

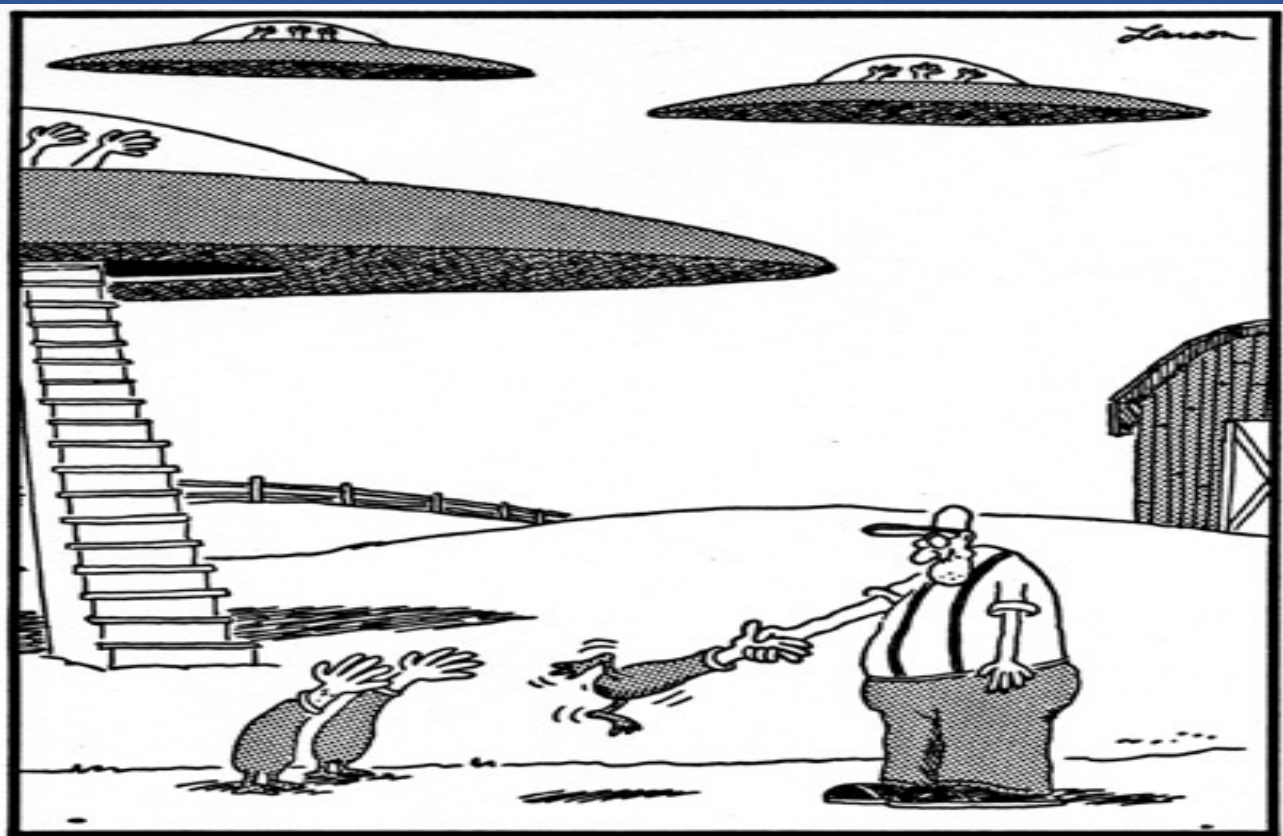
NON HUMAN COMMUNICATION

KISS WORKSHOP – Data Driven Approaches to Searches for the Technosignatures of Advanced Civilizations

May 20-24 2019

DR. DENISE HERZING, RESEARCH DIRECTOR
WILD DOLPHIN PROJECT

AFFILIATE ASSISTANT PROFESSOR, DEPT OF
BIOLOGICAL SCIENCES FLORIDA ATLANTIC UNV.



Inadvertently, Roy dooms the entire earth to annihilation when, in an attempt to be friendly, he seizes their leader by the head and shakes vigorously.

In 1961, **Frank Drake** convened a meeting on detecting extraterrestrial intelligence. at the Green Bank facility. The ten attendees were conference organizer Peter Pearman, Frank Drake, Philip Morrison, businessman and radio amateur Dana Atchley, chemist **Melvin Calvin**, astronomer Su-Shu Huang, neuroscientist **John C. Lilly**, inventor **Barney Oliver**, astronomer **Carl Sagan** and radio astronomer Otto Struve. These participants became known as the "Order of the Dolphin".

Brenda McCowan, Sean Hanser, and Laurance Doyle
Quantitative tools for comparing animal communication
systems:information theory applied to bottlenose dolphin whistle
repertoires. Animal Behaviour, 1999, 57, 409–419

Claudio Maccone
Paris, Budapest,San Marino
Acta Astronomica Sp Issues

1961
Order of the
Dolphin

1999
Dolphin Signals
and Information Theory

2008, 2010, 2012
Searching for Life Signatures

1993
Dolphins as
Extraterrestrial model

2008, 2010, 2012
Dolphins and
NonHuman Intelligence

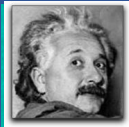
Lori Marino, Diana Reiss, Gordon Gallup
Self-Recognition in the Bottlenose dolphins:
A Methodological test Case for the Study of
Extraterrestrial Intelligence. Third
Decennial
US_USSR Conference on SETI. ASP Conf
Series, Vol. 47, 1993.

