

Thinking about Thought

Theories of Brain, Mind, Consciousness

Apr 28, 2015

Piero Scaruffi

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Part 3.

Language

Emotions

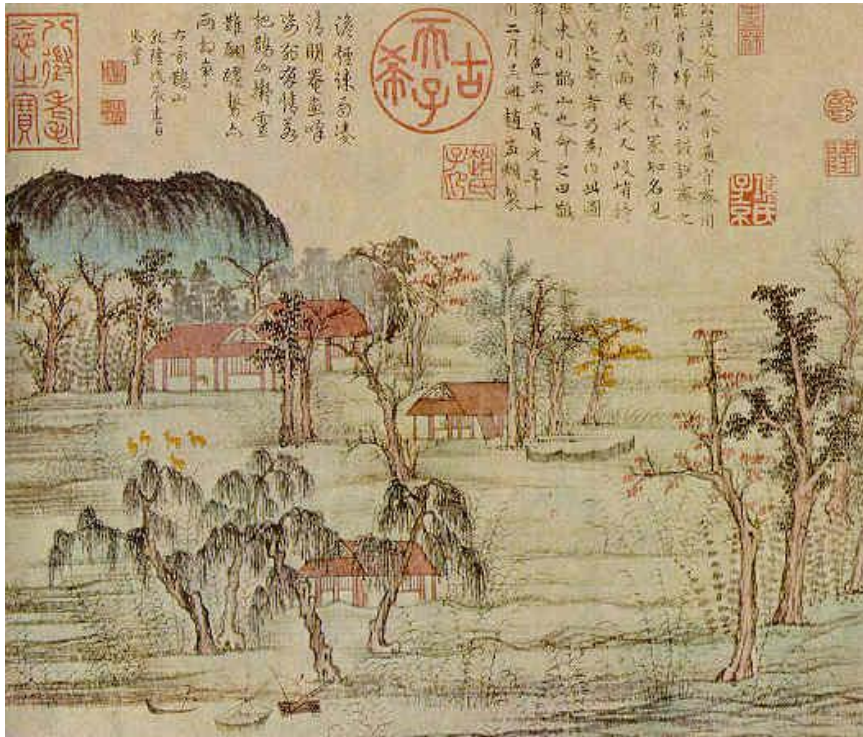
Dreams

Introduction to Language

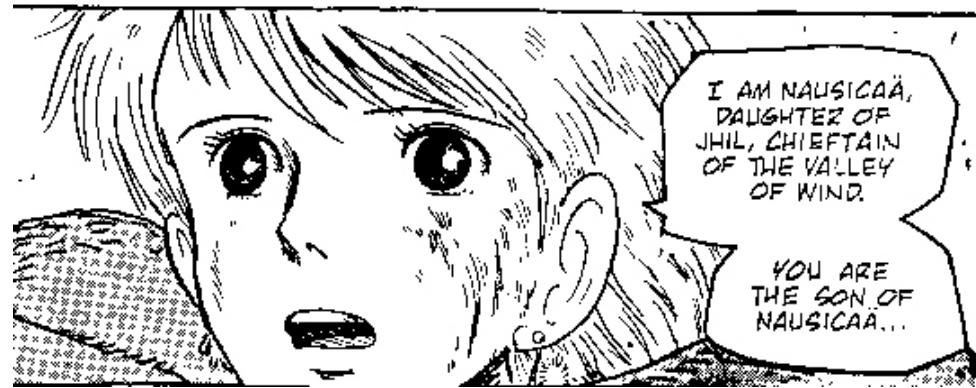
- Video: <https://youtu.be/g8FMmU6xRWs>
 - Howard Hawks: “His Girl Friday” (1940)
 - Soliloquy from “Hamlet” (1948) by Laurence Olivier
 - Granma and granddaughter in Sicily
 - A patient with Broca's aphasia (Wisconsin Physio Dept)
 - Dutch vocalist Jaap Blonk's virtuoso performance of Kurt Schwitter's “Ursonate” (1932)
 - The end of Bela Tarr's “Werckmeister Harmonies” (2000)

Introduction to Language

- Chinese scrolls, comic books, posters



Chao Meng-fu (1254)



Nausicaa (1982)



Hayao Miyazaki

Introduction to Language

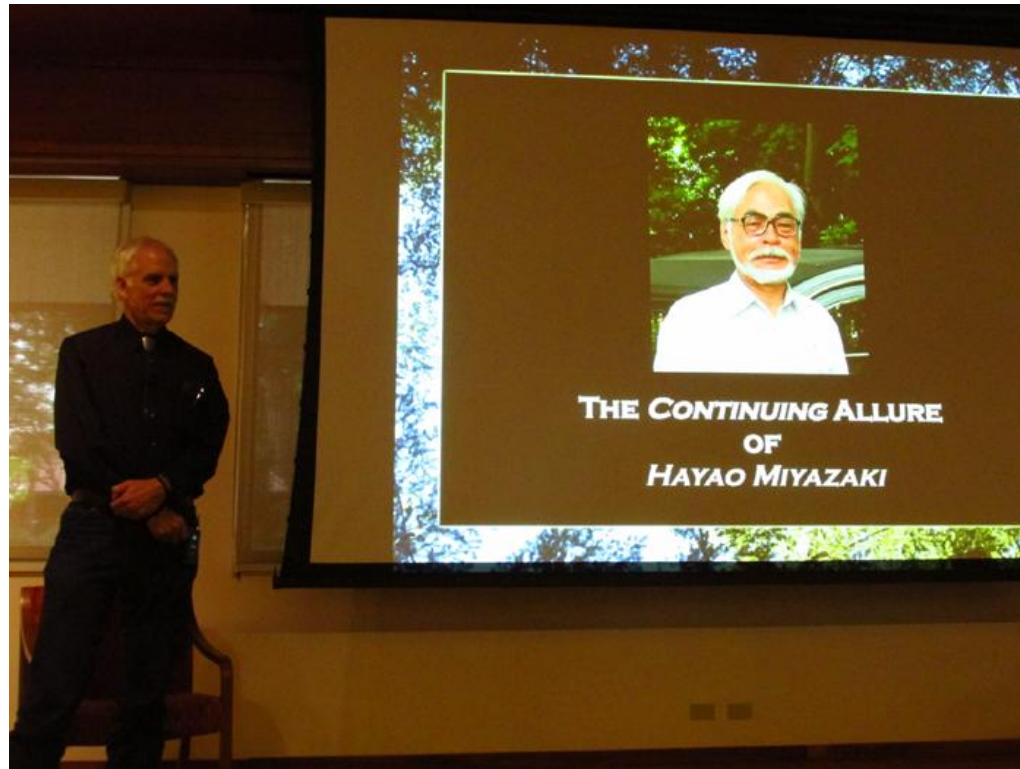
- Why is translation so difficult?

