

ENG124: Language and Society

4. Natural Language, Artificial Languages, and Animal Communication Systems

Language and other communication systems

- Two of the most contentious issues in language study:
 - How unique is natural language?
 - How specific is natural language to humans?
- Uniqueness in terms of communicative systems available to humans
- Species specificity as a biological system

Comparisons

- We can hope to resolve these two issues by setting up comparisons with other communication systems available to humans and communication systems available to animals.
- What does human language share with other communication systems?
 - Natural language vs. artificial languages
 - Natural language vs. animal communication systems

Artificial languages (AL): Examples

- Machine-man interface systems
- Traffic Code
- Morse Code (dots and dashes or dits and dahs, and intra-character gaps, used in electric telegraph and amateur radio)
- Secret codes of communities
- Esperanto: introduced by L.L. Zamenhof in 1887
- Ithkuil: introduced by John Quijada (Ithkuil: A Philosophical Design for a Hypothetical Language)
- Glossopoeia: Construction of artificial languages a legitimate activity

Lingua Ignota

- First recorded AL: Lingua Ignota, invented by the twelfth-century German nun and mystic Hildegard von Bingen
- The inventor used Lingua Ignota for some form of mystical communion.
- More than 900 languages invented since then of which practically none have survived.

Esperanto

- Most successful of nearly a hundred languages invented in the nineteenth century
- Invented by L.L. Zamenhof in 1887
- *A simple to learn* global language
- Currently in use by a community estimated at between 100,000 and two million speakers, with about a thousand first language speakers
- Not in use as an official language in any part of the world

Esperanto: Some Characteristics

- Nouns have no gender, and end in -o; the plural ends in -oj (pronounced /oy/) and the accusative in -on.
- *amiko*: friend; *amikoj*: friends; *amikon*: accusative 'to a friend' and *amikojn*: accusative 'to friends'.
- Adjectives end in -a and take plural and accusative endings to agree with nouns.
- All verbs are regular and have only one form for each tense; they are not altered for person or number.
mi havas bonajn amikojn: I have good friends.
- Adverbs end in -e. *la bona amiko estas ie*: The good friend is here.

Ithkuil

- Natural languages are adequate, but that does not mean they are optimal – John Quijada
- He hopes to create an optimal system, to accomplish what languages generally fail to accomplish: a perfect communication.
- A language which has words for every conceivable thought.

Ithkuil

- “... an idealized language whose aim is the highest possible degree of logic, efficiency, detail, and accuracy in cognitive expression via spoken human language, while minimizing the ambiguity, vagueness, illogic, redundancy, polysemy and overall arbitrariness that is seemingly ubiquitous in natural human language.” John Quijada

JRR Tolkiens's languages

- Tolkien : a prolific inventor of languages.
- Known to have constructed in varying degrees of detail about twenty languages, each with a unique grammar and vocabulary.
- The exact number of languages constructed by Tolkien is unknown, for many of his linguistic papers are still unpublished.

Tolkien the Colanger

“What I think is a primary ‘fact’ about my work, that it is. . .fundamentally linguistic in inspiration. . . .The invention of languages is the foundation. The ‘stories’ were made rather to provide a world for the languages than the reverse. To me a name comes first and the story follows. . . .”

Tolkien the Colanger

I should have preferred to write in 'Elvish'.

But, of course, such a work as *The Lord of the Rings* has been edited and only as much 'language' has been left in as I thought would be stomached by readers....It is to me, anyway, largely an essay in 'linguistic aesthetic', as I sometimes say to people who ask me 'what is it all about'."

Mythologies

- Tolkien's invention of languages is connected to the mythology he developed in his fictional world
- Elvish: a family of languages, used in Tolkien's fictional universe.
- Secret Languages such as Khudal
- Sign Languages such as Iglishmek

Tolkien's argument

- Language is never complete without the history of the people who spoke it, just as these fictional people would never be real if imagined only through the English Language and in speaking English.
- Saw himself as a translator and an adaptor rather than the original author of his works.