Lori Marino and Kathryn Denning
Astrobiology Conference
San Jose, Houston, Atlanta
Website and Workshops



NON HUMANS AS A PROXY FOR ALIEN LIFE

WHY DOLPHINS?



ENCEPHALIZATION QUOTIENT-
EQ (BRAIN/BODY RATIO)

EQ = 7.0

EQ = 3.5

Marino, 1998

EQ = 2.2



TOOL USE



A Coakes

Smolker, Richards, Connor 1997

ARTIFICIAL LANGUAGE COMPREHENSION



L. Herman, A. Pack

MIRROR SELF RECOGNITION



Marten 1998, Delfour 1998,
Reiss & Marino 2001

3:53:27 AM

CANDIDATES FOR COMPLEXITY

- Long-lived
- Mixed age-classes
- Multi-generation groups
- Individual Personalities
- Teaching and Imitation



HOW DO NONHUMAN ANIMALS COMMUNICATE *WITH THEIR OWN*?



Acoustic- Sound

Cross
Modal



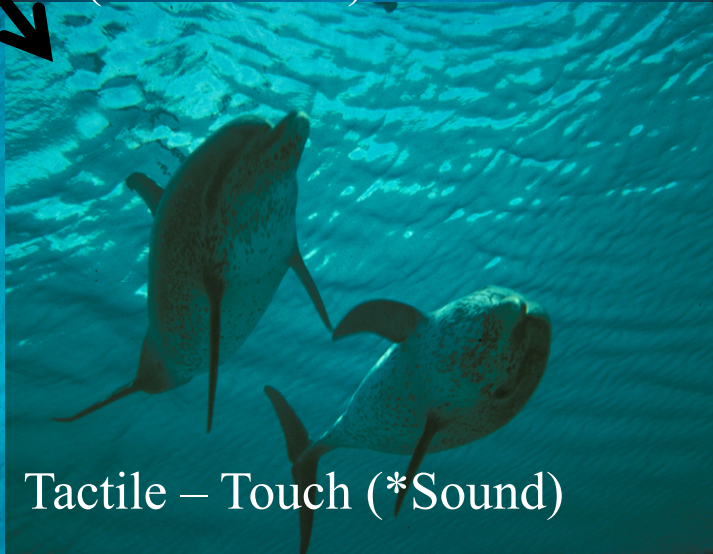
Vision – Visual
(Mono/Bino)



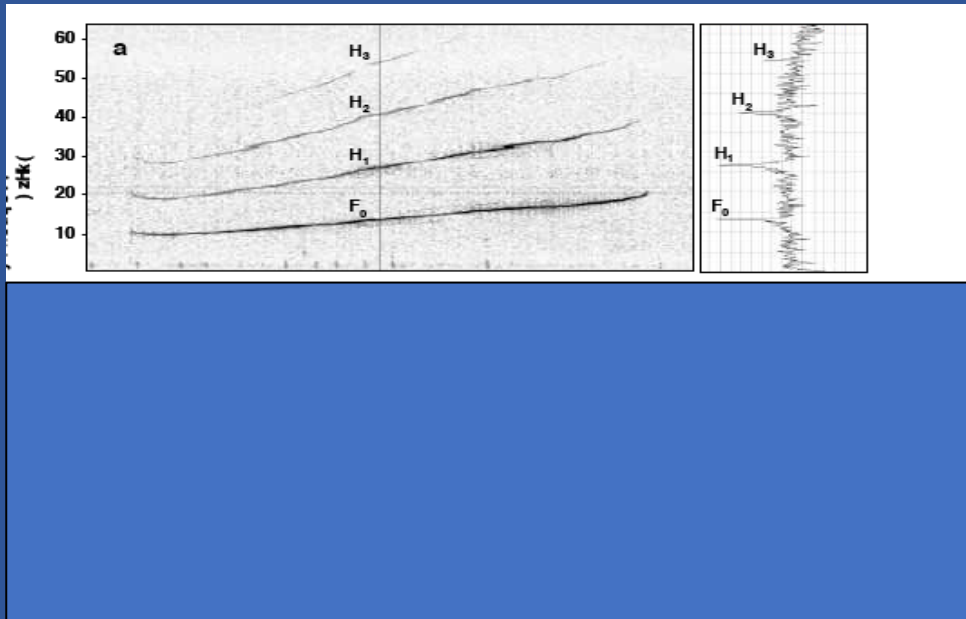
Gustatory - Taste



Tactile – Touch (*Sound)