A sample translation done by Google of one of my music bios:

“The hesitation of the record , rightly frightened by the ideas of the complex , had been won when Zappa and Cohen had shown that of that music , innovative and unusual as you want, direct Yow mainly to an audience of intellectuals stragglers , was also exciting for weirdness and comicità` , for ease and panache . “

Introduction to Language

- And why do we need translators in the first place? Is there any other animal that needs translators?



Fred Schodt, translator of books on Miyazaki

Introduction to Language



Piero Scaruffi

February 5 at 3:59pm · 🌐 ▼

dfhbgdfneoifjmfklrnjoiucbvtytwfendvuiohsrugyhfnkh0cjniuvhntgksh

Like · Comment · Share

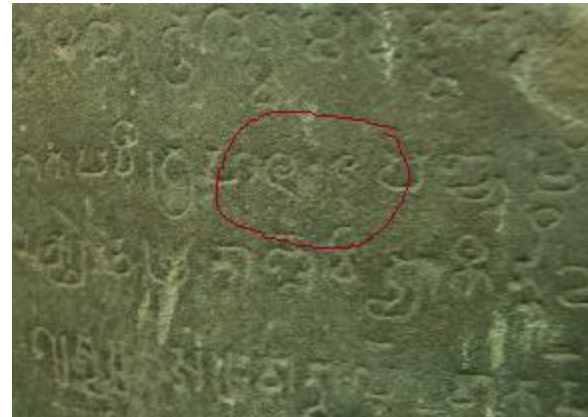
👍 Raoul Rego, Meredith Tromble, Anthony Arcana and 195 others like this.

↪ 17 shares

Introduction to Language

- 0: Like all symbols it refers to something, but in this case it refers to nothing.

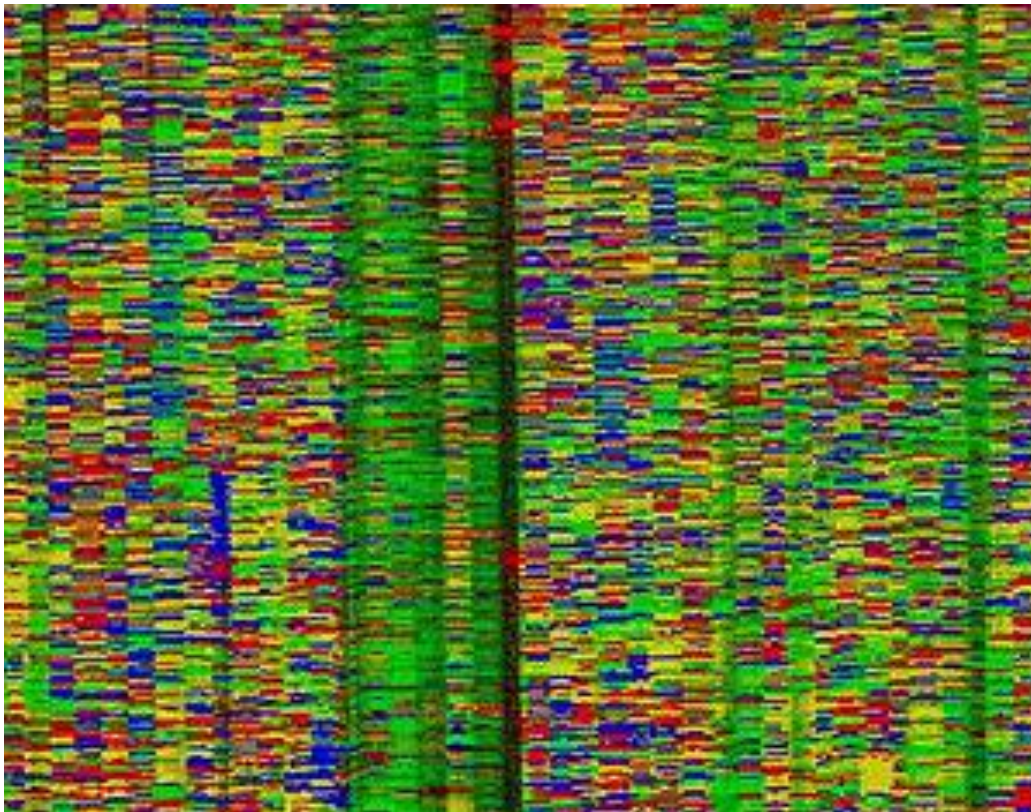
Inscription K-127, from Sambor on Mekong, the oldest extant representation of zero: the number 605 etched on a Khmer stele (7th c)



The second oldest extant representation of zero: the number 270 etched in a Gwalior temple (9th c)

