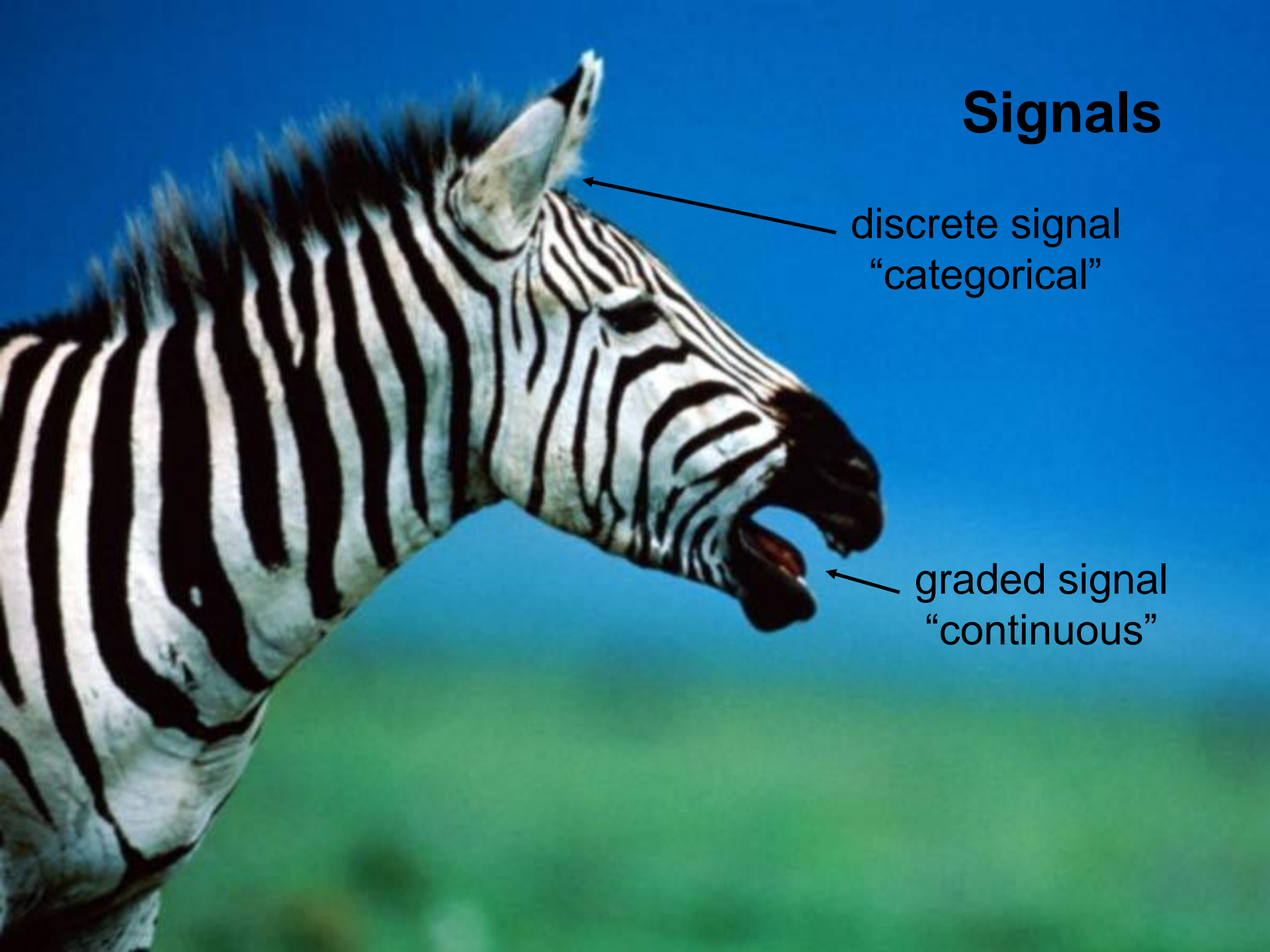


Evolved for that function (e.g. not body size)

Signals

discrete signal
“categorical”

graded signal
“continuous”



Signals

Some signals change the meaning of signals that follow (= metacommunication)



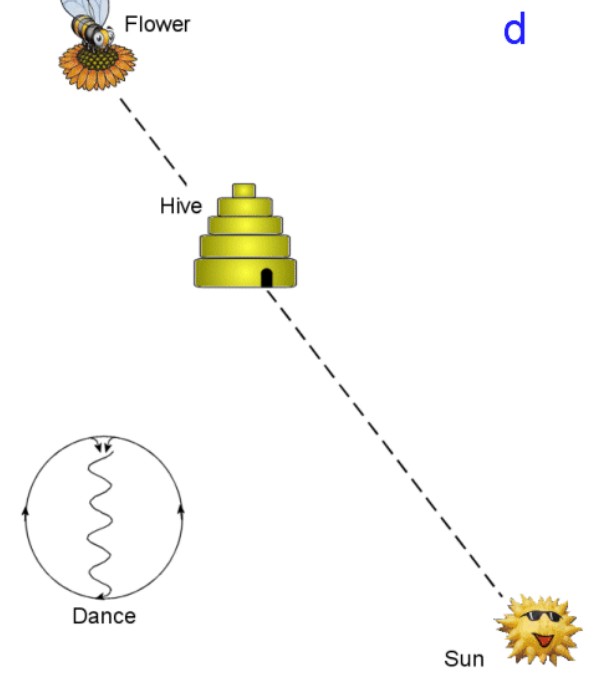
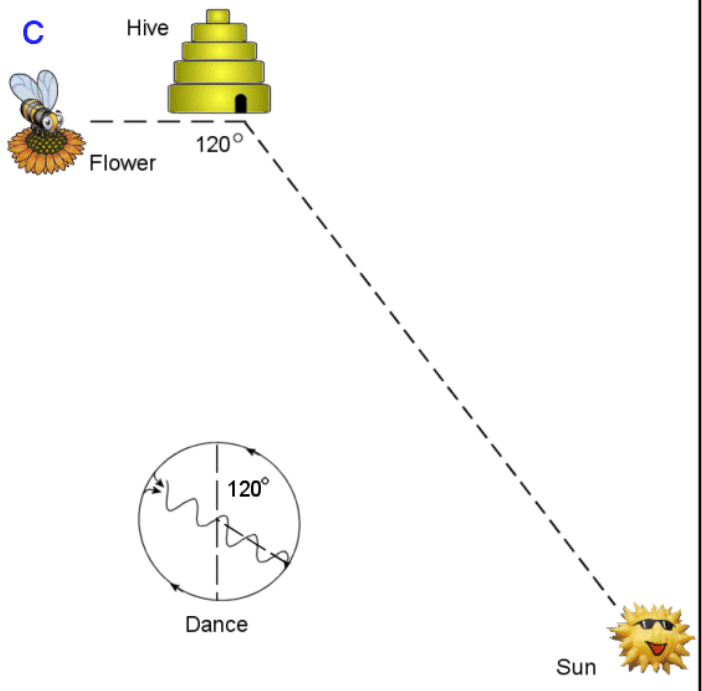
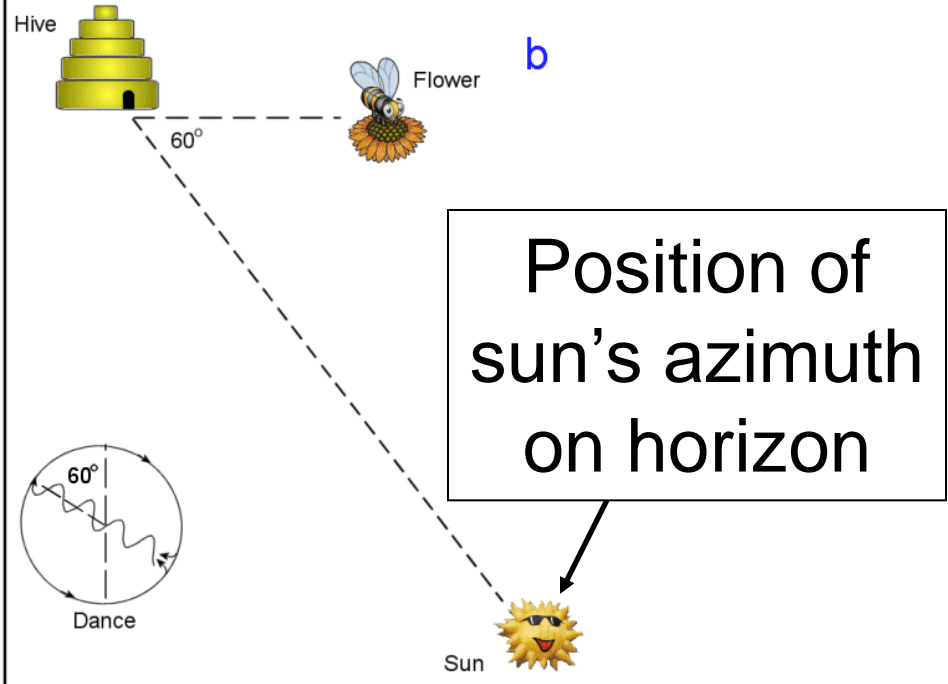
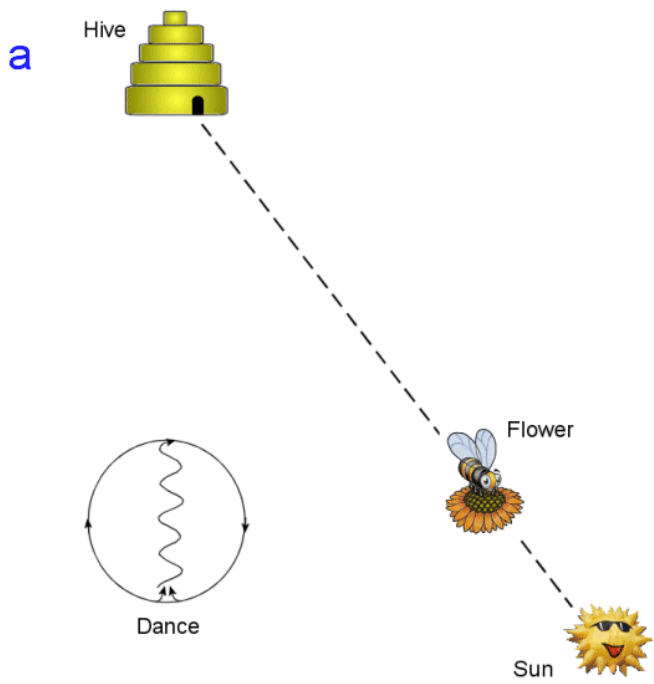