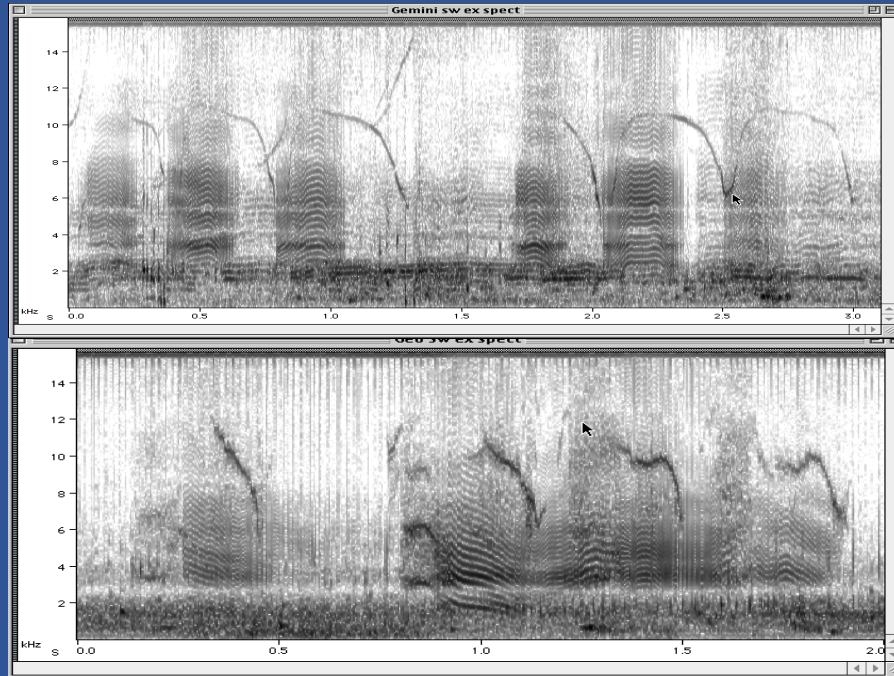
ARE WE MEASURING WHAT THEY HEAR?



Second figure adjusted for hearing sensitivity - striped dolphin

Dr. Marc Lammers, Univ. Hawaii

NOISE OR DATA?



GEMINI - MOM

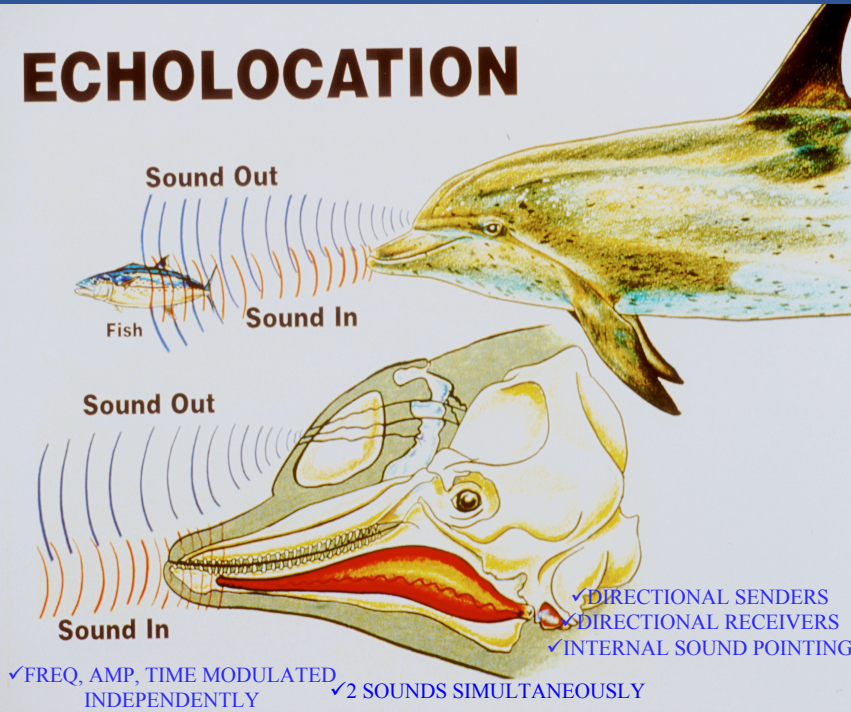


GEO - SON

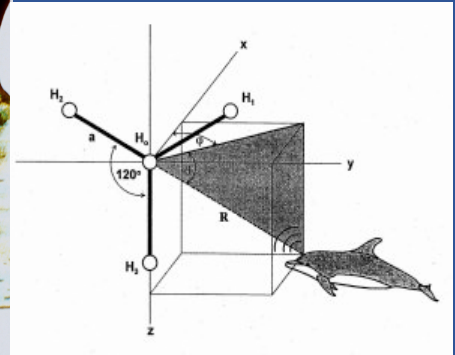
WHAT ARE THE CHALLENGES OF DATA ACQUISITION?