Introduction to Language

- The oldest language on Earth

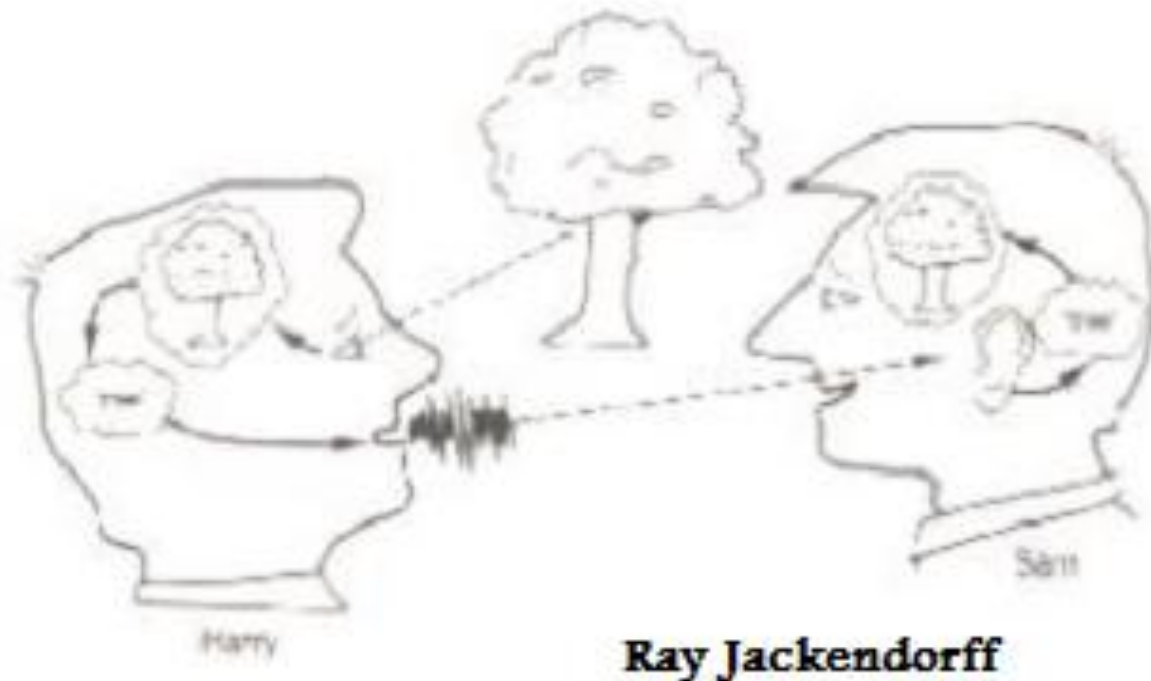


*...GATTTGGGGTTCAAAG
CAGTATCGATCAAATAGT
AAATCCATTTGTTCAACT
CACAGTTT...*

An excerpt from the human genome

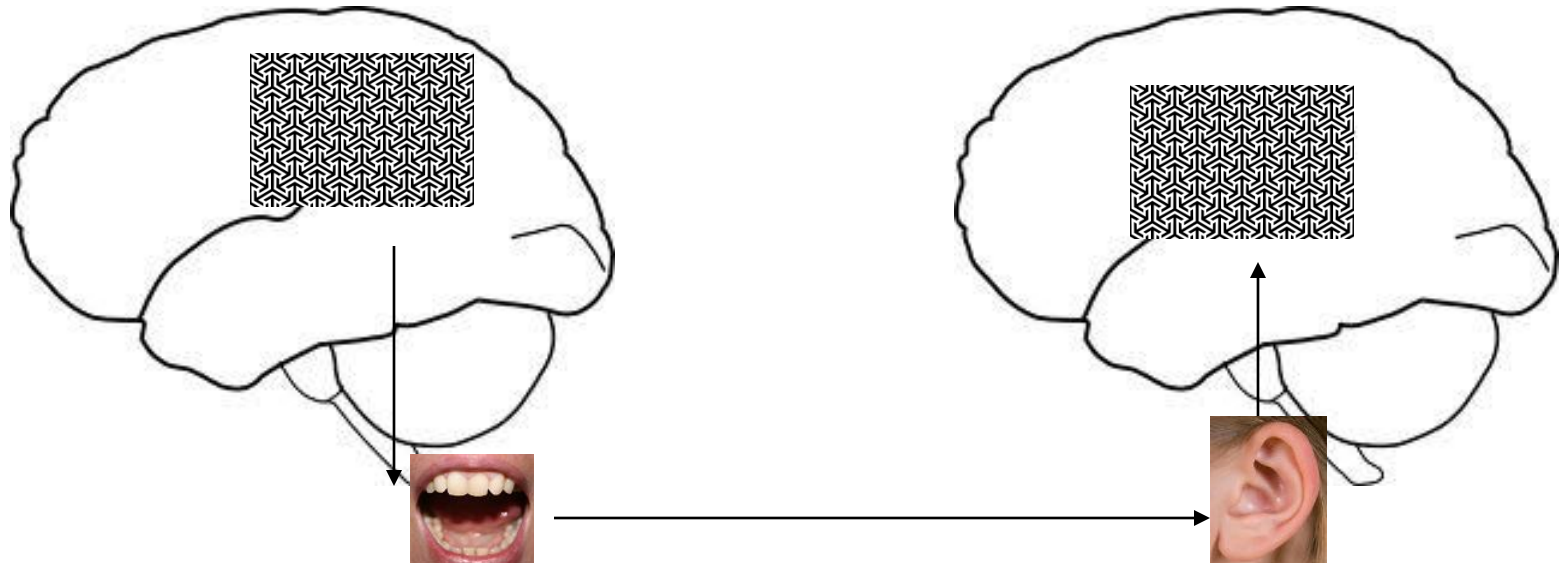
What Is Language?

- Language is a way to transfer a pattern from our brain to another person's brain



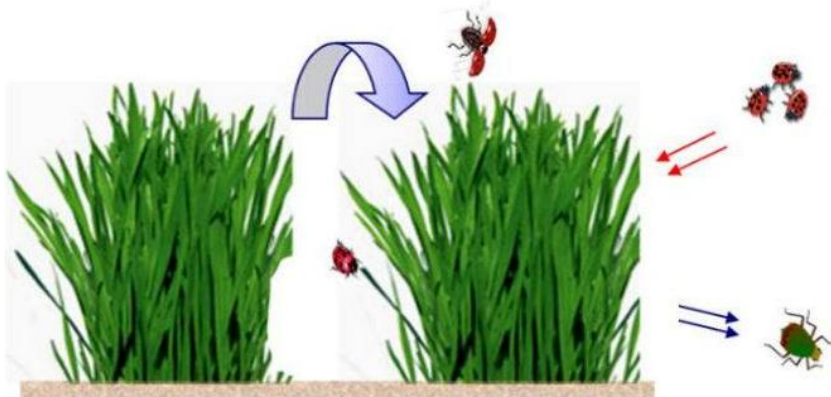
What Is Language?

- Language is a way to transfer a pattern from our brain to another person's brain
- It involves two brains, not just one
- The speaking expresses our mind, but the listening shapes our mind

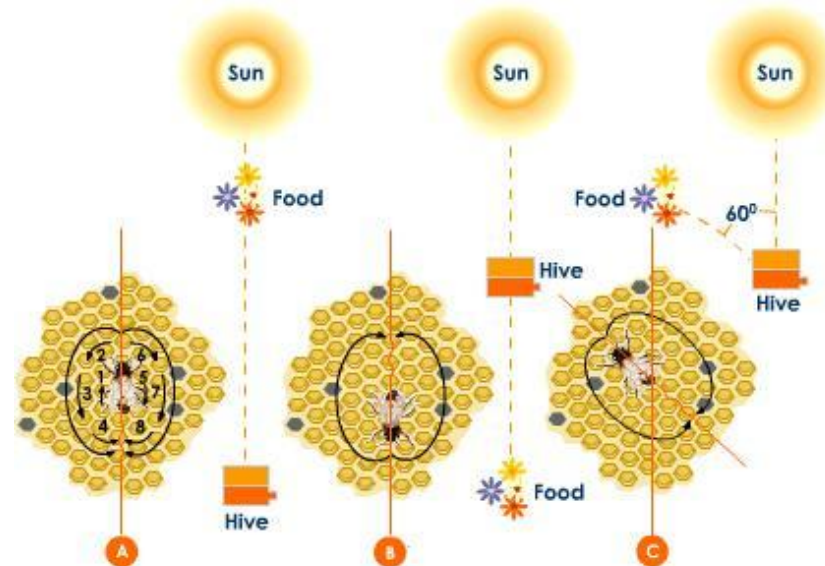


What Is Language?

- All animals communicate and even plants have some rudimentary form of interaction
- Communication is pervasive in nature, language being just one aspect of it
- Nature “speaks” to us all the time



Inger Ahman



What Is Language?