Intraspecific communication

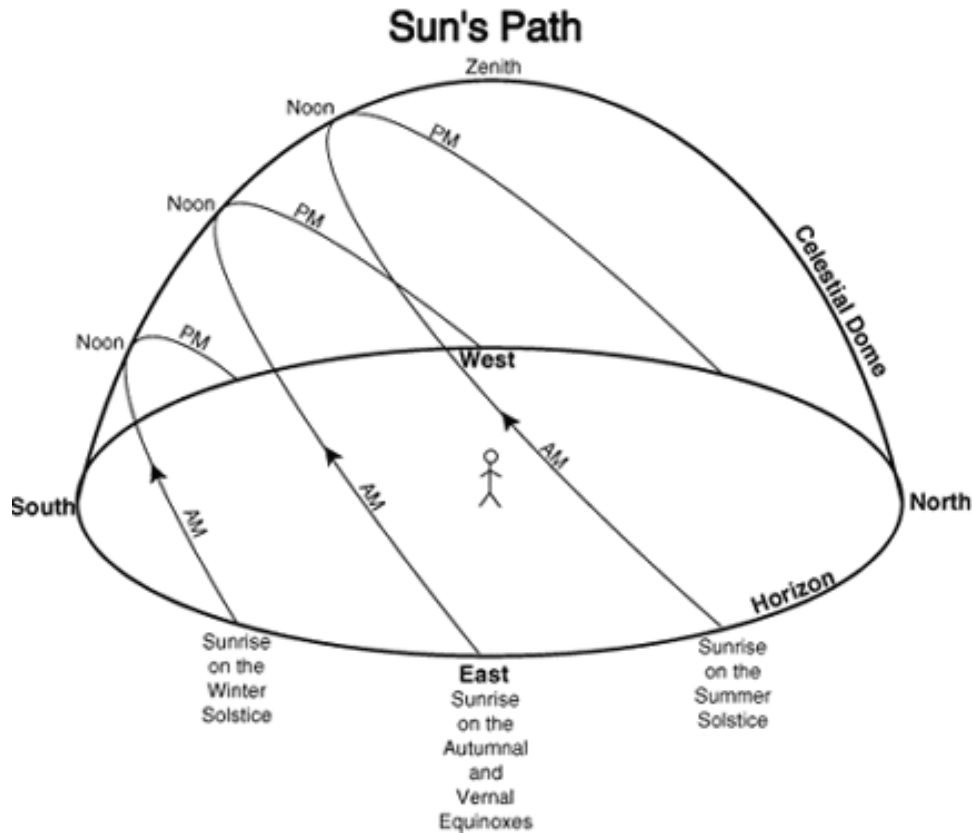
von Frisch: successful foragers convey vector information to naïve hive mates via waggle dance



What provides directional information?



The honey bee waggle dance

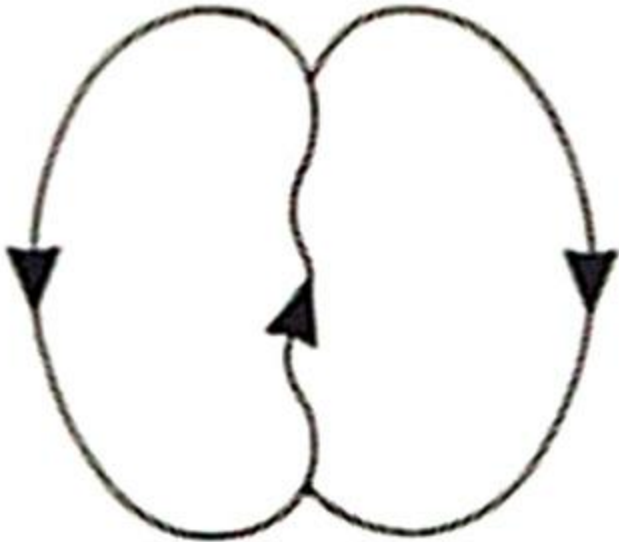
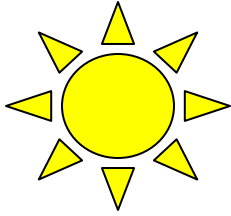


How do they keep track of distance traveled?

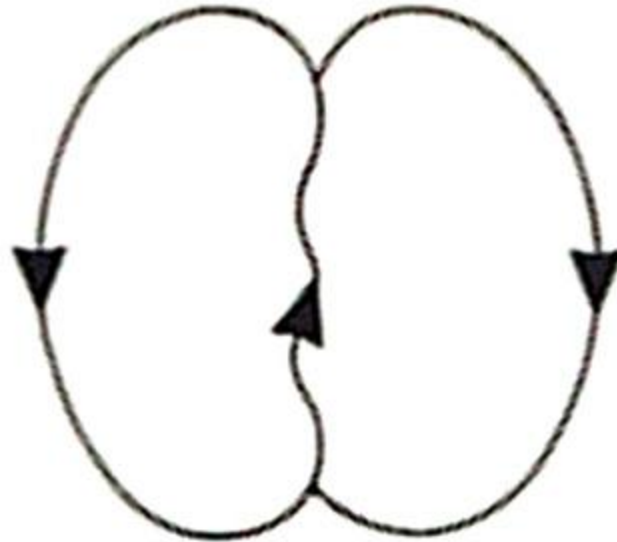


Ability to compensate for sun's movement requires biological clock!

The honey bee waggle dance



Honeybee forager
trained on feeder
directly toward
sun's azimuth



If blinded, forager
continues dancing, but
artificial "sun"
influences
interpretation of dance

Waggle dance controversy



Recruits' flight time longer than expected



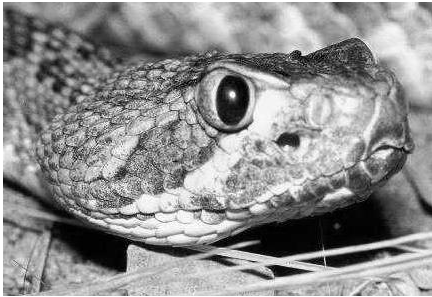
Resolution requires quantitative evaluation of bee flight paths....

Interspecific communication?

California ground squirrel



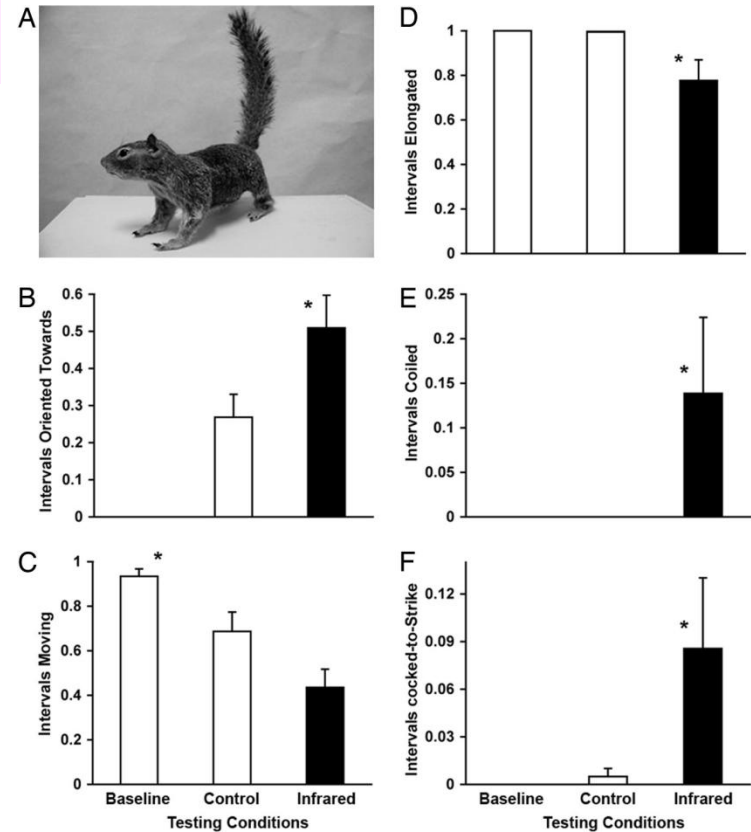
Infrared tail stimulus causes snakes to adopt defensive posture



Rattlesnakes detect ground squirrels with thermoreceptors

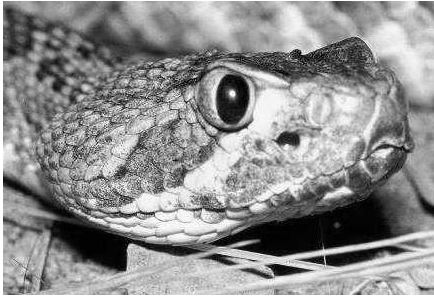
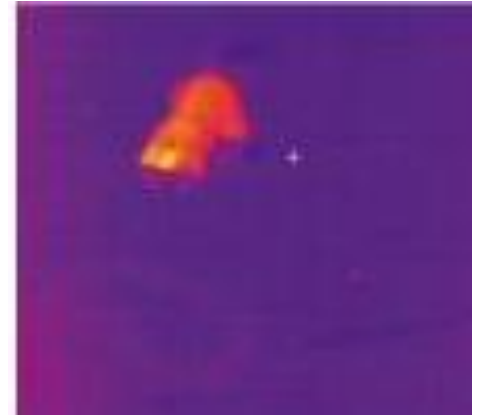


But is this a signal?