Suggested Reading

- Utopian for Beginners

by Joshua Foer

Natural language Vs. artificial languages

- Both NL and ALS are symbolic systems.
- Distinguishing features:
 - Evolution
 - Acquisition
 - Nature of reference
 - Combinatorial possibilities

Evolution

- NL: A naturally evolving symbolic system
 - protolanguage and subsequent elaboration
 - driven not necessarily by communicative ease and efficiency
 - NL is known to be inefficient
 - subject to change over time
- AL: Man-made symbolic systems
 - Constructed systems; deliberation
 - design guided by potential function
 - generally aiming at ease and efficiency in communication
 - change in time, if at all, is also a consequence of deliberation

Acquisition

- NL: acquisition in a naturalistic setting
 - unconscious learning
 - no instruction, no corrective intervention
 - unstructured input
 - partly declarative and partly procedural; partly learnt and partly acquired
- ALS: acquisition in an institutional setting
 - formal learning
 - instruction and corrective intervention
 - structured input
 - partly declarative and partly procedural; entirely learnt, except in first language contexts

Reference

- Reference is arbitrary in both AL and NL.
 - Both are symbolic systems.
- The essential difference lies in the nature and internal structure of the meaning space.
 - NL: infinite meaning space, with a complex and dynamic network of interrelationships
 - AL: a pre-defined meaning space, a simpler and presumably stable network of relationships

Meaning Space

- Human conceptual space is complex and dynamic where inter-relationships between concepts are constantly changing.
- What does the word *Fast* mean?
- Fast typist, fast game, fast field, fast food, fast book, fast lane, fast girl
- A rich and imprecise meaning space which is constantly evolving
- Words mean what we want them to mean.

Combinatorial possibilities

- Both NL and ALS can be infinitely recursive.
 - tail as well as embedded recursion
- Tail recursion
 - My friend told her mother that she wanted to go to the movies.
- Embedded recursion
 - My friend who lives in Delhi went to the movies.

Other distinguishing features

- Ambiguity in NL
 - Reference is not fixed in NL
 - Combinatorial/structural ambiguities
 - Ambiguity resolution through contextual knowledge
- Redundancy in NL
 - induced by reference being open-ended
 - rule induced redundancy
- Underspecification of meaning in NL
 - Meaning is contextually determined. ('achcha' from PK)
- Metaphorical extensions
 - transference across conceptual domains

- What does the following extract from Lewis Carroll's *Through the Looking Glass* (Chapter VI) tell us about the human *linguaging* potential:

“When I use a word,” Humpty Dumpty said in rather a scornful tone, “it means just what I choose it to mean - neither more nor less.”

“The question is,” said Alice, “whether you can make words mean so many different things.”

“The question is,” said Humpty Dumpty, “which is to be master - that's all.”

Human Language and Animal Communication Systems

Extensively investigated ACSs

- Bees
- Herring gulls
- Song birds
- Primates
- Dolphins

General Functions

- Signals made in order to:
 - assert territorial rights
 - indicate social hierarchy and dominance
 - accomplish courtship rituals
 - send food related signals
 - send alarm calls

Language of the bees

- Bee Dance: the dance configuration reflects the source, direction, distance and quantity of food
 - Perhaps the most elaborate food-related signal
 - Studied in detail by Karl Von Frisch
- Olfactory communication: Bees carry with them a pouch of material from the hive which they release as they re-enter
 - The smell of the material indicates if they are a part of the hive and grants their safe entry.

Bee Buzz

- Gard Otis, a professor of environmental biology at the University of Guelph in Ontario who studies bee behavior, ecology and evolution, wrote about this about ten years back.
- According to Otis, bees buzz for two reasons.
- First, the rapid wing beats of many species create wind vibrations that people hear as buzzes. The larger the bee, the slower the wing beat and the lower the pitch of the resulting buzz.
- This is a phenomenon of the wing beats and not specifically of bees-some flies, beetles, and wasps also have buzzy flight caused by their wing beats.