- The Earth existed before life as we know it, and the Earth is also made of living components such as ecosystems, which are made of societies, which are made of individual beings
- It is no surprise that all those ecosystems, societies and individuals are capable of communicating: they are merely “parts” of one giant organism, the Earth
- Communicating is their natural state



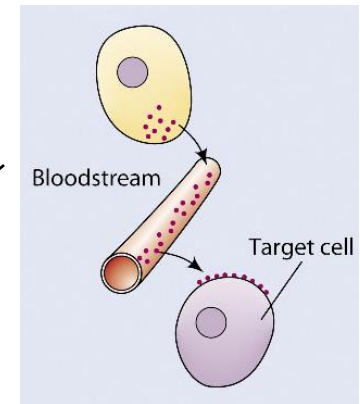
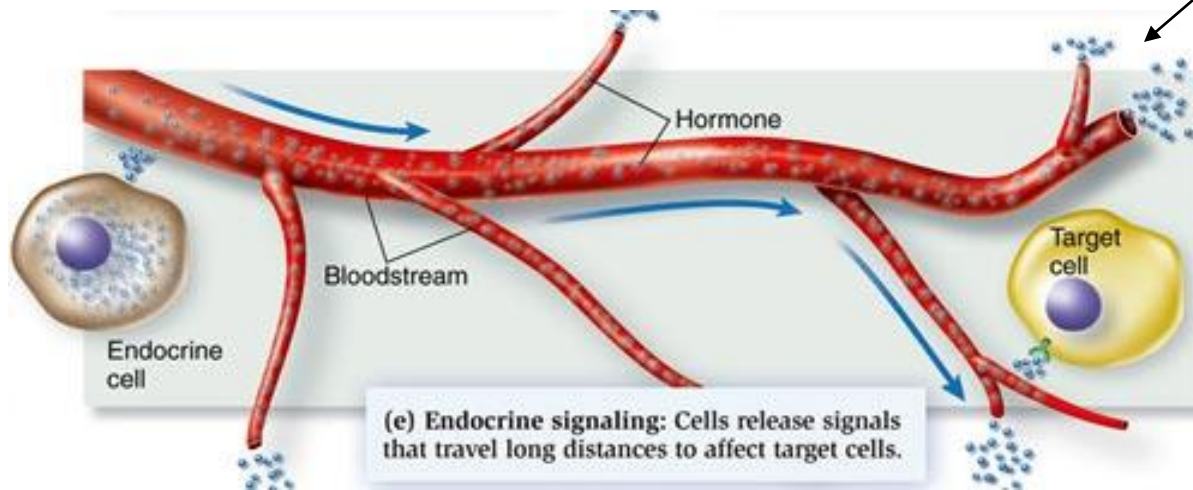
What Is Language?

- When a dog urinates repeatedly on its daily walk, the chemical markers it leaves behind tell other dogs about its gender, health and reproductive status



What Is Language?

- Molecular communication (using chemical signals to carry information) is widespread in nature
- Cells communicate with each other
 - Paracrine signaling via a proteine (short distance)
 - Synaptic signaling via neurotransmitters (short distance)
 - Endocrine signaling via hormones in the bloodstream (long distance)



What is Language?

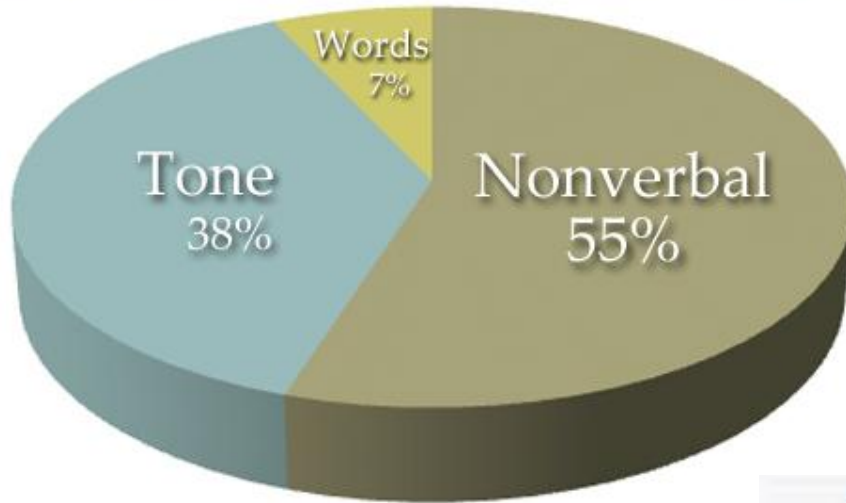
- Ray Birdwhistell (1952)
 - “Kinesics”, paralinguistic body communication, such as facial expression
 - All movements of the body have some kind of meaning
 - Non-verbal behavior obeys its own grammar, with a "kineme" being the kinesic equivalent of the phoneme.



What is Language?

- Nonverbal communication

Communication Breakdown



(Julia Woods, 2012)



Questions?



Why do We Speak

- There is too much:
 - Western languages are about 50% redundant
 - We can guess the meaning of most sentences from a fragment of them
 - English still adds an “s” to the third person singular of a verb (“he eats”)

Why do We Speak

- There is too little:
 - Linguistic communication is inefficient
 - Two computers can simply exchange in a split second an image or a text, pixel by pixel or character by character, without any loss of information
 - Alfred Korzybski (1933): there are fewer words than experiences



Why do We Speak

- Language has always been a way to determine someone's place of birth
- It is surprisingly difficult to imitate a dialect
- Language may have been a powerful tool to recognize members of the same tribe even before it became a powerful tool to philosophize.

Why Do We Speak?



- Edward Sapir (1921)
 - Language and thought influence each other
 - Language also shapes thought
 - The structure of the language has an influence on the way its speakers understand the environment
 - Grammatical and categorial patterns of language embody cultural models
 - Language contains a “hidden metaphysics”
 - Language is a culturally-determined system of patterns that creates the categories by which individuals not only communicate but also think



Why Do We Speak?



- *“Each mother tongue teaches its users a unique way of seeing and feeling the world, and of acting in the world”*
(Marshall McLuhan)
- *“The greatest propaganda in the world is our mother tongue, that is what we learn as children, and which we learn unconsciously. That shapes our perceptions for life.”* (Marshall McLuhan)

Why Do We Speak?



- Lev Vygotsky (1934)
 - Language is a way to organize (internally) the world
 - Language guides the child's cognitive growth
 - Cognitive faculties are internalized versions of social processes
 - Children develop under the influence of both biology and society

Instruments used by Human Beings according to Vygotsky		
Symbolic Instrument	Language is a symbolic instrument	Language belongs to the Realm of Epistemology
Instruments of Technology	Technology is an ontological instrument	Technology belongs to the Realm of Ontology

Why Do We Speak?



- Lev Vygotsky (1934)
 - The individual is the result of a dialectical cooperation between nature and history, between the biological sphere and the social sphere
 - Language is a way to transmit mind to weaker individuals and across generations

Why Do We Speak?



- Katherine Nelson (1996)
 - Language is the medium through which the mind becomes part of a culture
 - Language is the medium through which the shared meanings of society take over the individualistic meanings of the child's mind
 - Society takes over the individual mind, and it does so through language.