RECORDING ULTRASONICS

ECHOLOCATION

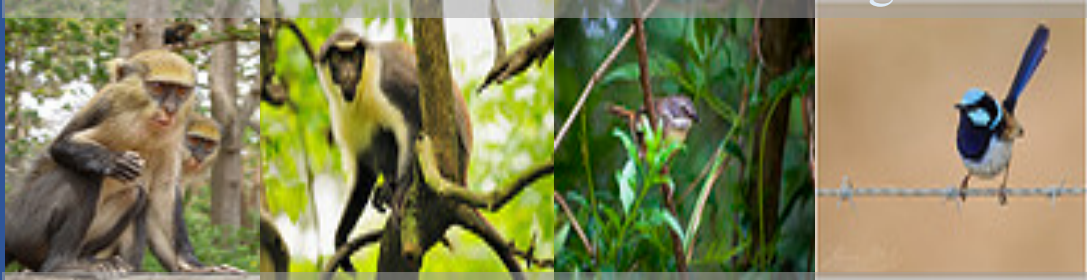


LOCALIZING THE VOCALIZER

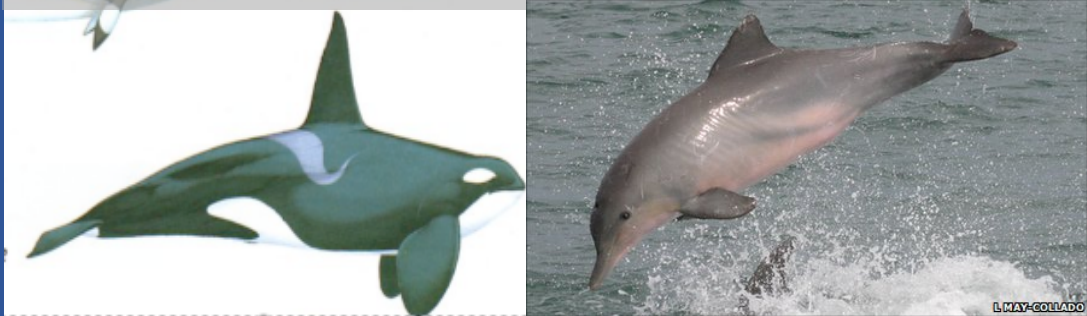


HOW DO NONHUMAN ANIMALS COMMUNICATE *WITH OTHER SPECIES?*

Listen and Decode - Sentinel Warning Calls



Create and Use – Shared/Mutual Calls



STEALTH OR PRIVATE COMMUNICATIONS

-who is intended audience?

Killer whales – acoustic crypticity

Residents
Eat fish
Use regular click spacing



Transients
Eat marine mammals
(w/ good hearing)
Use irregular click patterns

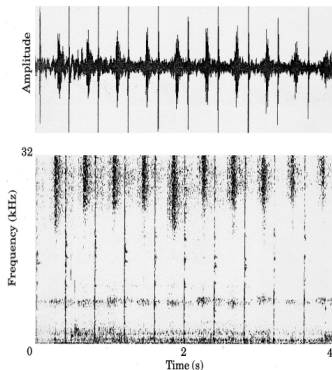


Figure 1. Waveform and spectrogram of 4 s of a resident killer whale click train. Clicks are narrow vertical lines on the spectrogram plot; the wide shaded areas extending up from 20 kHz are click echoes, probably from a large diffuse target such as a kelp bed.

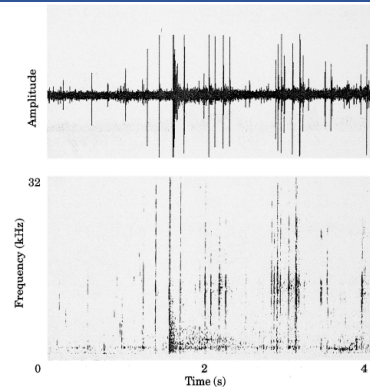


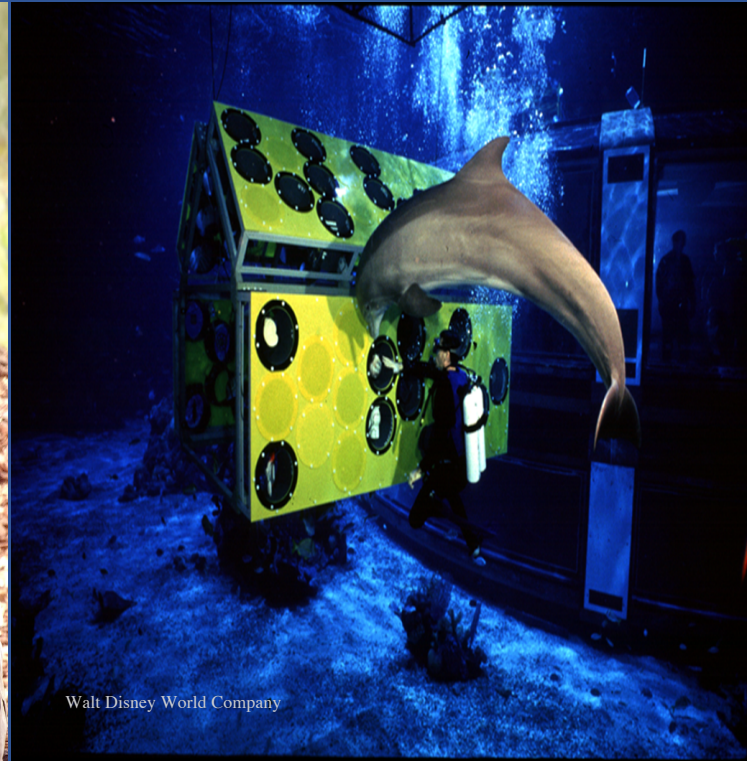
Figure 2. Waveform and spectrogram of 4 s of a transient killer whale echolocation click train. Note the uneven spacing between clicks.

