Communication: Channels & Functions

MSc ETHOLOGY COURSE
Defining communication

- ‘Transfer of information’ (Batteau, 1968)
- ‘The sender provides information to another individual that can be used by the receiver to make a decision about the most appropriate action, given the existing circumstances’ (Bradbury and Vehrencamp, 1998)
- Its beneficial both for the sender and the receiver
Some aspects of communication...

- **Signals**
  - Trait, posture, movement, sound or chemical with a specific meaning

- **Stereotypy**
  - Every member of the population sends the same signal in a similar way

- **Cues**
  - The sender doesn’t benefit *because* the action
  - Fish cleans its nest
# Channels for communication

<table>
<thead>
<tr>
<th>Feature</th>
<th>Visual</th>
<th>Auditory</th>
<th>Chemical</th>
<th>Tactile</th>
<th>Electrical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective distance</td>
<td>Medium</td>
<td>Long</td>
<td>Long</td>
<td>Short</td>
<td>Short</td>
</tr>
<tr>
<td>Localization of sender</td>
<td>High</td>
<td>Medium</td>
<td>Variable</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Ability to go around obstacles</td>
<td>Poor</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Speed of transmission</td>
<td>Fast</td>
<td>Fast</td>
<td>Slow</td>
<td>Fast</td>
<td>Fast</td>
</tr>
<tr>
<td>Complexity</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Durability</td>
<td>Variable</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
Vision

- Ease of localisation
- Rapid transmission and fade out time
- Rich variety of signals
  - Brightness, color, spatial & temporal pattern
  - Movement, posturing
- Easily blocked
  - Razorback sucker spawning season
- Nocturnal animals
  - Focus on contrast
  - Eagle owls white throat
Hearing

- Long distances
- Rapid exchange & immediate modification
  - If the visibility is limited
- Can be complex
  - Frequency, amplitude & rhythm
- Producing sounds
  - Specialised structures
    - Larynx, syrinx, air sacs...
  - Using the environment
    - Ground, water, trees
    - rabbit stamping
Chemical senses

- Smell and taste
- Long distance, slower fade-out time
- Difficult to locate the signaler
- Scent marking - „odor mosaic” (Johnston, 2000)
  - Common marmosets
    - use a mixture of scent
    - unique scent signature
- Varies with context
  - Queen honeybee’s inhibitor and sex attractant
- Remote and Contact chemoreception
Chemical sense

- Vomeronasal organ
  - Some amphibians, reptiles, mammals
  - Separated from the olfactoy system
  - Detect nonvolatile chemicals
    - Direct contact
  - Flehmen
Touch

- Sent quickly and easy to locate the sender
- Only over short distance and not effective around barriers
- Honeybee scouts touch the dancer bees with their antennae
- Humans are able to send and decode 12 emotional signals via touching
Electrical fields

- Knifefishes & Elephant-nose fishes
- „weakly-electric”
- Electric organ derived from muscles
  - Tail becomes negative while the head is positive > electric field
- Electroreceptors detect the signal
  - Shape of the field
  - Pattern: wave-type and pulse
- Used in various situations
  - Courtship (electrical duet 😊)
  - Agonistic encounters
  - Parent offspring communication
Multimodal communication

- Signaling in different channels
- Courtship display of a male bird
  - Visual & auditory signals
- Redundant or nonredundant
  - Recipient responds in the same way for each component or not
- Benefits
  - More information can be sent per unit time
  - Insurrrance that the message will be received and recognised
- Costs
  - Energy
  - Predation
Function of communication

- Settles conflict or allows cooperation
- Brings individuals together or keeps them apart
- Reproduction, parenting
- And so on...
Recognition of species & mate attraction

- Important when there are many closely related species
- In 56 square meter 12 species of fiddler crab were measured
  - Different courtship behavior
- Chemical and acoustic signals --> long distance
  - Silkmoth pheromone attracts males from 100 m
  - Cricket stridulation
Courtship & Mating

- Identification of the opposite sex
  - Some species communicate their sex
  - Some not...blue-ring octopuses

- Mate assessment
  - Courtship allows the female to judge the qualities of the male
  - Sterna hirundo catches fish and offers to the female

- Coordination of behaviour and physiology
  - Courtship synchronises the male’s and female’s behaviour
  - Ring doves
    - From the courtship till the feeding of the nestlings are coreographed by the behaviour and hormonal state
Maintenance of pair bonds

- Monogamous species
- Dusky titi monkeys sit with intertwined tales
- Pipefish have a greeting ceremony every morning

Maintaining social bonds

- Social group members
- Generally based on contact
- Allogrooming
  - Social grooming in rhesus monkeys
    - Differs from self-grooming
Alarm

- ‘flee signals’ have specific characteristics
  - Easy to emit quickly, difficult to locate
  - High pitched sounds, rapid visual signals...

- Calls according the context:
  - California ground squirrel
    - Whistle
    - Chatter-call

- Alarm signals to congregate into a group
  - Ant alarm pheromone
    - Freezing
    - Raising the head and waving their antennae
    - Moving towards the source
    - Releasing pheromone themselves
    - Biting the potential enemy
Communication about resources: Honeybee

- bee dance
Honeybee foragers increase the use of waggle dance information when private information becomes unrewarding.


- **Social information vs. Private information**
  - Foragers can follow waggle dances or follow their own experiences, route memory
- **Social information should be prioritized if private information has a low benefit**
- **They trained two groups of foragers to feeders (sucrose + special odour)**
  - F1 & F2
  - One became unrewarding while the other not
Honeybee foragers increase the use of waggle dance information when private information becomes unrewarding.


- F1 had an increased interest to F2’s dance
- However, after smelling the specific odour they checked the known but unrewarding feeder again
  - Foragers has a strong attachment to a known food patch
- Later they started switching from the familiar to the new rewarding but unfamiliar location
- Food resources commonly become temporarily unrewarding but later they may yield again
Humans as signallers in interspecific interactions

► Points for considering
  ► Where can we expect anything special?
  ► Why can we expect special cases among domesticated species?
  ► How can communication reveal specific aspects of cognition?
  ► Communicating of emotions and reference
  ► ‘Human specific’ aspects of communication - do they exist also in animals?