Cogs 143 * Animal Cognition

Lecture 7: CETACEAN COMMUNICATION

NOTE: Hydrodynamic design (reduces turbulence) & minimal articulation, limits their gestural & facial repertoires
But still, cetaceans have multiple modalities in which they communicate . . . (see *Herzing 2015* reading)

Detecting, Predicting, Engaging with Moving Others

- **Individual Movement** - Head points in direction most likely to move
  - **Pectoral fins** – manipulated to help steer
    - Usually high contrast to body, salient, predictive of animals' movements
    - Likely used by others, at close range, to synchronize behavior

- **Group Movements** – configurations of multiple animals
  - **Cooperative defense**
    - e.g. Spinner school forms tight cluster as defense against predators, often with young surrounded
    - e.g. Sperm Whales form "flower formation", heads toward center, to use powerful tails to repel Orca
  - **Synchrony** (see Fellner, Bauer & Harley, 2006)
    - Mothers & infants from birth engage in synchronous swimming, surfacing
    - Synchronous surfacing in adults predict prolonged pairing
    - Elaborate synchronous displays in male coalitions convey "we are one" to competitors, females

Antagonistic Signals (mostly)

- **Display teeth**, - As in many other species, showing teeth a threat
  - Includes **Jaw Claps** – snapping jaws together, makes loud, threatening sound
  - Such threats demonstrate willing/able to fight to gain access, less costly than actual fight
    - Altho fights DO happen; Animals show "**rake marks**" from being scraped by other's teeth

- "**S Posture**" – arch body vertically, appear larger as approach other
  - Observed in many cetacean species, used as a threat

- **Head/Body Orientation** – Neck vertebrae fused (except in Beluga) so limits on head movements, but…
  - e.g. Pelagic (deep water) species like Spinners must get along, since separate from group = threat to survival
    - So, maintain rule "Parallel is polite"
  - e.g. Coastal species, like Bottlenose, can afford to be aggressive, since if separate, can easy rejoin later
    - So, frequently perpendicular, i.e. Often point head/sound blasts at each other
  - Note head turn also indicates focus of attention - More on this later!

Affiliative Signals (mostly)

Touch - High tactile sensitivity, Affiliative behavior often involves contact, with body & sound
  - e.g. Rub, pet, "whet pecs" >> like grooming in primates, calming, bonding, builds trust
  - **Reconciliation** – After aggression, friendly contact increasingly likely between antagonists
- Sex – often involves prolonged "foreplay" of rubbing, caressing, buzzing
  - Cetacean penis ("sea snake") usually quite large & red (salient), motorically controlled & semi-prehensile
- "Mounting" also occurs between males, presumably as a dominance behavior

Body tilt, show bright underside, give access to genitals
- Most species dark above, light below, camouflaged from below against sky, from above, depths
  - So tilting is salient to vision sensitive to high-contrast, motion
- e.g. Spinner dolphins tilt belly toward other as greeting/farewell, tilt back toward other as rejection

PLUS:

- **Eyes** are often high contrast to body, so noticeable (salient) cue
  Likely to be signals of social attention, especially at close range
- Alternatively can be obscured ("disruptive coloring") as in top predators (e.g. Orca) or prey (e.g. Commersons)

- **Bubbles** – visually salient even from afar, emitted from blowhole
  - Can release bubble trail while whistling – possibly for emphasis?
  - When released in large burst, indicates frustration, aggravation, surprise

- All cetaceans also use **Percussives** - Provide info on location, size, arousal state, attitude, etc.
  - Breach, pec slap, tail slap etc. against surface of water >> loud sound, visible splash
    - e.g. Spinner dolphin "spin" makes distinctive percussion, indicate very high arousal
      - As in rising excitement before group leaves resting bays to feed together offshore

Vocal/Auditory Communication

Cetaceans' primary mode of communication

Odontocetes produce three classes of vocalizations: **Clicks**, **Burst Pulses**, & **Whistles**