Barrett-Lennard, L.G, Ford, J.K.B., Heise, K.A.1996. The mixed blessing of echolocation: Difference in sonar use by fish-eating and mammal-eating killer whales. *Anim. Behav.* 51, 553-565

CEPHALOPODS – SIGNAL WITH CHROMATOPHORES TO PREDATORS, WHILE SIMULTANEOUSLY CHANGING POLARIZATION TO TALK TO CONSPECIFICS

HOW HAVE HUMANS TRIED TO COMMUNICATE WITH NONHUMAN ANIMALS?

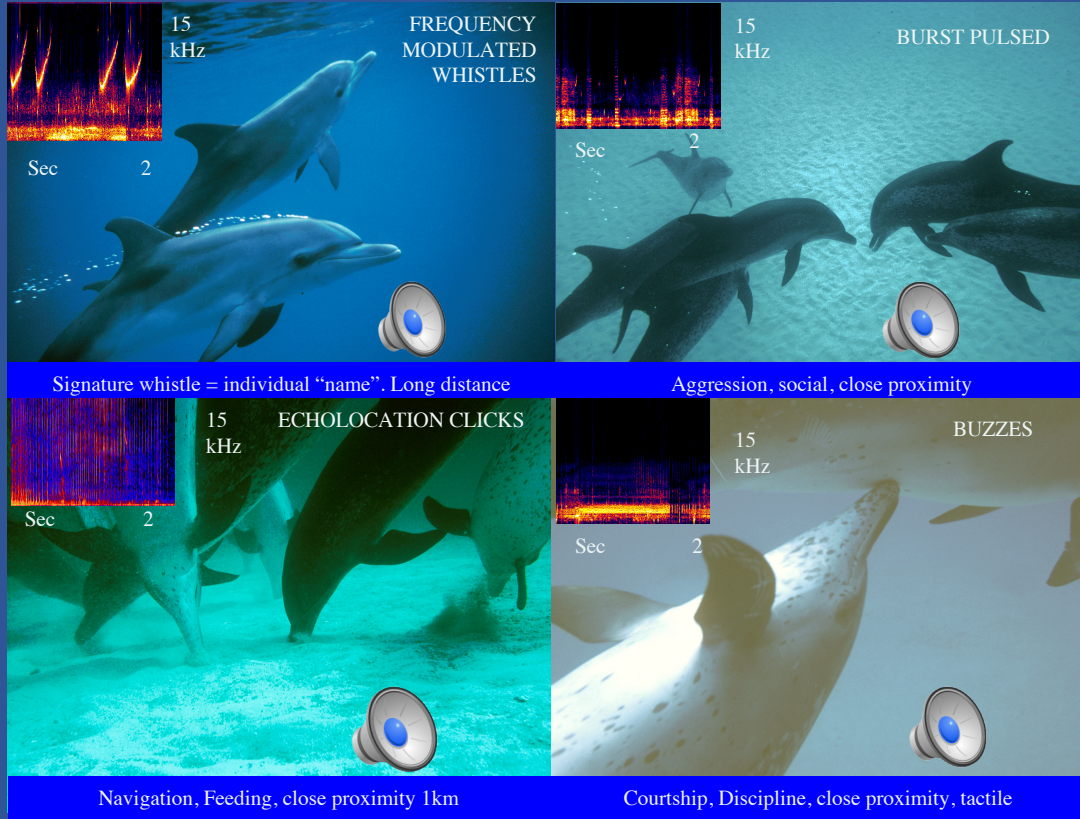
BRIDGING THE GAP WITH TECHNOLOGY Interfaces and Keyboards



DID WE REALLY EXPECT THEM TO SPEAK “ENGLISH”?