What do We Speak

- **Phonetics** studies the physical aspects of speech sound
- **Phonology** studies the way these sounds make sense
 - Nicholas Trubetzkoy (1920s): the "phoneme" is the elementary unit of speech

What do We Speak

- **Syntax** studies the structure of language, the fact that only some combinations of words are valid.
- **Semantics** studies the meaning that those valid combinations create.
- **Pragmatics** studies why we speak the way we speak, the purpose of speaking.

What do We Speak

- **Phonetics** studies the sounds that we make when we speak
 - A string of words can be pronounced in an infinitely large number of ways at an infinitely large number of speeds, using an infinitely large number of variations of pauses and accelerations.
 - No two speakers pronounce the same sentence with the exact same sounds, and even the same speaker cannot pronounce the same sentence twice using the exact same sounds.

What do We Speak

- What defines a language?
- There is no definition of what the English language is
- If you want to find out whether a word is English or not, you have to check a dictionary
- If you want to find out whether a sentence is English, the individual words are not enough.
 - "Mangiare is not an English word" is an English sentence
 - "Xgewut is not a meaningful word" is an English sentence
 - What makes a sentence English?

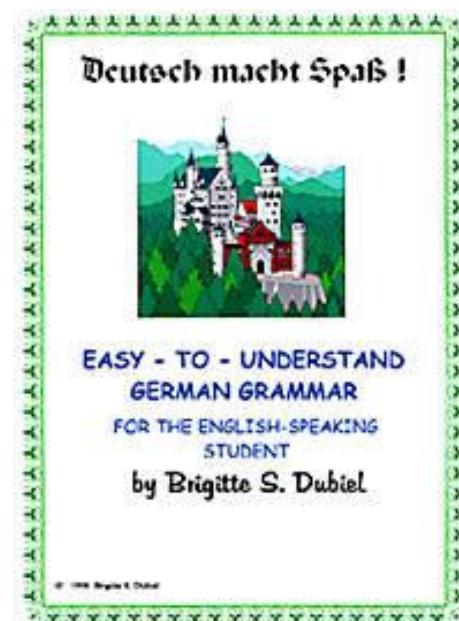
Generative Grammar



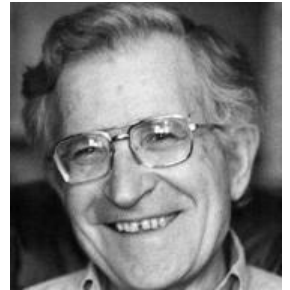
- Noam Chomsky (1957)
 - Performance vs competence
 - We understand sentences that we have never heard before
 - We can tell right away whether a sentence is correct or not, even when we do not understand its meaning
 - We are capable of saying far more than we will ever say in our entire lifetime.
 - "performance" = all sentences that an individual will ever use
 - "competence" = all sentences that an individual can utter, but will not necessarily utter

Generative Grammar

- Noam Chomsky (1957)
 - A language is defined by a grammar
 - The number of sentences in a language is potentially infinite
 - But there is a finite system of rules that defines which sentences can potentially be built and determines their meaning
 - That system of rules is what defines a language
 - Grammar = rules that account for all valid sentences of the language



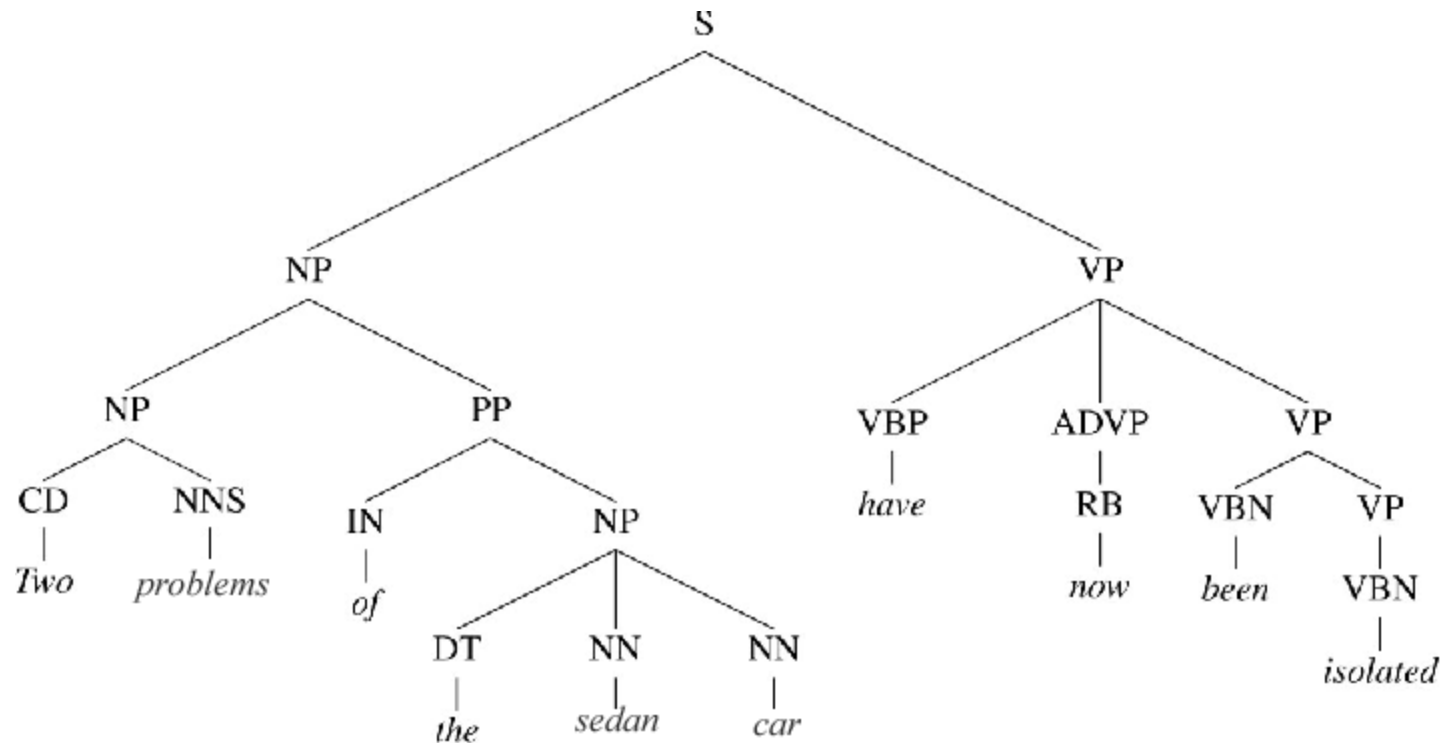
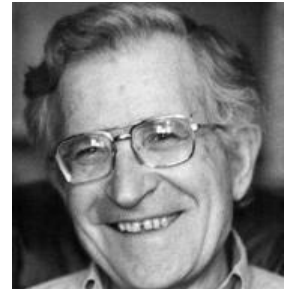
Generative Grammar