Interspecific communication

California ground squirrel

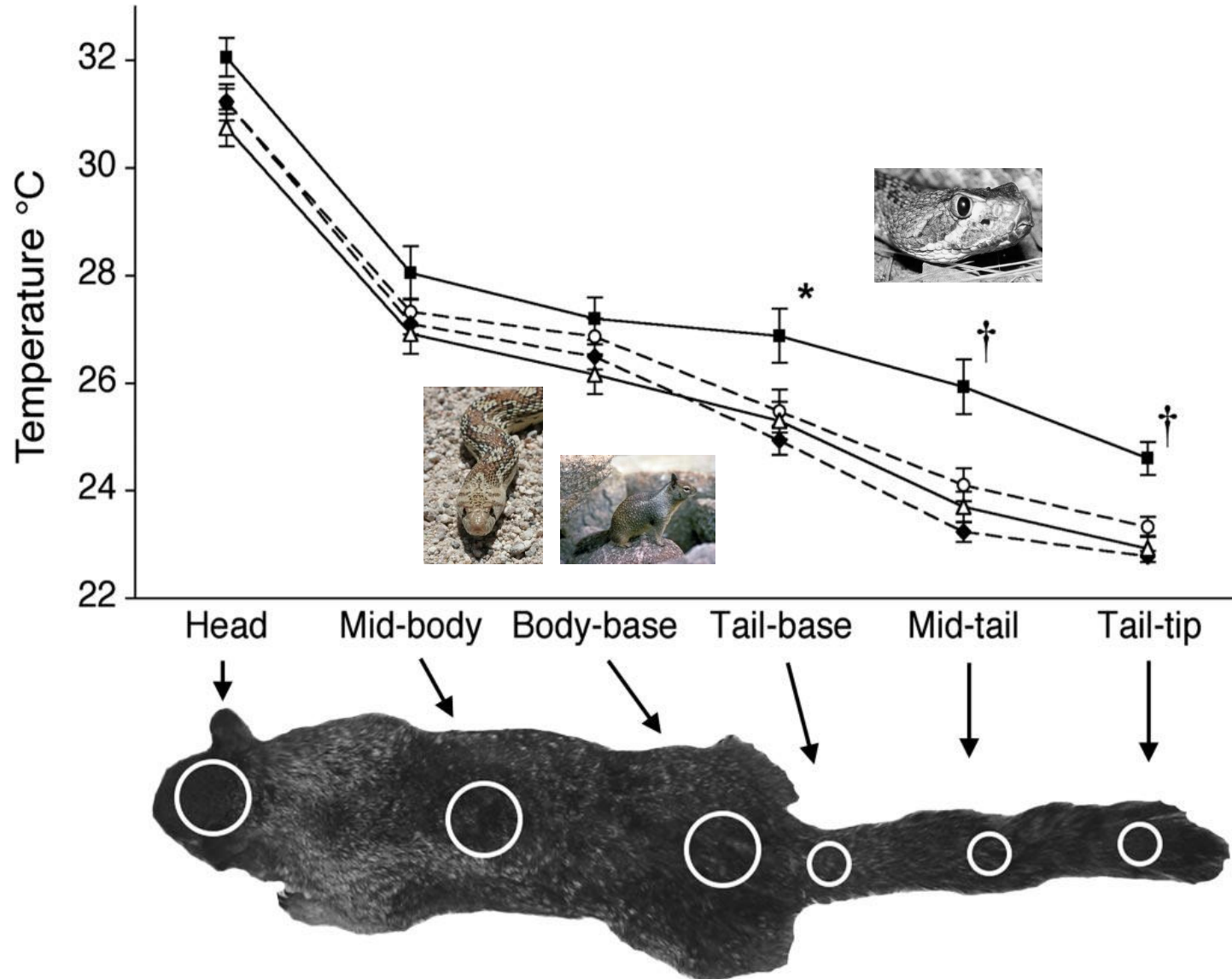


Rattlesnakes detect ground squirrels with thermoreceptors

Response to gopher snake, which lack thermoreceptors



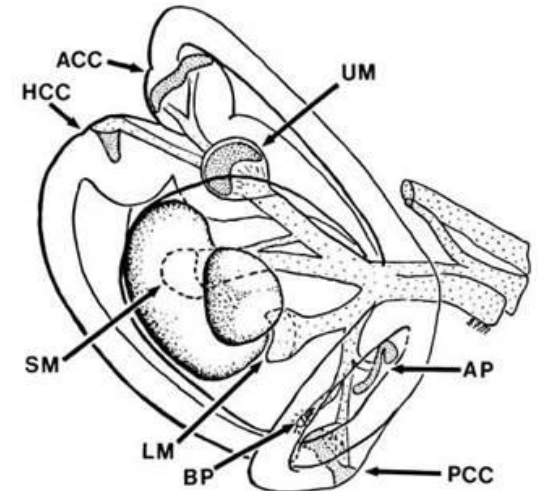
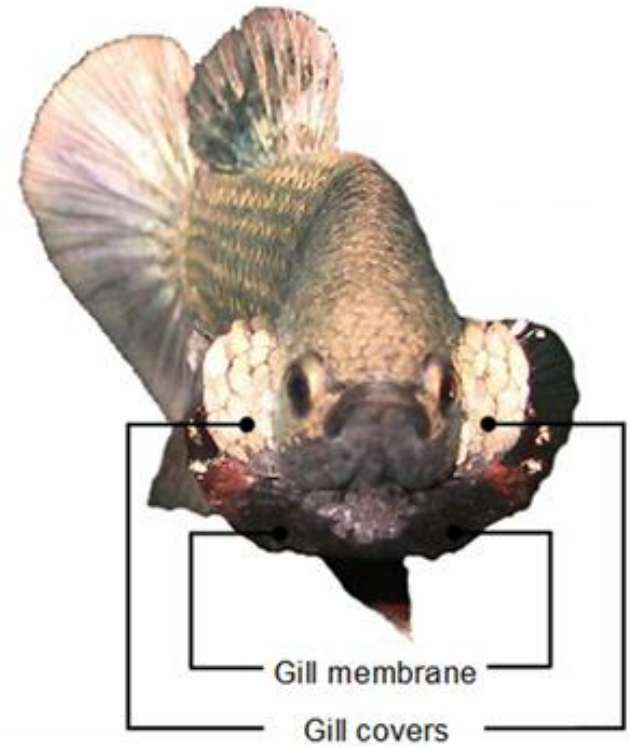
Interspecific communication



Signal evolution

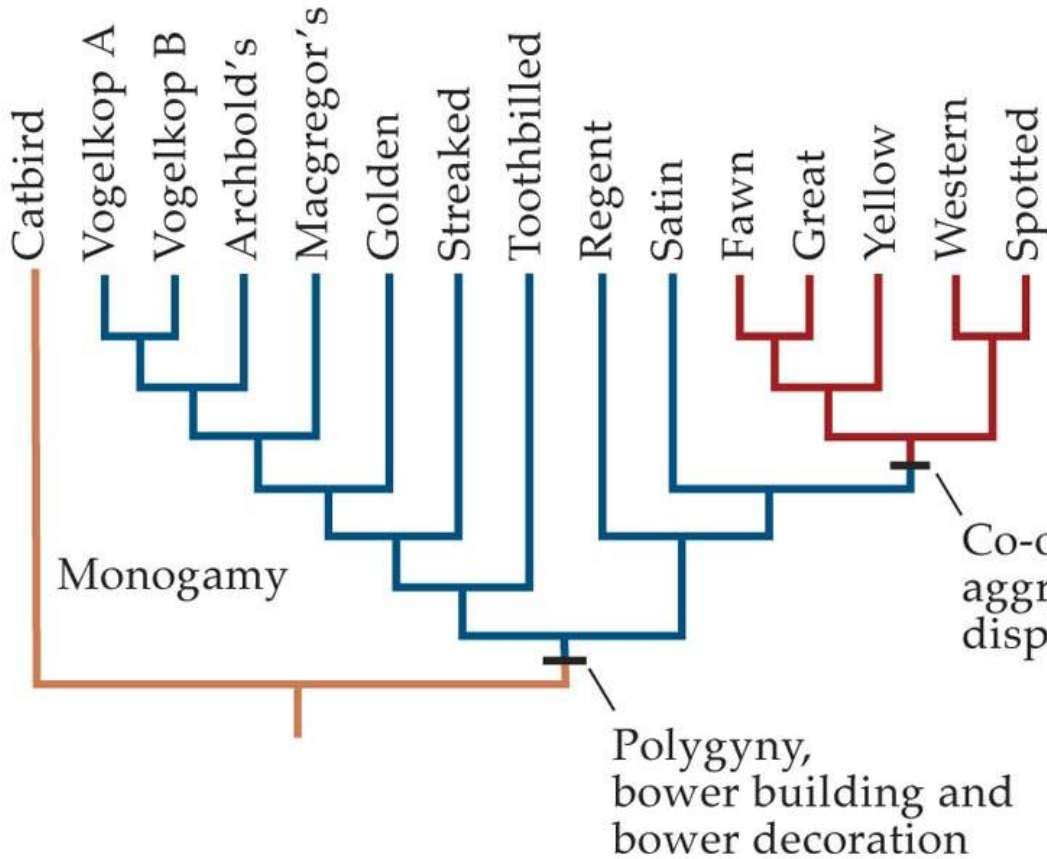
Signal may evolve for one function, then be co-opted for another