OBSERVING AND EAVESDROPPING



LEVELS OF INFORMATION ENCODED IN DOLPHIN SOUNDS

- SPECIES

- *MAXIMUM FREQUENCY* OF WHISTLES
- *WAVEFORM SHAPE* OF ECHOLOCATION CLICKS

- COMMUNITY

- *DIALECTS* - SUBTLE DIFFERENTS IN WHISTLES

- FAMILY/CLAN

- UNIQUE *SOUND TYPES* OR SHAPES OF WHISTLES

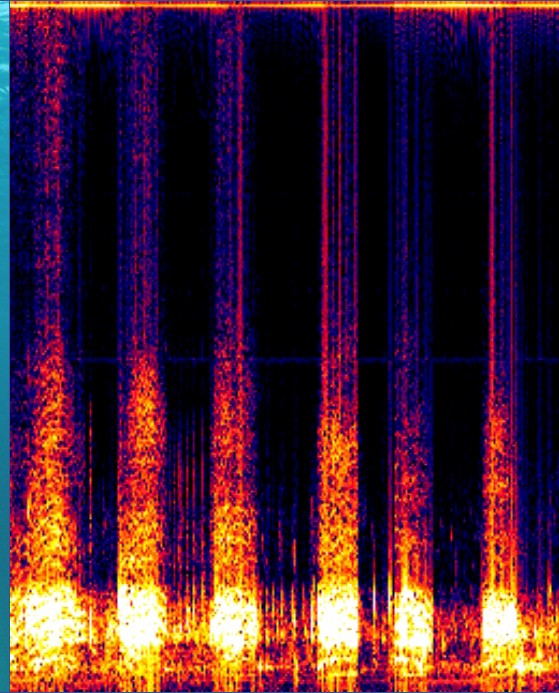
- INDIVIDUALS

- *CONTOUR* OF SIGNATURE WHISTLE



SYNCHRONY, SEQUENCES, AND SIGNAL RELATIONS

Louder Than, Longer Than

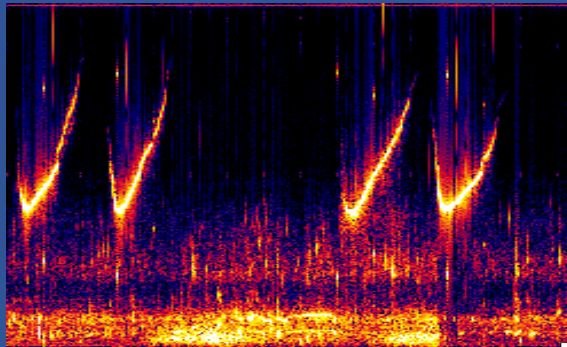


REFERENTIAL OR GRADED?

SIGNATURE WHISTLES
MOTHER/CALF REUNIONS



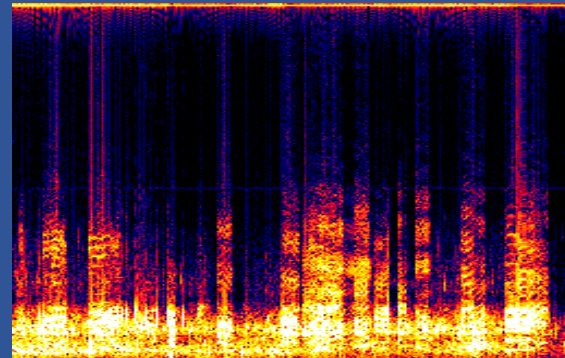
DOLPHIN AGGRESSION
HEAD TO HEAD POSTURE



0

SECONDS

2



0

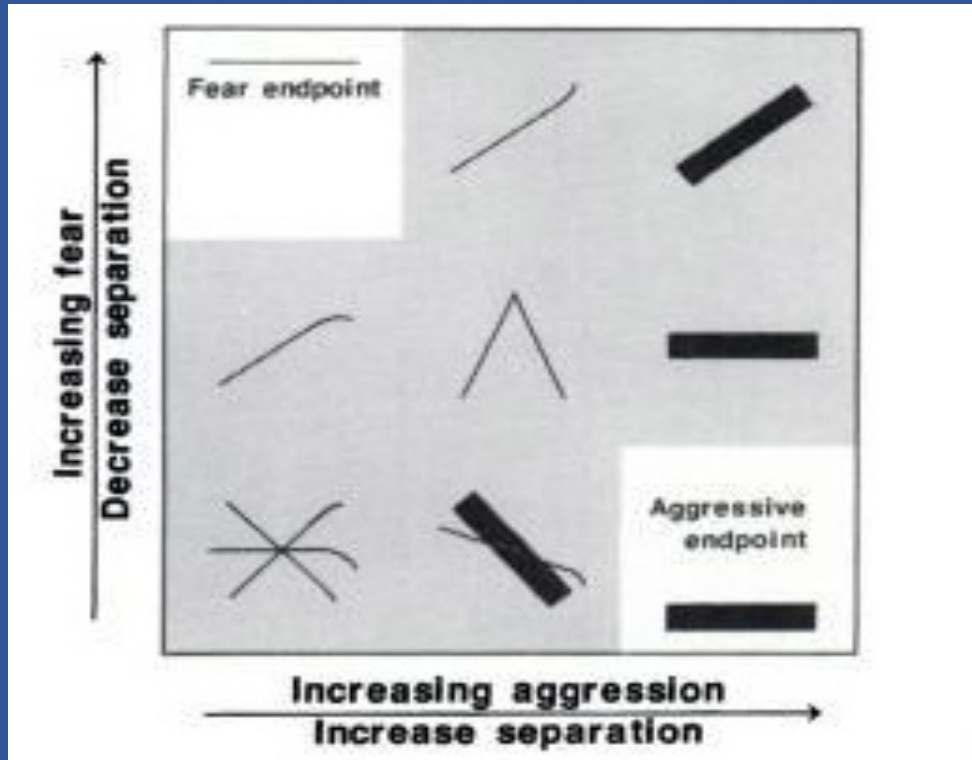
SECONDS

2



ARE THERE ANY UNIVERSAL RULES?