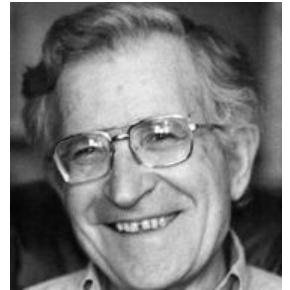
- Noam Chomsky
 - Application of formal logic to linguistics
 - Analyzing language is transformed into a mechanical process of generating more and more formal strings, just like when trying to prove a mathematical theorem
 - How to derive all possible sentences of a language from an abstract structure
 - Language = set of sentences
 - Sentence = finite string of words from a lexicon
 - Grammar = set of rules that can generate all possible sentences in that language

Generative Grammar

- Noam Chomsky
 - Phrase marker



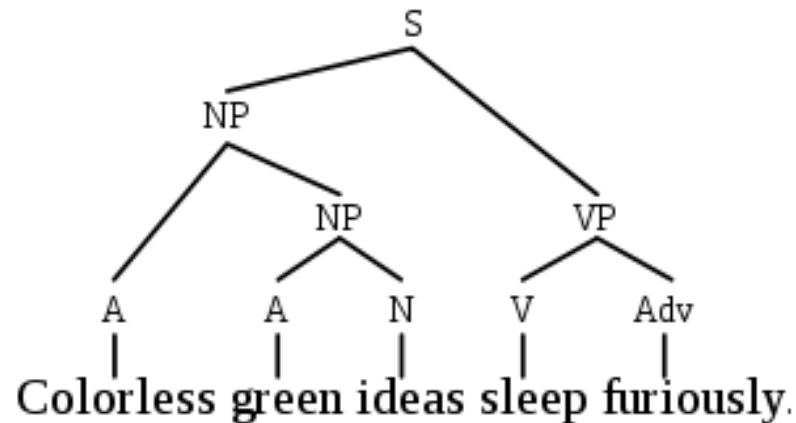
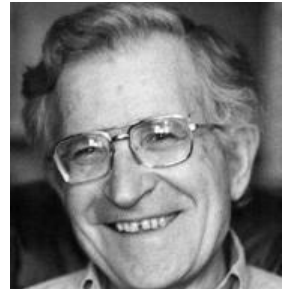
Generative Grammar



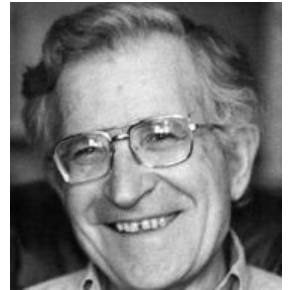
- Noam Chomsky
 - A “phrase structure” is defined by the constituents of the sentence: article, noun, verb...
 - A phrase structure grammar is equivalent to a Turing machine
 - Understanding is like proving a mathematical theorem
 - Understanding is a by-product of a mechanical process of generating more and more formal strings

Generative Grammar

- Noam Chomsky
 - The phrase marker is independent of meaning (syntax only, no semantics)

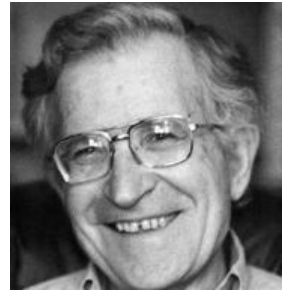


Generative Grammar



- Noam Chomsky
 - "Deep structure" = fundamental relationships among components
 - actor: piero
 - acted upon: tomato
 - action: eat
 - "Surface structure" = the sentences that are actually uttered
 - piero eats the tomato
 - the tomato is eaten by piero
- Understanding = transforming surface structures into deep structures

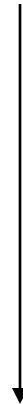
Generative Grammar



- Noam Chomsky
 - An important assumption:
 - Independence of syntax from semantics
(well-formed vs meaningful sentence)