Signals may evolve to exploit pre-existing biases in sensory systems

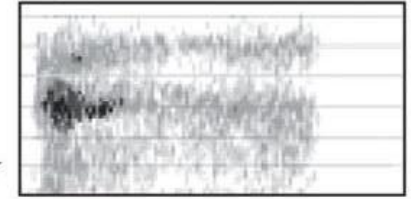


Signal evolution

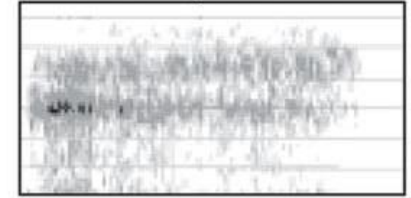
Use of
"skrraa" in:
Aggression
Courtship



Aggressive skrraa



Courtship skrraa

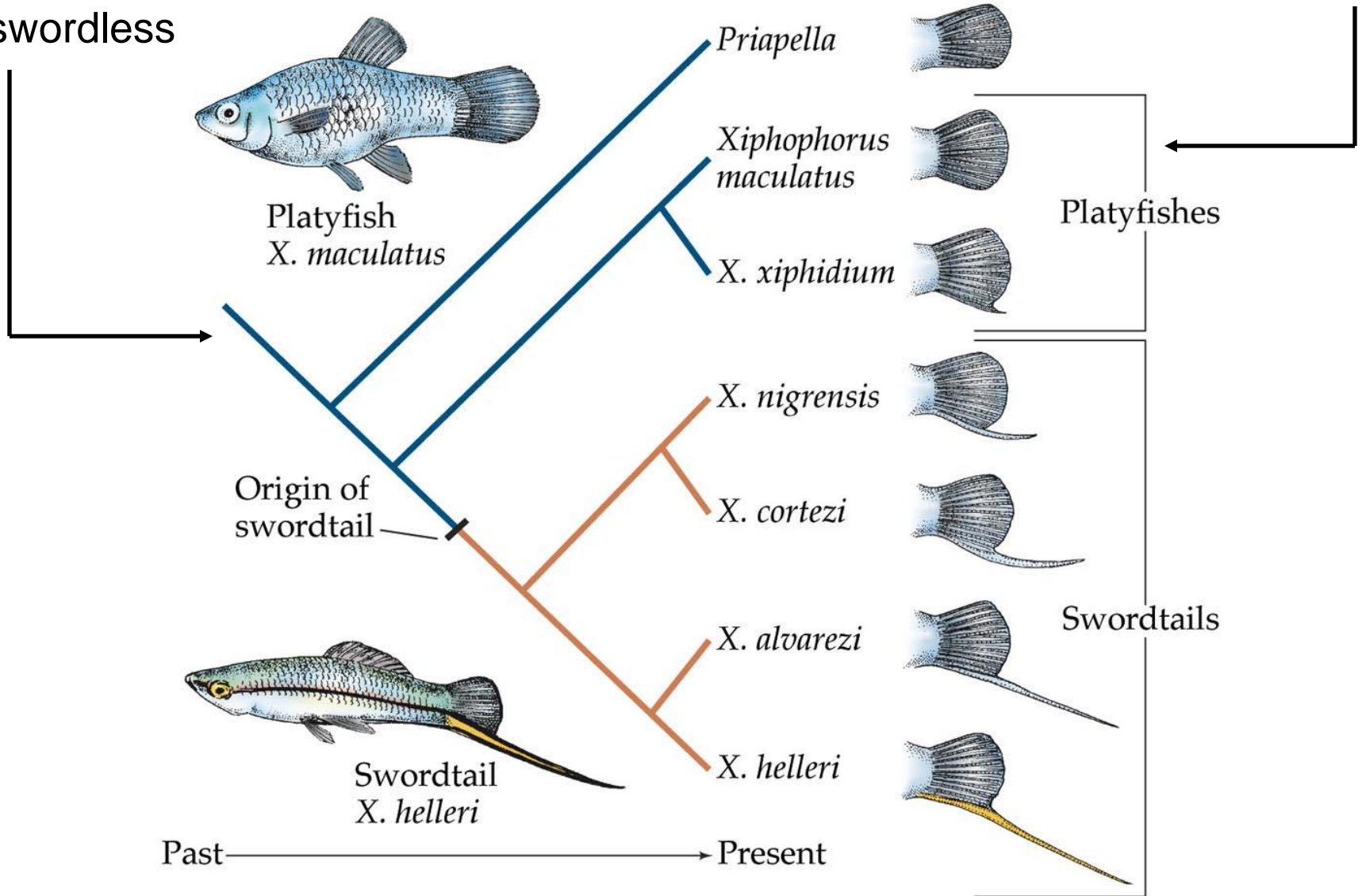


spotted bowerbird

Signal evolution

Parsimony suggests ancestor was swordless

Female *maculatus* prefer swords!



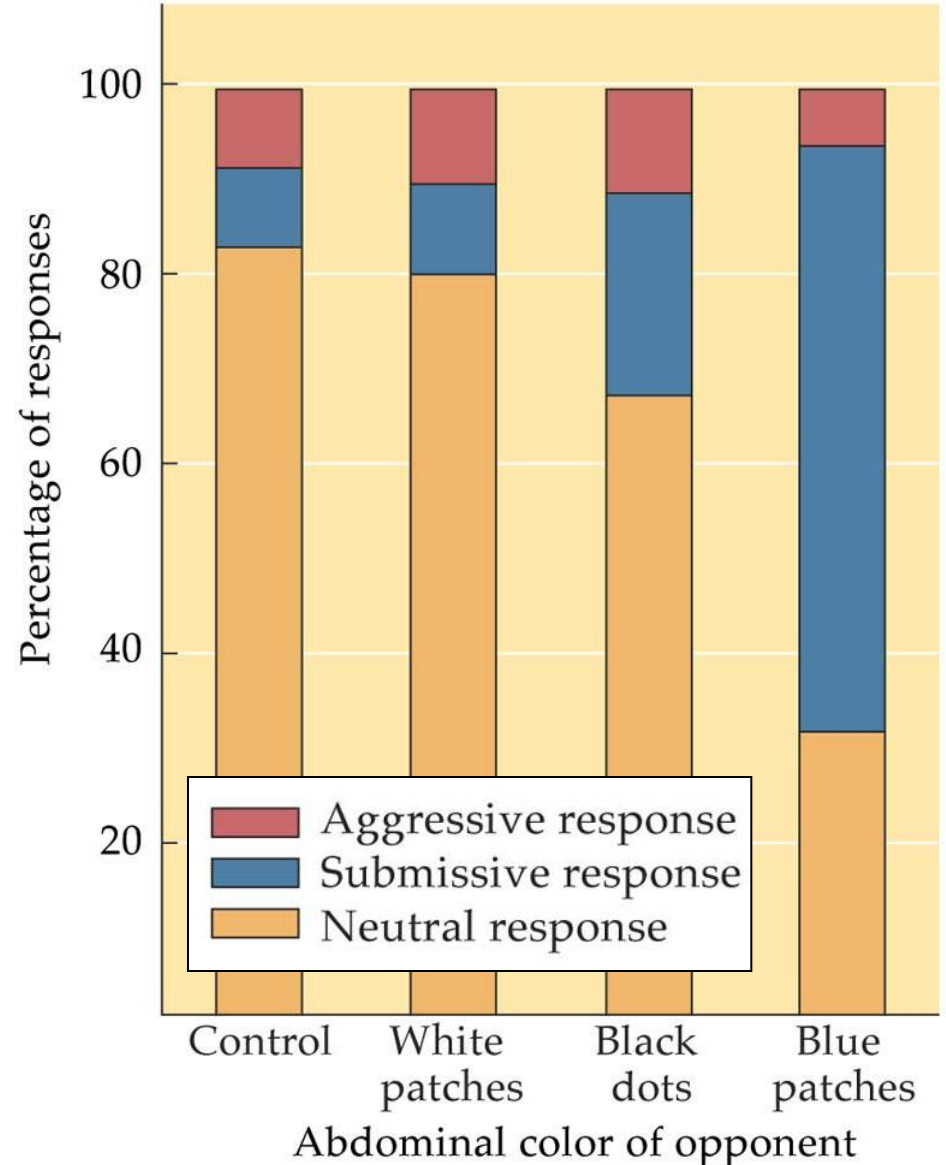
Sceloporus virgatus
lack blue ventral patches