- In addition some bees, most commonly bumblebees, are capable of vibrating their wing muscles and thorax (the middle segment of their body) while visiting flowers.
- These vibrations shake the pollen off the flower's anthers and on to the bee's body. Some of that pollen then gets deposited on the next flower the bee visits, resulting in pollination.
- The bee grooms the remainder of the pollen on to special pollen-carrying structures (on the hind legs of most bees) and takes it back to the nest to feed to the larvae.

- Suggested Reading: The Bee Dance



Herring Gull

- Herring Gull has a brightly coloured bill, yellow with a red spot on the lower mandible near the tip.
- When it returns to the nest with food, the parent stands over its chick and taps the bill on the ground in front of it.
- This elicits a response from a hungry chick (pecking at the red spot), which stimulates the parent to regurgitate food in front of it.

Herring Gull

- The communication consists of:
 - an anatomical feature: the red spot on the bill
 - and the distinctive movement, which makes the red spot on the bill visible to the chick.
- Studied by Nikolaas Tinbergen
- 1973 Nobel Prize in Physiology/Medicine shared by Karl von Frisch and Nikolaas Tinbergen for their work on bee dance and herring gull respectively

Bird song

- More recently, in ornithology, *bird song* has been distinguished from bird calls in its syllabic diversity and temporal regularity which gives it a structure.
- Expression of territorial rights, mating etc.
(Templeton)
- For some interesting factoids on bird song, visit:
http://files.dnr.state.mn.us/publications/volunteer/young_naturalists/birdsong/birdsong.pdf

Primate languages

- Primates
 - Sophisticated gestural systems
- Can primates learn the language of the humans?
 - Some limited success for the experiments in language production
 - Skepticism about the success in some quarters

Primate Languages

- Chimpanzees, bonobos, gorillas, and orangutans
- Early emphasis on language production
- Sign language and computer keyboards are used in primate language research because non-human primate vocal cords cannot close fully and they have less control of the tongue and lower jaw.
- However, primates do possess the manual dexterity required for signing and keyboard operation.

Washoe the chimpanzee

- Washoe used the sign "more" in many different situations until a more specific sign had been learned. At one point, she used the sign for "flower" to express the idea of "smell." After additional training, Washoe was eventually able to differentiate between "smell" and "flower."
- Although the same object was presented for each learning trial (a specific hat, for example), Washoe was able to use the sign for other similar objects (e.g. other hats).
- Washoe was able to combine two or three signs in an original way. For example, "open food drink" meant "open the fridge".

Nim Chimpsky the chimpanzee

- In a training schedule lasting 44 months, Nim Chimpsky learned 125 signs.
- Analysis of Nim's production data demonstrated that Nim's use of signs was symbolic, and lacked grammar, or rules, of the kind that humans use in communicating via language.

Koko the gorilla

- Koko understands approximately 1,000 ASL signs and 2,000 English words.
- Although the gorilla learned a large number of signs she never understood grammar, and hasn't displayed any cognition beyond that of a 2-3 year old human child.

Primate languages

- Recent work with bonobo chimpanzees, pioneered by Sue Savage-Rumbaugh goes beyond the language production studies of earlier times and focuses on language comprehension.
- The bonobos are claimed to have an ability to learn to understand instructions given in spoken English sentences.
- Together with some of her earlier work, Savage-Rumbaugh has suggested that chimpanzees can learn to appreciate the signs “symbolically.”

Intra- and Inter-species communication

- Animal Communication systems have a complexity of their own
- Intra-species and inter-species communication patterns existing in the same species.