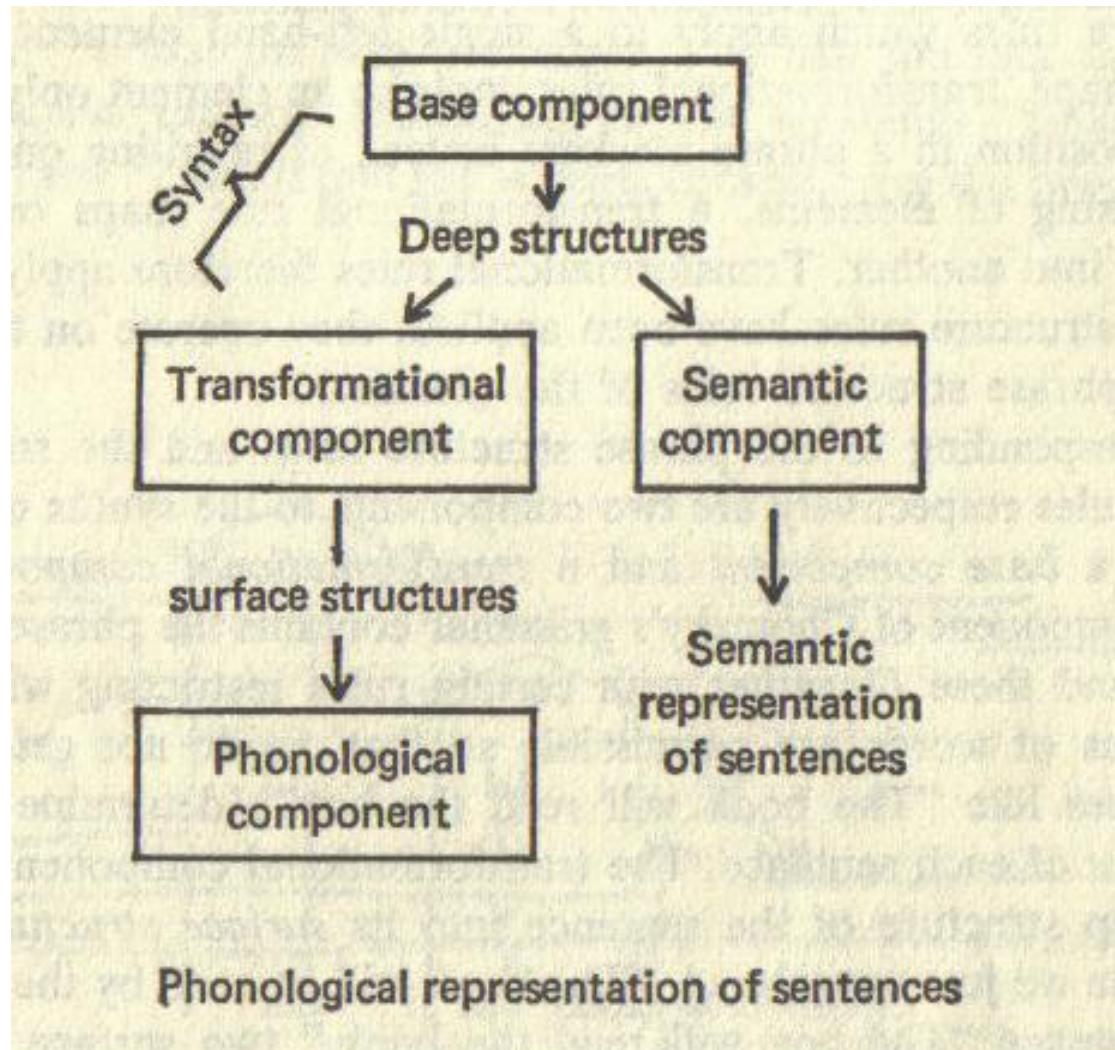


The barking meat eats dogs



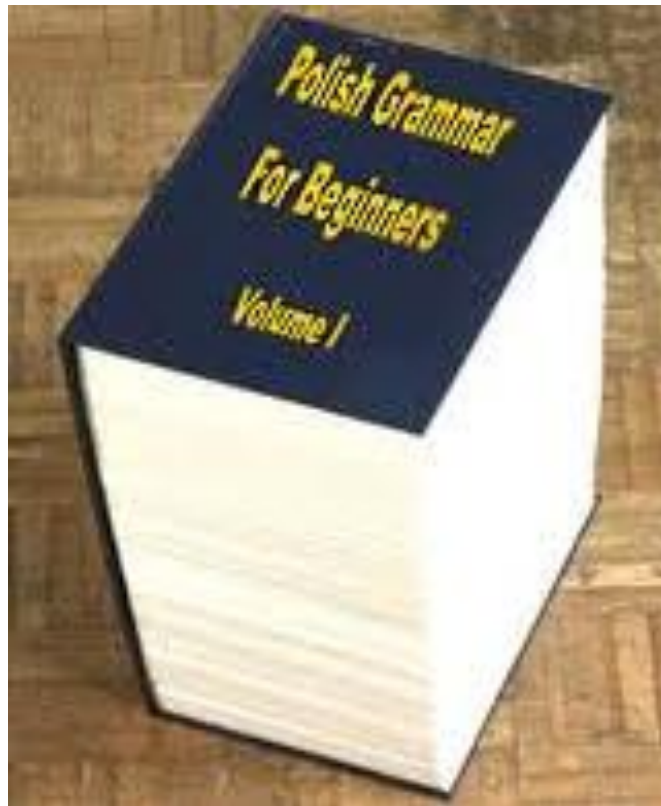
The barking dog eats meat

Standard Theory



Generative Grammar

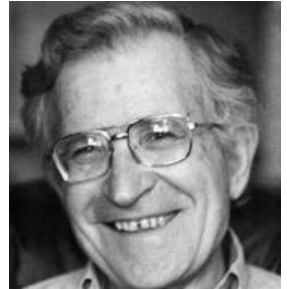
Unfortunately every grammar has its exceptions...



Universal Grammar

- Mark Gold's theorem (1967):
 - No amount of correct examples of sentences are enough to learn a language
 - It is mathematically impossible for a child to have learned the language she speaks

Universal Grammar



- Noam Chomsky (1981):
 - There exists universal linguistic knowledge
 - Learning a language = innate knowledge plus experience
 - A child is genetically programmed to learn a language, and experience will simply determine which one
 - Language "happens" to a child, just like growth
 - Universal grammar = linguistic genotype

Chomsky's Influence



- Ray Jackendoff (1993)
 - The acoustic signal of someone's voice speaking to us is not broken down into sentences and words: it tends to be a continuous flow of sounds.
 - Only a hearer equipped with the proper decoding device (the universal grammar) can turn that noise into syntactic structures

Chomsky's Influence



- Ray Jackendoff (1993)
 - The same argument about universal grammars can be applied to all facets of human nature
 - Vision too is controlled and enabled by a mental grammar, by a genetic predisposition to recognize objects and situations
 - We can understand a virtually unlimited set of visual situations

Chomsky's Influence



- Ray Jackendoff (1993)
 - Thought too is constructed by using a "universal grammar of concepts".
 - We can think a virtually unlimited number of thoughts
 - Without innate knowledge to guide, direct, prune and so forth our mental life, it would be difficult to speak, see and think.
 - The brain contains several modules, each specialized in a cognitive function and each driven by a "universal grammar".

Chomsky's Influence



- Steven Pinker (1994):
 - We think in mentalese, not in English or Chinese.
 - It is only when we have to pack information for another human being that we use the language of our community
 - In doing so we have to limit our message to what can be said in that language
 - “Knowing a language is knowing how to translate mentalese into strings of words, and viceversa”

Chomsky's Influence



- Steven Pinker (1994):
 - Humans are equipped with a language instinct
 - Our brains are hardwired to recognize "meaningful" words out of a stream of sounds
 - Different speakers pronounce the same words in different ways.
 - The same speaker can pronounce the same word in different ways depending her mood

Chomsky's Influence



- Steven Pinker (1994):
 - Children do not simply repeat the sentences that they have been taught: children come up with their own sentences.
 - That is what animals cannot do
 - Human language is controlled by the neocortex, whereas animal "language" is controlled by the brain stem and the limbic system
 - Humans too have this primitive form of language (a scream of terror, a burst of laughter, etc)
 - But humans are also capable of combinatorially combining sounds

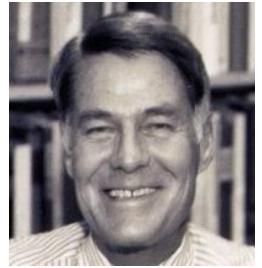
Questions?



Other Grammars

- Yehoshua Bar-Hillel's categorial grammar (1953)
- Case-frame grammar (Charles Fillmore, 1967)
- Richard Montague's intensional semantics (1974)
- Conceptual dependency (Roger Schank, 1975)
- Gerald Gazdar 's generalized phrase-structure grammar" (1985)
- Ronald Langacker's cognitive grammar (1986)
- Gilles Fauconnier's mental spaces (1994)
- George Lakoff's cognitive linguistics (1994)

Other Language Theories



- Roger Brown (1977)
 - Jean Piaget's "constructivism": language acquisition follows the acquisition of cognitive skills
 - First the child's mind develops the representation of the world in terms of objects and actions, then the child learns to speak
 - That initial speech (of one-word sentences) is "semantic"
 - Chomsky's "universal grammar" is an illusion due to the fact that all children are programmed to develop through the same stages



Other Language Theories

- Elizabeth Bates (1979)
 - Language is not "one" isolated phenomenon but the result of a number of cognitive developments, each of which affects more than one cognitive faculty and the sum of which accounts for the development of all cognitive faculties, including language.
 - There is no "universal grammar". There is a global development of interconnected cognitive skills



Other Language Theories

- Donald Loritz (1999)
 - Rhythm is the "central organizing mechanism" of language
 - The sequence in which a child learns both phonology and morphology is based on the development of rhythms
 - Children learn to walk before they learn to talk
 - Their learning of talking improves after they have learned to walk
 - Walking introduces a "rhythmic dipole" into the child's brain
 - "Babbling gets rhythm and becomes speech"

Understanding Discourse

- Ambiguity (rose, play, light)
- Anaphora (you, here, now)
- Metaphor, metonymy
- Pragmatics

Understanding Discourse

Soviet virgin lands short of goal again

Prostitutes appeal to Pope

Panda mating fails - veterinarian takes over

Killer sentenced to die for second time

Miners refuse to mine after death

(Newspaper headlines)



Questions?