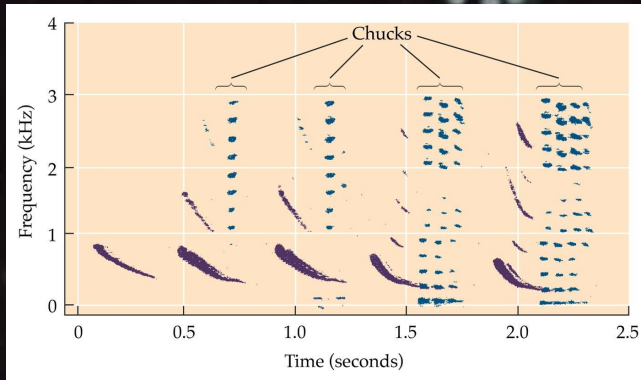
Close relatives
have them



S. virgatus respond to
artificial blue patches



Exploiting a sensory bias



Male túngara frogs produce simple (whines) or complex (whines + chucks) calls



Preferred by females

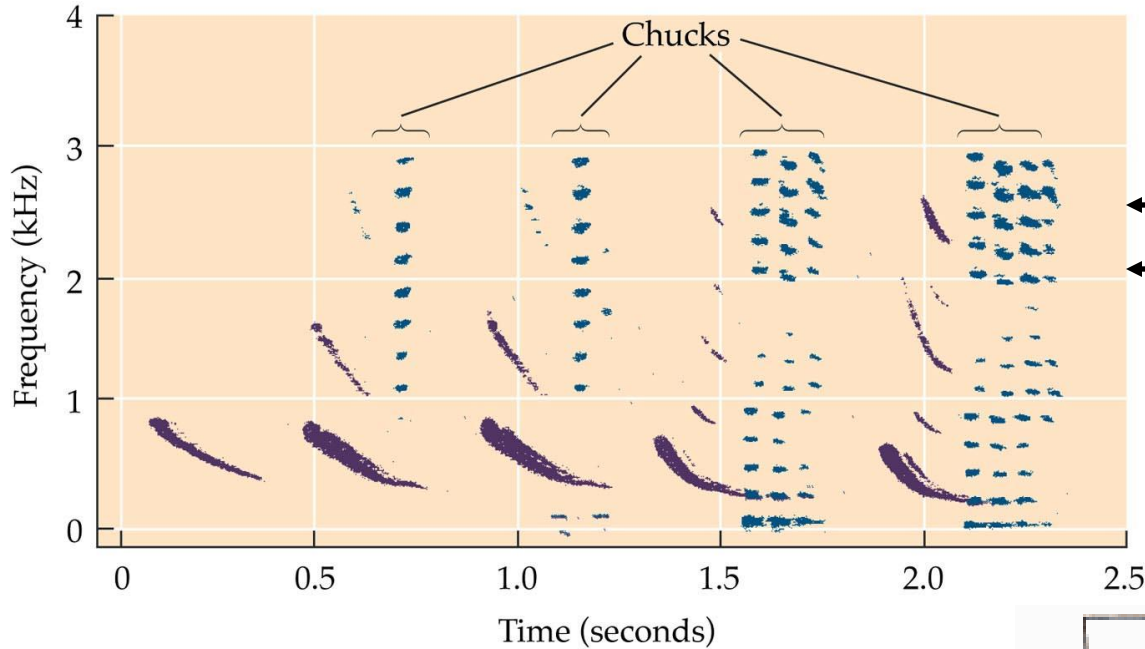
túngara frog



Mike Ryan

Why do females prefer complex songs?

Exploiting a sensory bias

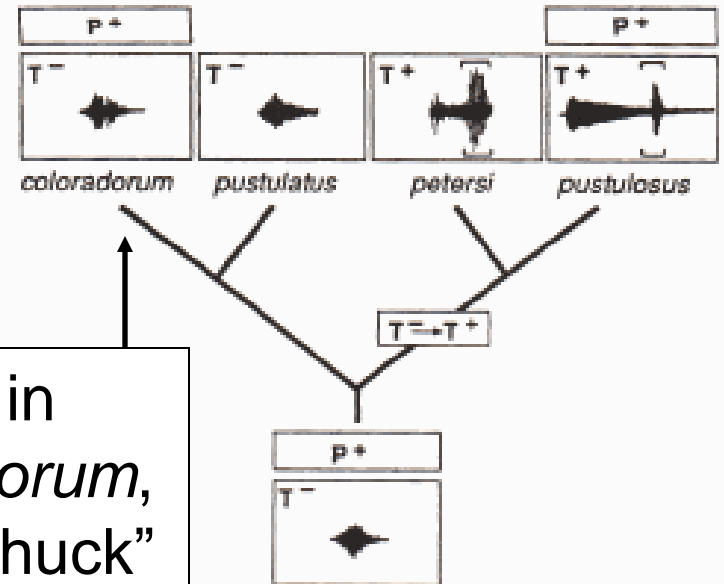


Population mean frequency of "chucks" = 2.55 kHz

Best frequency of basilar papilla in ear = 2.13 kHz

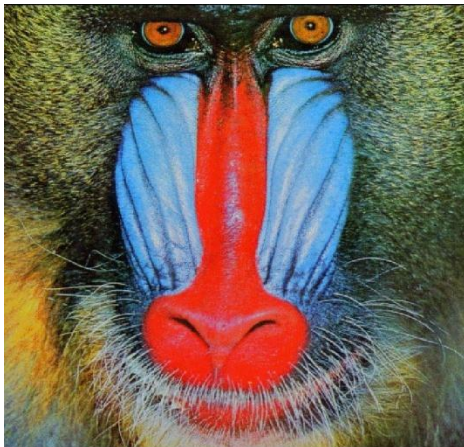


Similar tuning in ear of *coloradorum*, which lacks "chuck"





Why produce such costly signals?



Handicap principle

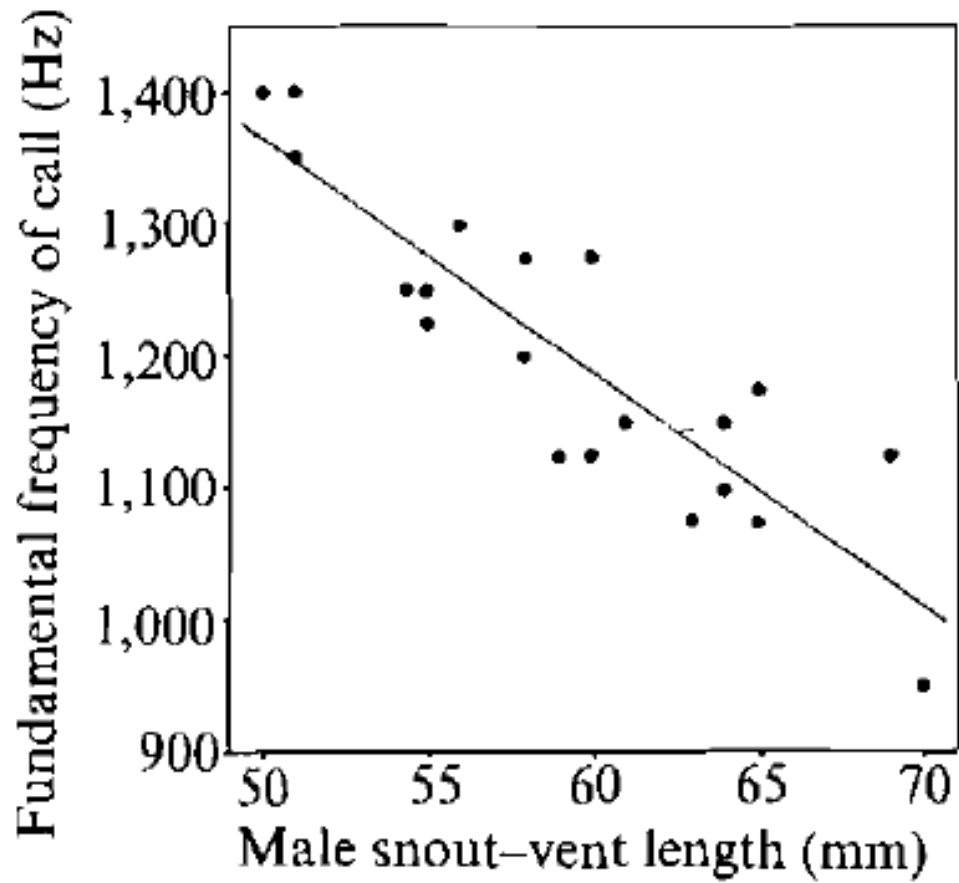


Costly signals are more likely to be honest indicators of quality, therefore should be more salient to conspecifics