Dolphins: Physical Contact

- Dolphins appear to have evolved a set of behaviours for intra-species communication.
- They use physical contact for communication:
 - a gentle nuzzle of the rostrum
 - a playful bite to the dorsal fin
 - a soft petting using the pectoral fin
 - a smack to the head

Dolphin Visual Signals

- They use visual signals (like human gestures) to convey information. For example, frustration, threat, or anger are conveyed by:
 - a vigorous bobbing of the head
 - a wide open gaping mouth
 - an S-shaped swimming position
 - flared-out pectoral fins
 - bubble bursts

Dolphin Vocalizations

- Dolphins, like chimpanzees, birds and many other animals, also use vocalizations for communication.
- They produce whistles, clicks, screams, squawks, pops, chirps – a whole assortment of sounds that researchers have labeled in a number of ways.
- Clicks are used for echolocation, the dolphin's form of sonar. Through echolocation, the dolphin can examine its world through sound, by listening to the echoes returning from objects struck by the clicks.

- Whistles may be used for communication, but it is still an open question as to whether, or how much of whistle communication is intentional versus unintentional.
- Thus, a rapidly repeated whistling may be elicited by stress, without any specific intention to convey that emotional state to others.
- David and Melba Caldwell suggest that the whistle functioned principally as a “signature,” with each individual dolphin producing a unique signature.

- During the 1960s, researchers attempted to determine whether the whistle vocalizations might be a form of language.
- Investigators recorded whistles from many dolphins in many different situations, but failed to demonstrate sufficient complexity in the vocalizations to support anything approaching a human language system.

- One dolphin could imitate another's whistle, thereby possibly referring to or calling that individual.
- We still do not know to what extent the dolphin's whistles may be used to refer to things other than themselves or another dolphin.

Signature whistle

- Past studies have shown that individual dolphins have a unique whistle, called a "signature whistle" which they often use in big group settings such as when several pods of dolphins meet at sea.
- The idea that dolphins have a name in the form of a whistle has been around since the 1960s, and studies of captive dolphins have shown that the animals are responsive to the whistles of dolphins they know.

Signature whistle

- Whitney Friedman, a dolphin-behavior expert at the University of California, San Diego takes the theory a step further.
- A dolphin will respond when it hears the sound of its own signature whistle, repeating that whistle back in a way that seems to say, "Yup, I'm here - did you call my name?"
- It's "compelling evidence" that the dolphin indeed uses the sound as a name, according to the study, published in 2013 in the Proceedings of the National Academy of Sciences.

Human language and animal communication systems

- On the parameters of evolution and acquisition:
 - ACS no different from NL
 - Evolution of communicative ability enhances survival possibilities.
 - Acquisition is in naturalistic setting, with unstructured input and no corrective intervention

Reference

- Reference: Indexical vs. symbolic signs
 - Displaced reference in NL (reference not tied down to a context)
 - Reference predominantly indexical in animals
- Fixity of reference in ACS
 - No metaphorical extensions possible
 - Why??
 - False belief, deception

A Recent Argument

- ACS Meanings can be complex.
- Tail wag of the domestic dog:
 - Excitement
 - Anticipation
 - Playfulness
 - Contentment/enjoyment
 - Relaxation or anxiety
 - Questioning another animal or a human as to intentions

Wag of the tail argument...

- Tentative role assessment on meeting another animal
- Reassurance ("I'm hoping to be friendly, are you?")
- Brief acknowledgement ("I hear you", or "I'm aware and responsive if you want my attention")
- Statement of interest ("I want that (object/food/activity), if you're willing")

Wag of the tail argument...

- Uncertainty / apprehension
- Submissive placation (if wooed by a more dominant animal)
- Not necessarily an argument against our view of a simple referential system in ACS.

Combinatoriality

- Earlier assumption:
 - ACS are holophrastic.
- Recent studies:
 - Experimental results from trained primates
 - Tail recursion in ACS, but no evidence so far of embedded recursion

Human language vs. animal communication systems

Do animals

- refer to objects in their environment
- refer to abstract concepts
- combine small meaningful elements into larger meaningful elements
- organize communicative elements into a recursive grammar
- refer to things in the past and the future
- learn and store in memory hundreds of thousands of concepts and map them onto specific combinations of vocal patterns

Human language vs. animal communication systems

Do animals have the following abilities:

- Ability to use contextual information -- ?
- Ability to attribute intentions to others -- ??
- Ability to deceive -- ??
- Ability to metaphorize -- ??