MOTIVATIONAL/STRUCTURAL RULES – BIRDS AND MAMMALS



Morton, E. S. 1982. Grading, discreteness, redundancy, and motivation—structural rules. In: *Acoustic Communication in Birds* (Ed. by D. Kroodsma & E. H. Miller), pp. 183–212. Academic Press.

REFERENTIAL CALLS IN NATURE

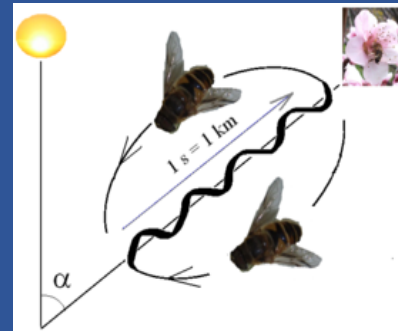


Vervet monkey alarm calls for different types of predators e.g. Seyfarth^a & Cheney 1992



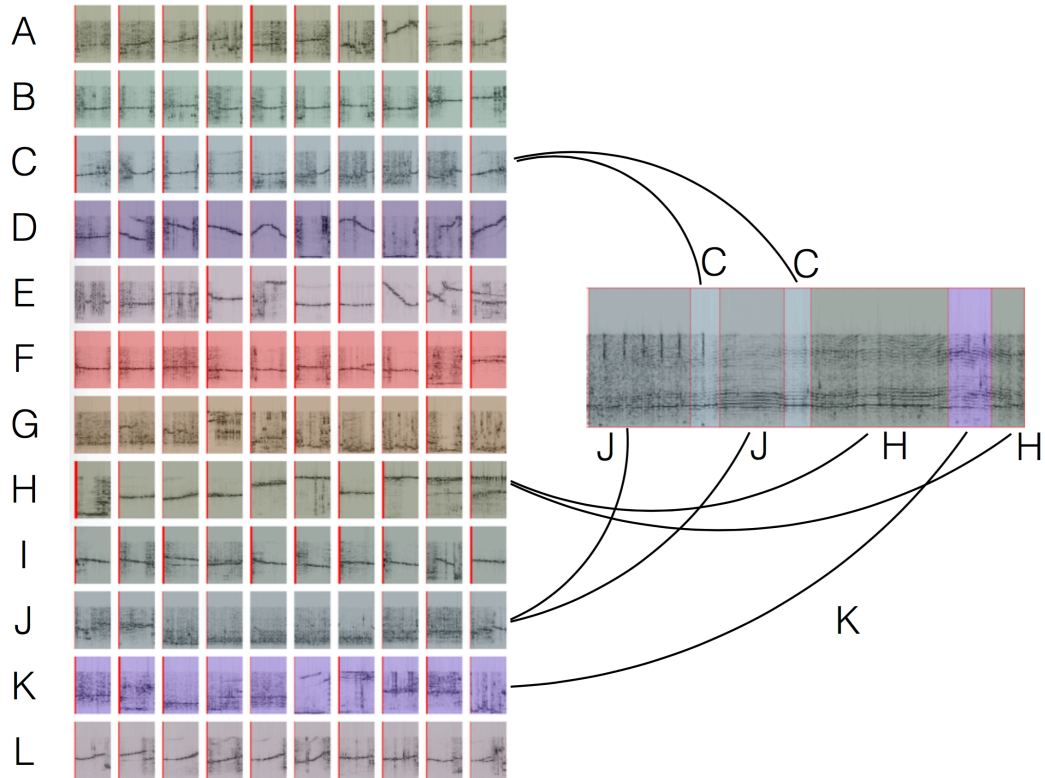
Prairie Dogs - calls for humans, guns, color of shirt, etc. e.g. Slobodchikoff and colleagues 2002