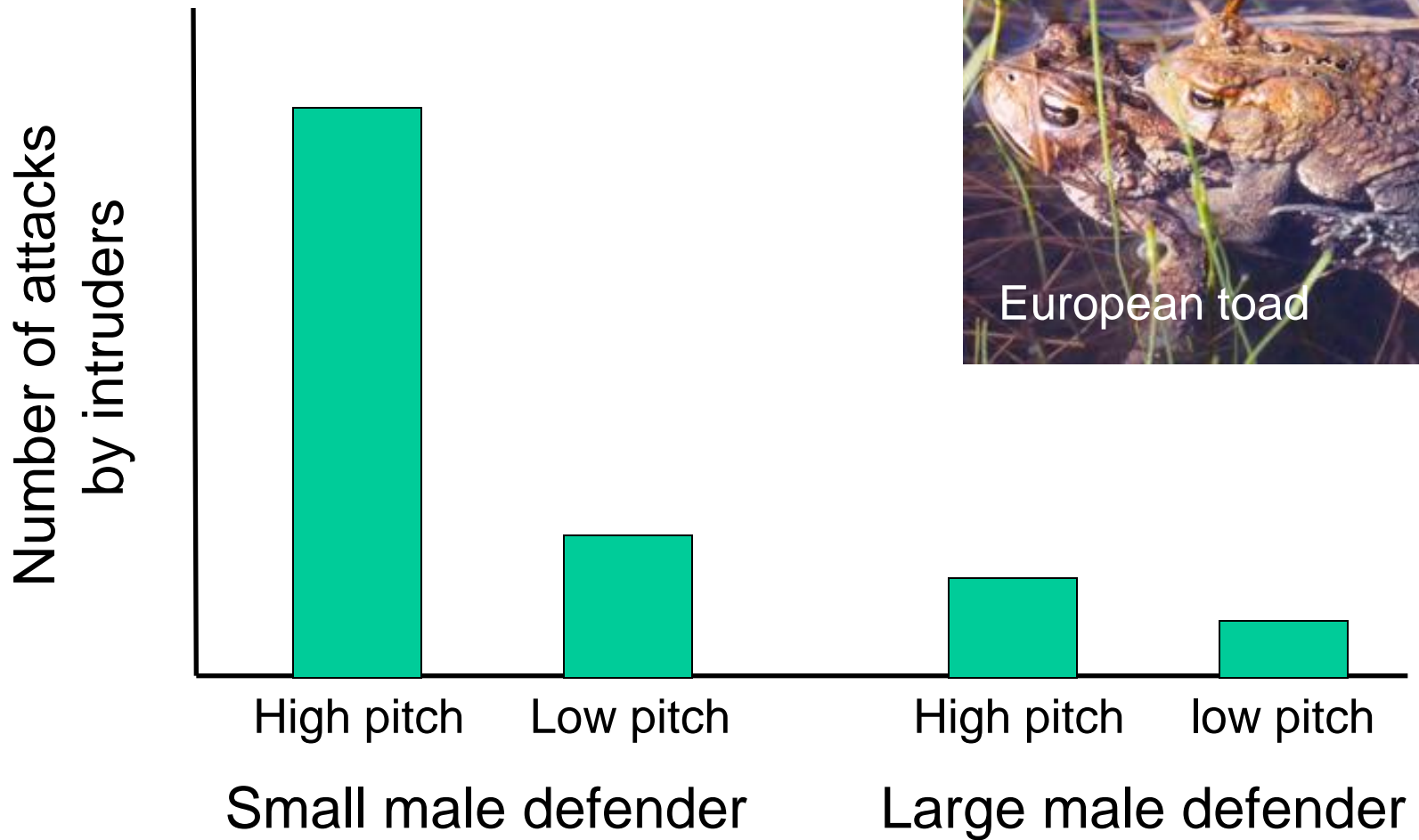
Amotz Zahavi



Honest signaling



Honest signaling



Honest signaling

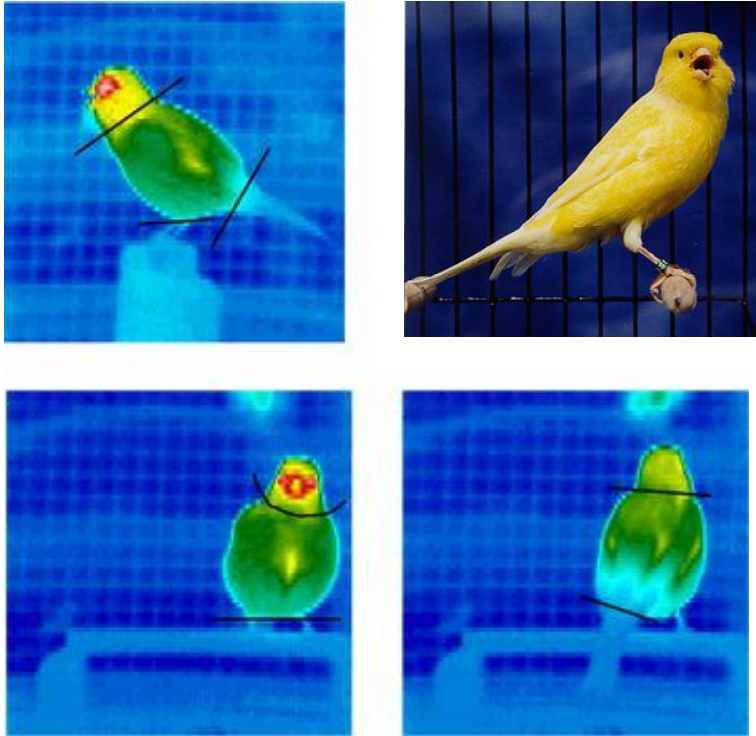
Honesty enforced by costs

1. Energetic costs
2. Third party interception
 - a. Predators, parasites
 - b. Conspecifics (eavesdropping)

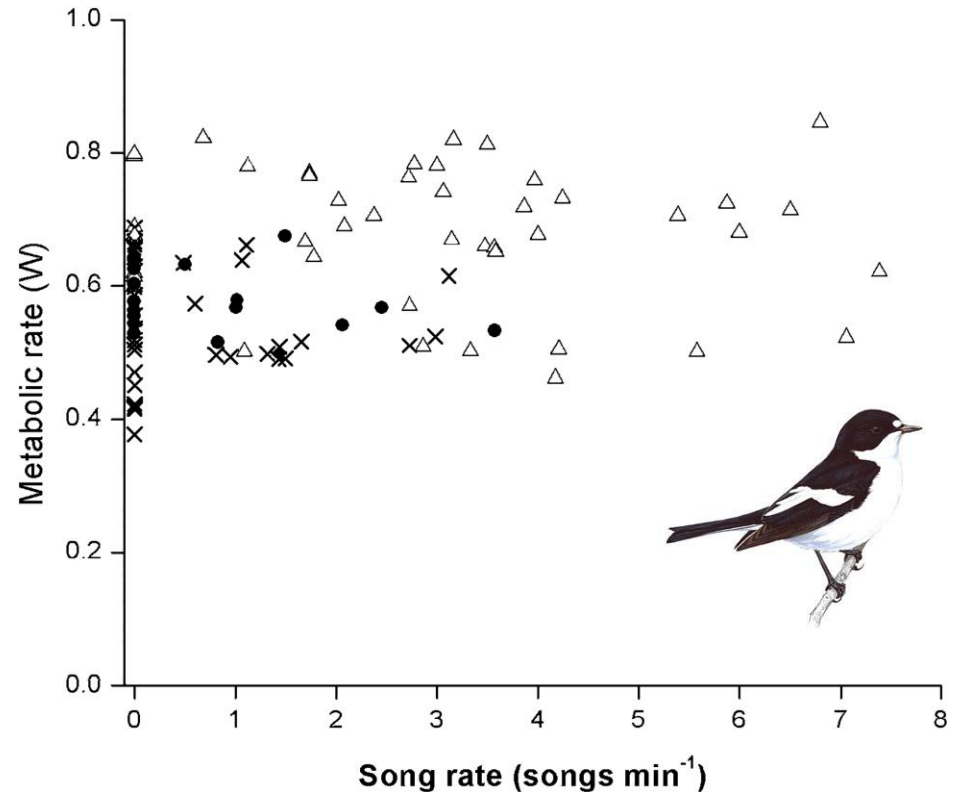


Costs of signaling

Talk is cheap, at least in birds



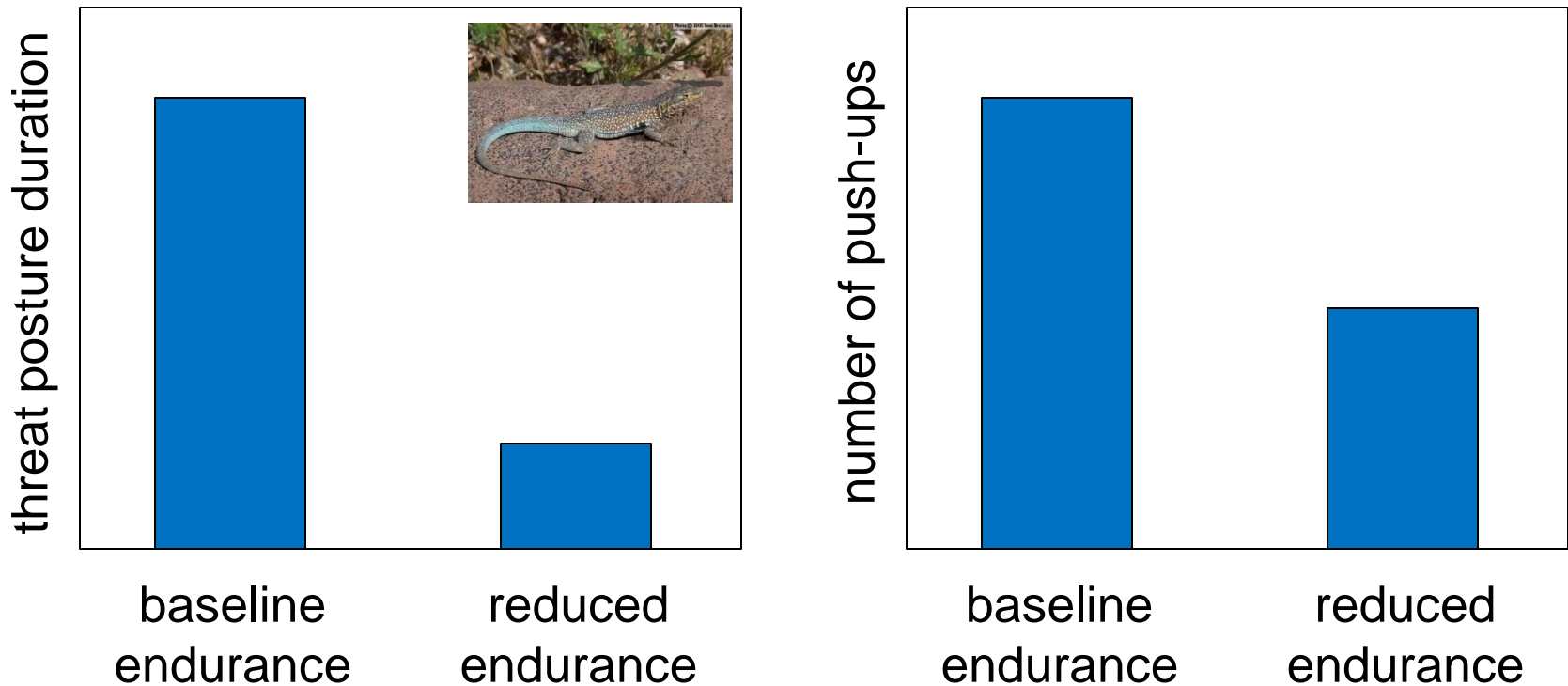
14% raise in metabolic rate in singing canaries



Minimal cost of singing in pied flycatchers

Costs of signaling

Energetic costs of display may be greater in lizards



Threat posture compresses body, increases anaerobic respiration (lactate in blood)