Open questions

Conceptual representations

- Nonlinguistic animals (e.g., mammals and birds) have rich conceptual representations
- Mismatch between the conceptual capacities and communicative content of their vocal and visual signals.
- E.g., nonhuman primates – a rich kinship structure and social hierarchy, though very coarsely expressed through vocalizations.

Study Results

- Studies tapping training schedules as well as spontaneous data indicate that
- Abstract concepts: animals develop and use a range of abstract concepts – tools, colour, geometric relationships, food, number etc.

Do animals have a theory of mind?

- What is Theory of Mind?
 - Sense of self and ability to represent the beliefs, desires and intentions of others, or attribute these to others

Theory of Mind?

- An open question: Do animals have a genetic endowment and/or social environment that allows them to acquire a theory of mind in the same way that human children do?
- A contentious issue: problem of inferring from animal behavior the existence of a concept of self or of self-awareness, or of awareness of other minds.

Theory of Mind?

- It is difficult to study human-like theory of mind and mental states in species of whose potential mental states we have an incomplete understanding.
- In their experiments, researchers have therefore focused on simpler components of more complex capabilities.

Theory of Mind?

- For example, many researchers focus on animals' understanding of intention, gaze, perspective, or knowledge (or rather, what another being has seen).
- Call and Tomasello's study looked at understanding of intention in orangutans, chimpanzees and children and claimed that all three species understood the difference between accidental and intentional acts.
- Part of the difficulty in this line of research is that observed phenomena can often be explained as simple stimulus-response learning.

Experimental Evidence

- There has been some controversy over the interpretation of evidence claiming to show theory of mind ability - or inability - in animals.
- Two examples serve as demonstration:

Experimental Evidence

- Povinelli and others presented chimpanzees with the choice of two sources from whom to request food: one who had seen where food was hidden, and one who, by one of a variety of mechanisms (having a bucket or bag over his head; a blindfold over his eyes) does not know, and can only guess.
- They found that the animals failed in most cases to differentially request food from the "knower" source.

Experimental Evidence

- By contrast, Hare, Call, and Tomasello found that chimpanzees were able make use of the knowledge state of humans to determine how they would approach the contested food item.
- *Chimpanzees deceive a human competitor by hiding* (H,C,T:2006)
- Bodily camouflage and tactical deception is common in animal species. But what about intentional deception?

Experimental Evidence

- When competing with a human in three novel tasks, eight chimpanzees, from their first trials, chose to approach a contested food item via a route hidden from the human's view, sometimes using a circuitous path to do so.
- These findings indicate that chimpanzees know what others can and cannot see, and also suggest that when competing for food chimpanzees are skillful at manipulating, to their own advantage, whether others can or cannot see them.

Experimental Evidence

- On the positive side, chimpanzee studies indicate a rudimentary theory of mind in terms of understanding goals and intentions of others as well as their perception and knowledge of things around them.

Experimental Evidence

- On the negative side, chimps are claimed to lack a theory of mind as they do not seem to understand others in terms of a fully human-like psychology in which they could appreciate that others have mental representations of the world driving their actions even when the representations do not correspond to reality (e.g., false belief situations).

Experimental Evidence

- Chimpanzees presented with the choice of two sources from whom to request food: one who had seen where food was hidden, and one who, by one of a variety of mechanisms (having a bucket or bag over his head; a blindfold over his eyes) does not know, and can only guess.
- The animals failed in most cases to request food from the “knower” source.

Conclusion

- Animals may possess a rudimentary theory of mind.
- However, a long way to go before we can generalize these positive findings on intentions to communicative intentions.

Recommended

- **The Bear – A Film by Jean-Jacques Annaud**