Bees – waggle dance – distance/orientation information e.g. Judd - 1994



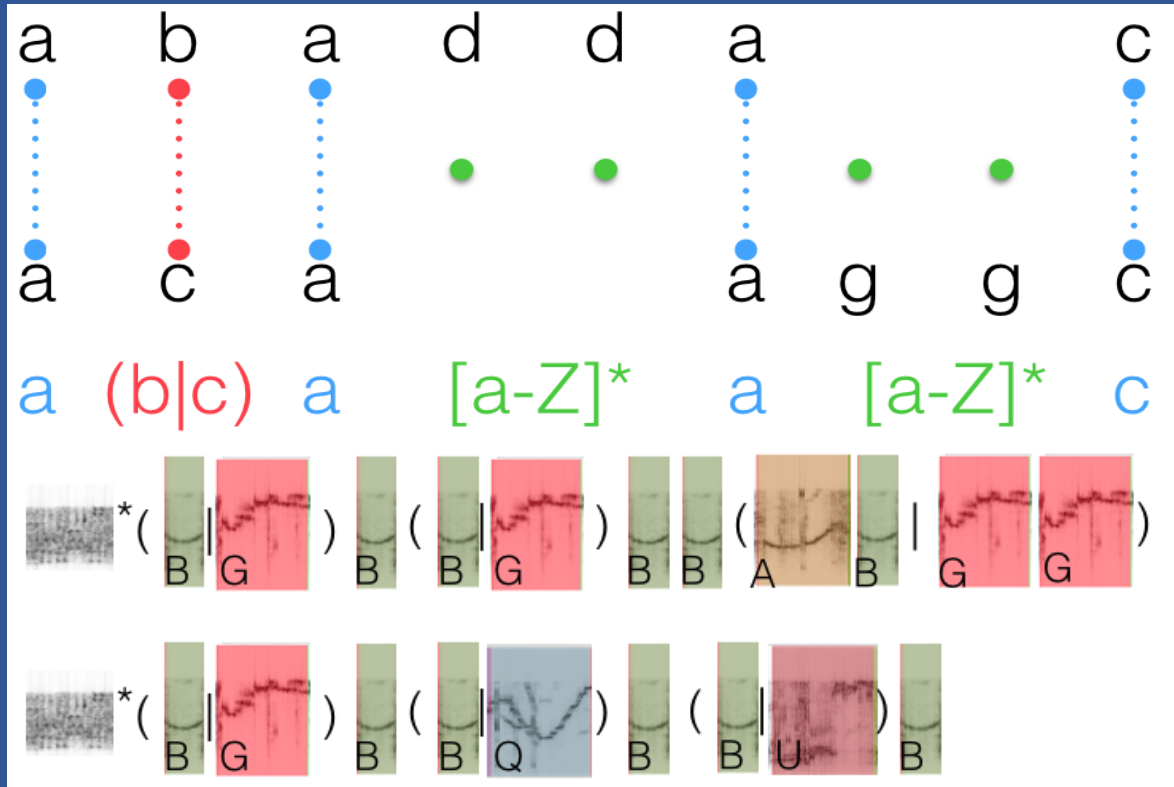
CATEGORIES AND CLUSTERING

Smallest units and sequences

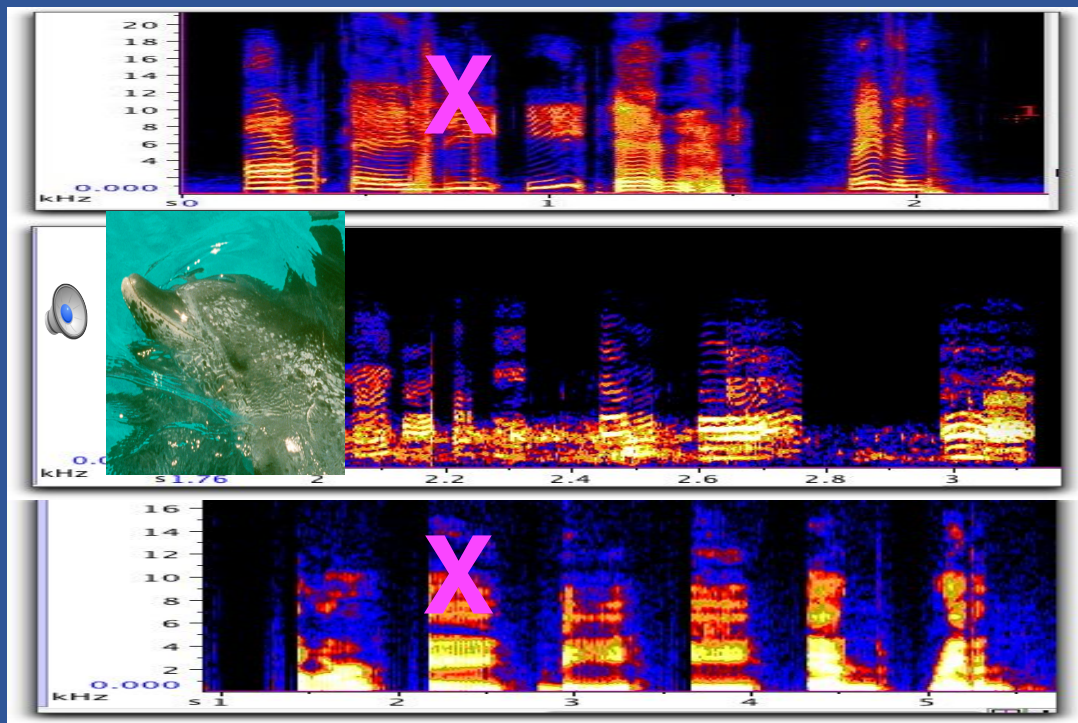


REGULAR EXPRESSIONS/RULES

Alignment Based Learning



HUMAN SOUNDS OR DOLPHIN SOUNDS?





DETECTING INTENTION
MIMICRY AND IMITATION (postural, vocal)

EXERCISE

OPERANT CONDITIONING

SOCIAL/MODEL RIVALRY

3 DOLPHINS TO WORK WITH ME

2 naïve, 1 experienced

REWARDS – FISH, SOCIAL PRAISE

SPECIES ALREADY
COMMUNICATIVE/SOCIAL