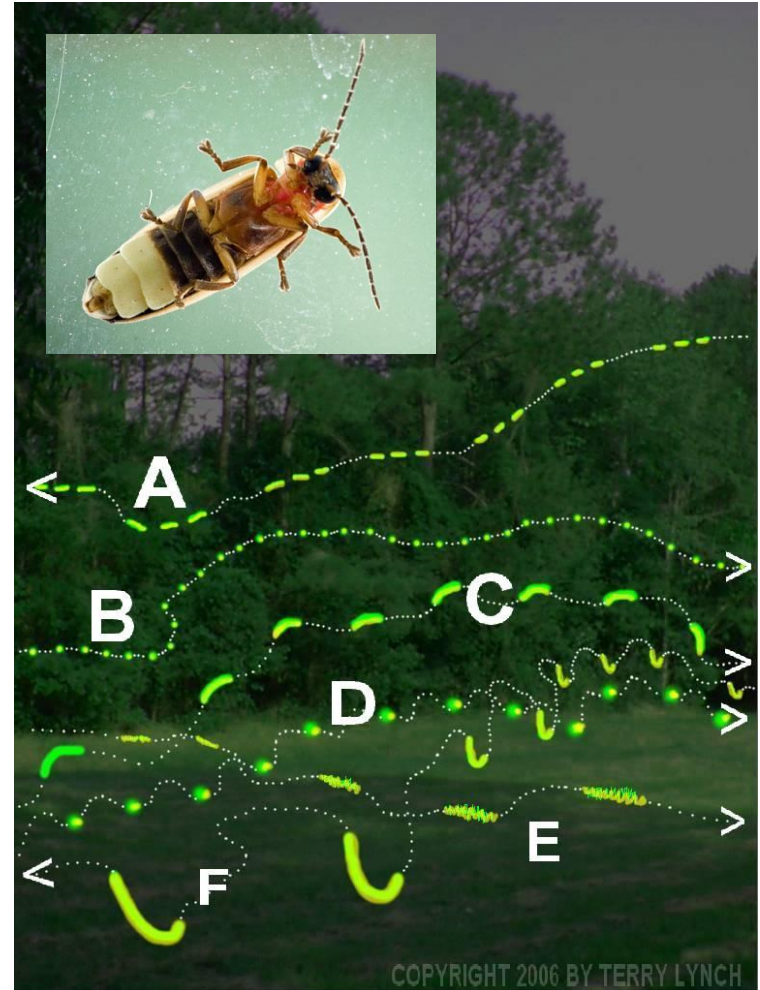
Costs of signaling

May be intercepted by unintended receiver

Photuris female



Photinus male



Why “femme fatales”?

Photinus pattern indicated by “F”

Costs of signaling



Photinus produce lucibufagins
Photuris do not

Palatable
Photuris female



+

Photinus male with
lucibufagins



=

Unpalatable
Photuris female

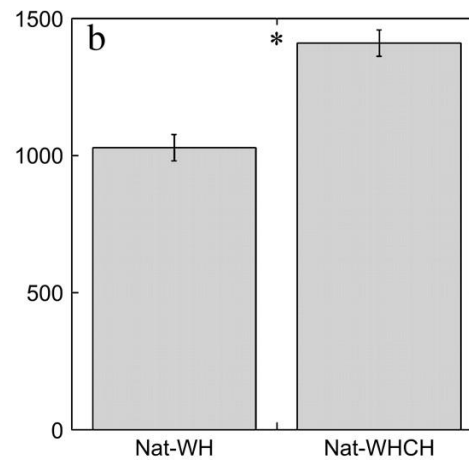
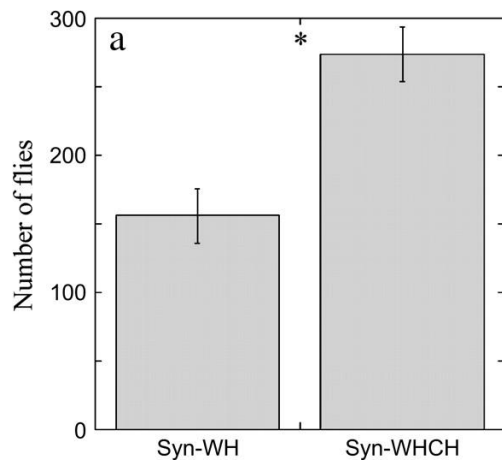
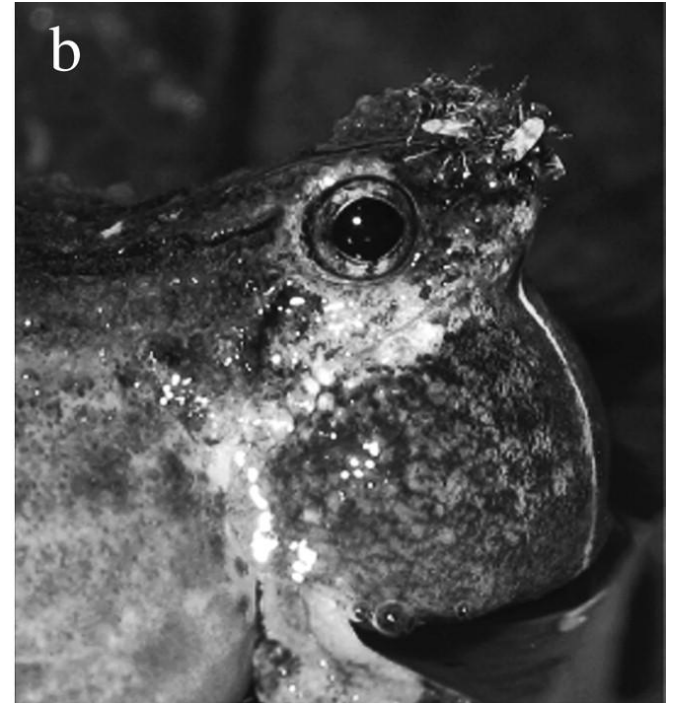


Costs of signaling

Complex túngara frog calls are attractive to other animals as well...



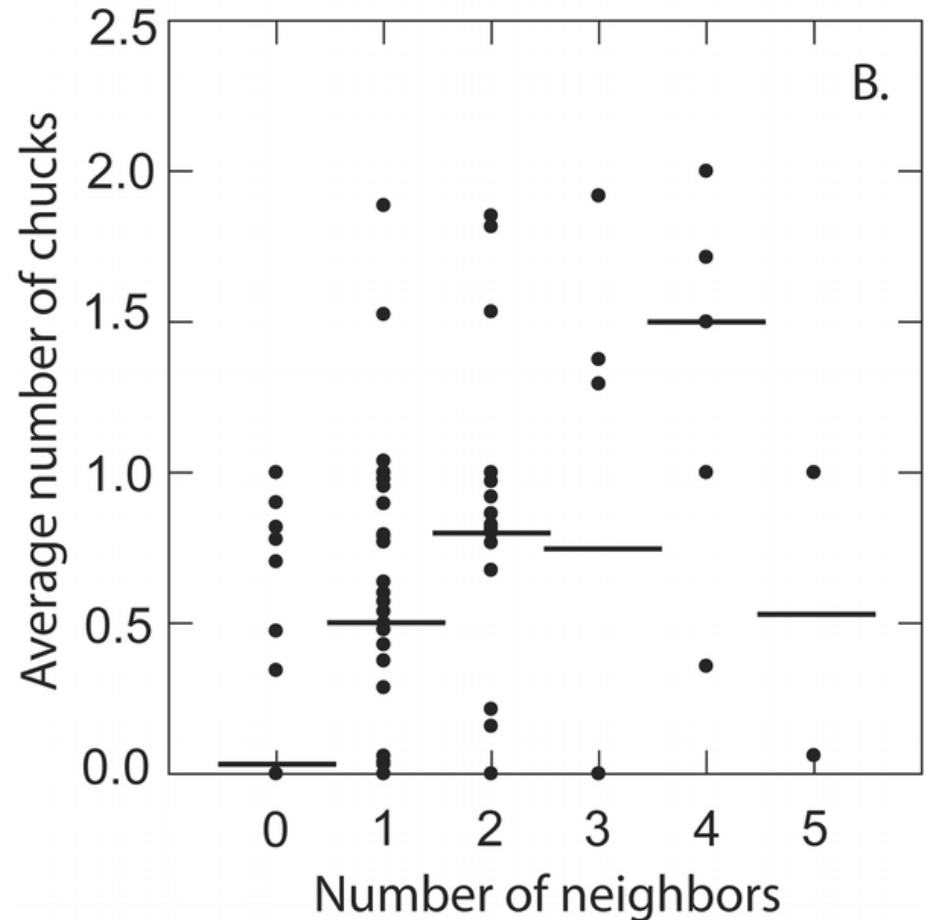
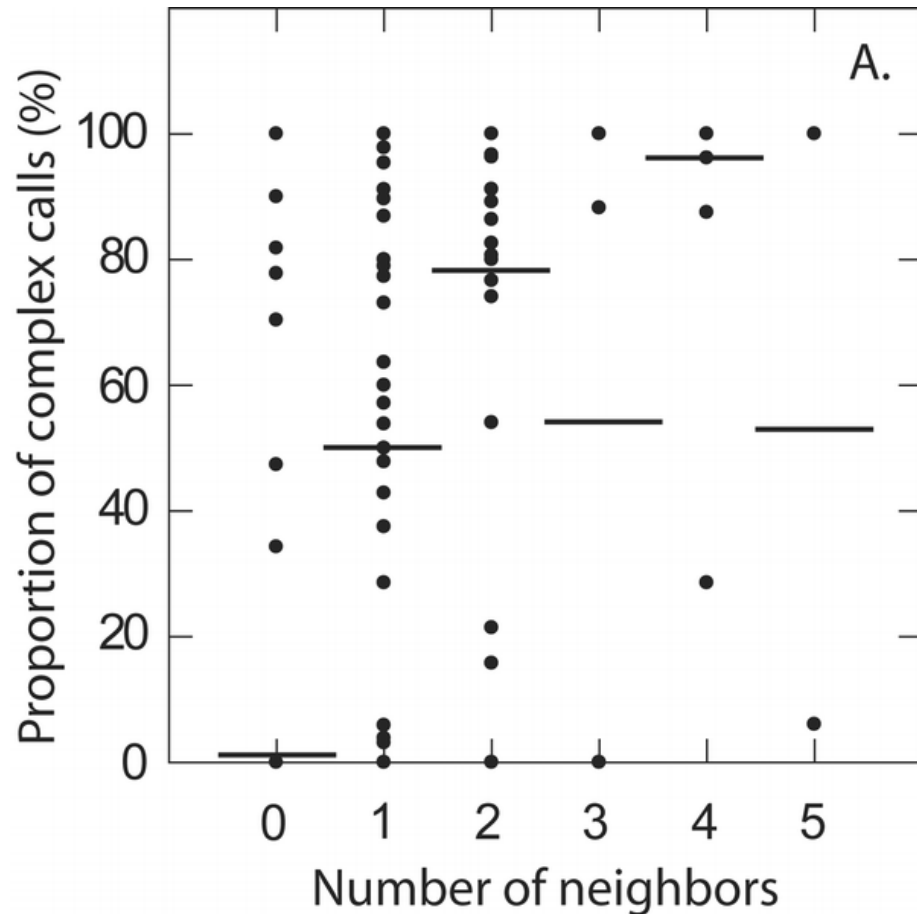
Costs of signaling