- **Clicks** – For Echolocation: Wide-band (e.g. 5-150 KHz), ultra-brief, in "trains" w/gaps for returning echoes
  - Can "Eavesdrop" on one another's echoes, learn about environment and about echolocater's interests
    - e.g. Detect echolocation as indication that others are feeding? (Poss function like primate "food calls"?)
  - Also has other social functions
    - e.g. Genital or fetus inspection, possibly other "internal state" read?
    - **Tacto-Acoustics** including tickle-buzz, caress, hit with high-intensity (>200bD) "Pops", etc.

- **Burst Pulse** – Social, but least well understood. Highly variable, produced by Dorsal Bursae like clicks
    - Mostly broad-band, but w/frequency & amplitude modulations
  - Includes high arousal vocalizations (screams, growls, etc.), but some more "conversational"
    - Most mysterious, little known about structure or function. Possibly high info content???
  - Most mysterious, virtually nothing known about structure or function. Possibly high info content???
    - ??Tacto-acoustic aspects ??Perspectival (e.g. a "language of looks" as types/angles of echoloc)??

- **Whistles** – Social. Narrow-band (usually 1 freq at a time), frequency modulated, highly variable
    - e.g. Spinner dolphins **chorus whistles** to rally whole school, resting in bay, to go hunt together

  - Includes "**Signature" Whistles**" in many dolphin species
    - Individual-specific Signature Whistles, announce self, occasionally made by others in group
      - Each is a specific contour. May shift size, length, transpose, but always preserve contour
    - Pregnant females hugely increase Signature production in last weeks of pregnancy
      - Infant born knowing mom's signature; Used as "contact call", promote mother/infant reunions
    - Contact calls in many species (pinnipeds, ungulates, some birds) but usually based on voice
      - But changes water depth affects pressure, alters voice >> so Ds evolved contours instead?
    - Male coalitions can develop a "Coalition whistle" that replaces individual signature
      - Altho other evidence suggests they (some?) may also retain their individual signatures
    - Also made by animals forcibly isolated from group (e.g. during capture/release)
      - Other group-members may match call; Also some evidence of matching when groups meet
      - May serve as way to present/acknowledge identity in visually limited Fission/Fusion situations
    - Use by others mostly still a mystery! Summon other? Refer to absent others??

  -NOTE Problem: We know so little about social functions of calls since so hard to identify speakers
    - i.e. Hydrophones, even arrays, cannot discriminate which of two side-by-side animals is vocalizing!
    - Need to attach "DTag" (Individual hydrophone) w/suction cups to each animal to study exchanges

- Other Odontocetes have similar "Identity" calls, but not these are not whistles
  - e.g. **Orca: Dialect" Calls** are Burst Pulse sounds
    - Specific to coalition, family, pod, kin group (even across pods), community. etc.
    - Probably serve much the same function as signatures, above, but not individual-specific
      (Orcas VERY family oriented)
    - Orcas from different oceans housed together, learn some of each others calls & develop a "tank" call

  - e.g. **Sperm Whales "Coda**" are Click patterns (|| | ||| | vs. || ||| || etc)
    - ID matrilineal pods & community

- PLUS, many **Mysticetes** "Sing"
  - Some (e.g. Bowhead whales) are simple, few-tone, repeated songs
  - Humpback Whale > extraordinarily complex song, a socio-cognitive feat!
    - Humpback Whale Song - Each male repeats 20+ min song w/several phrases
      - Sung mainly on breeding grounds, attracts females/repels (spaces out) males
      - All males in region (e.g. Hawaii) start season with same song, All maintain same changes thru season
        -Little singing on feeding grounds, but all resume song where left off when return to breeding
      - Changes usually = gradual modification of existing song (phrases lengthened, segmented etc) but sudden appearance of E Australia song in W Austr shifted whole W pop to E song by 3rd season!