Positive phonotaxis
to chucks by
blood-sucking flies

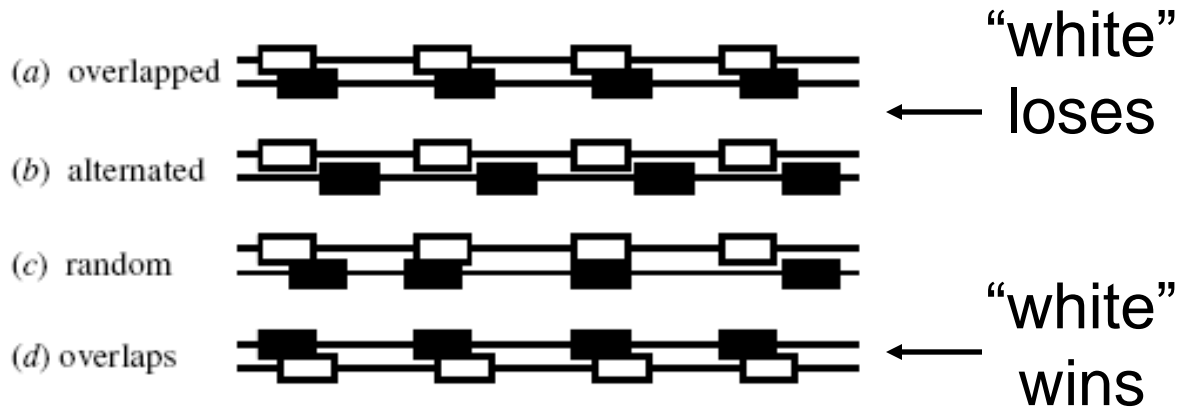
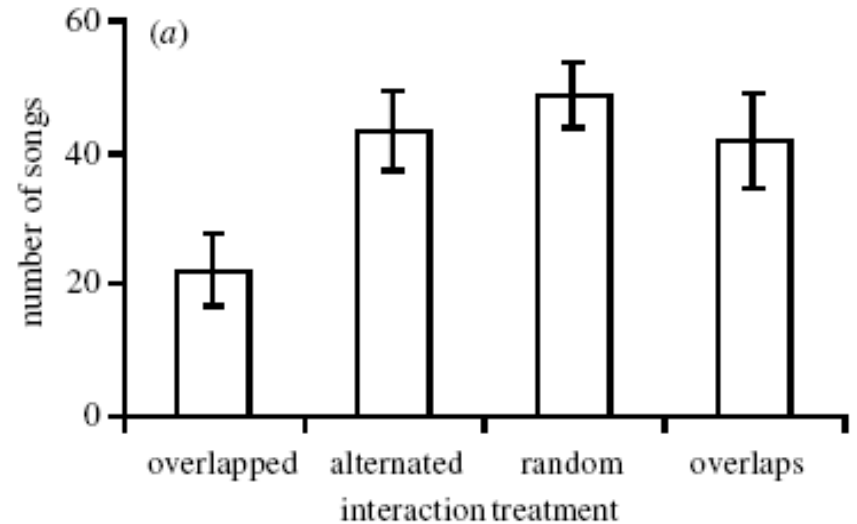
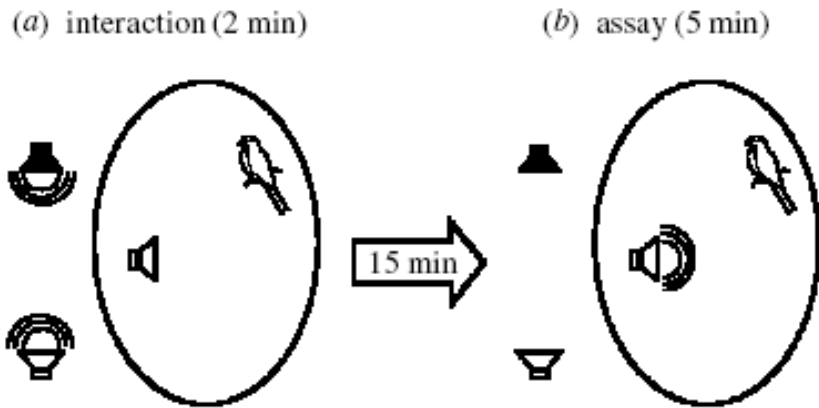
Costs of signaling

What would you predict about complex calls given by solo males versus males in groups?

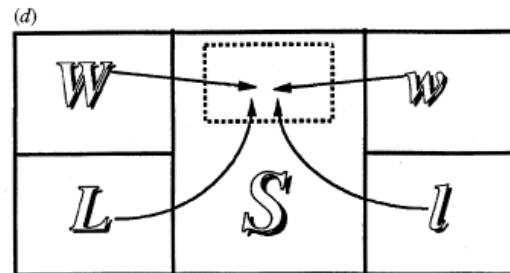
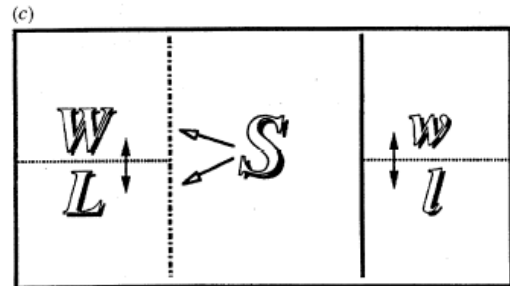
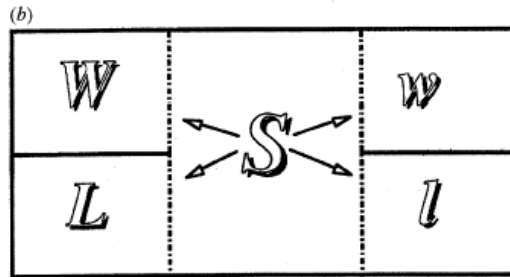
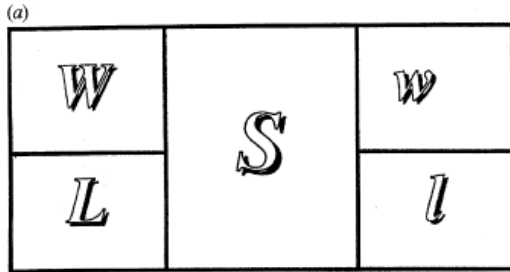


Eavesdropping

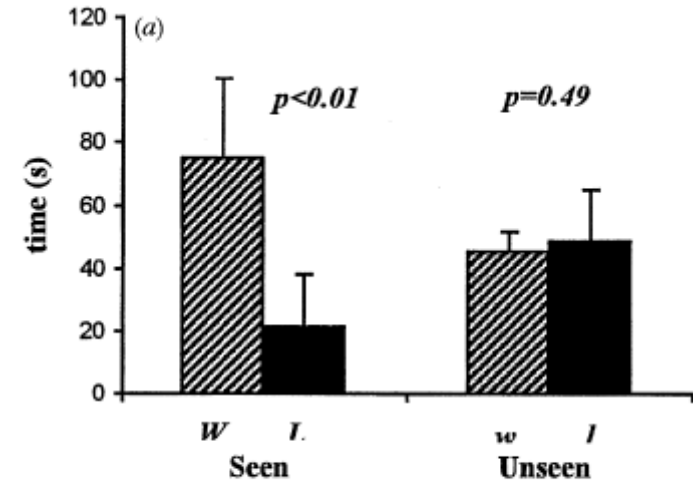
Third party gains information from an interaction that could not be obtained from the signal alone



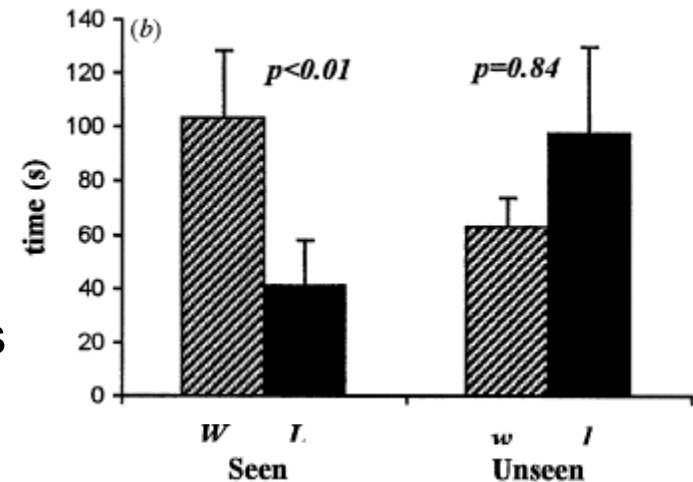
Eavesdropping



Latency to approach



Latency to display



Winners, losers in “seen” and “unseen” interactions sequentially put into tank with subject male