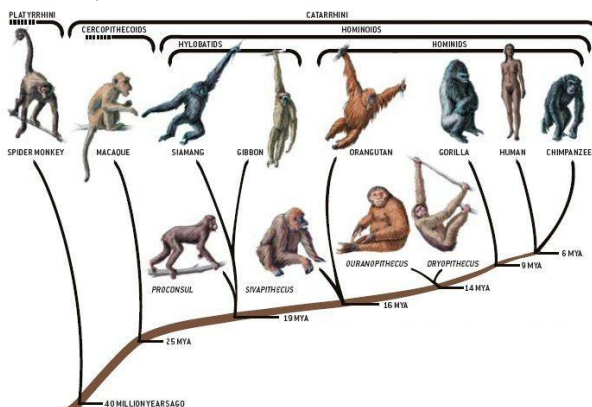
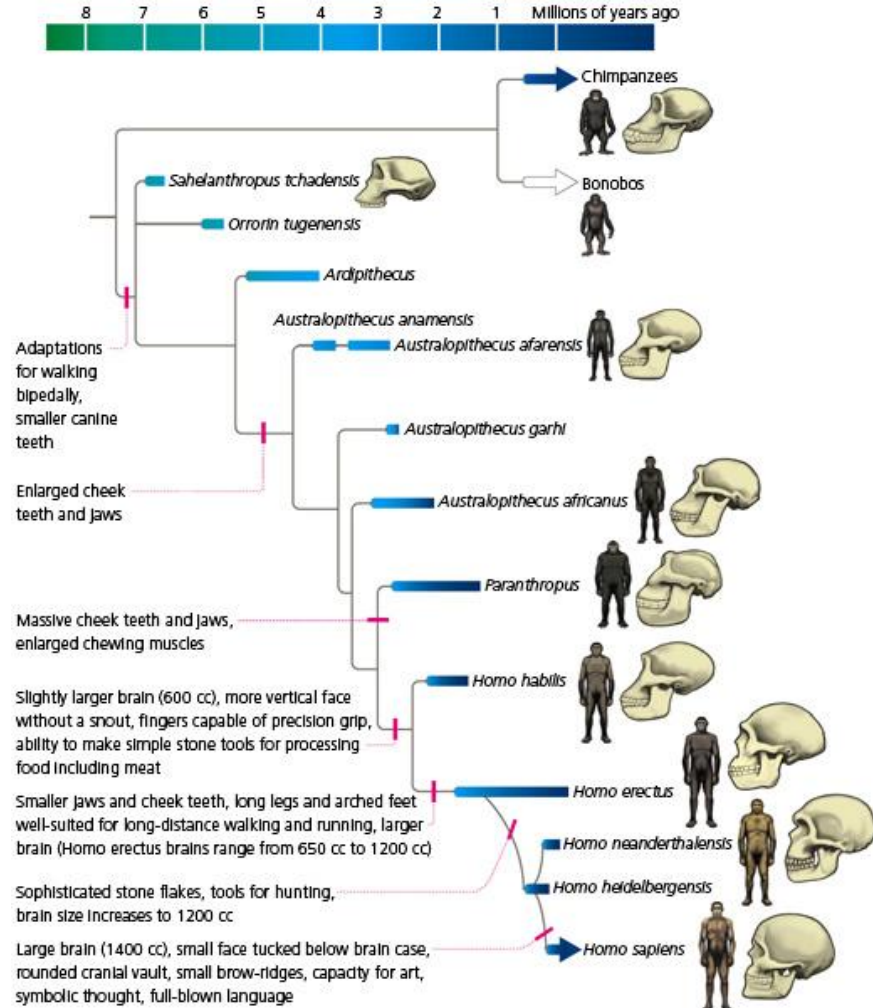
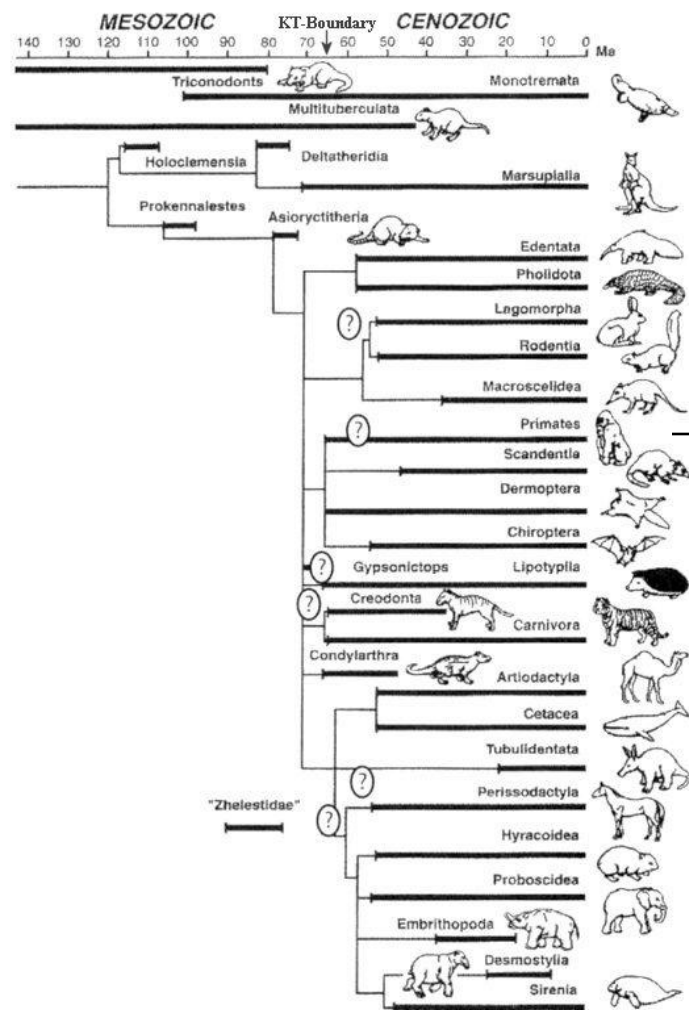


Origins of Language

- Charles Darwin: languages seem to evolve the same way that species evolve
- The real issue: how did non-linguistic animals evolve into a linguistic animal?

Origins of Language

- When did language arise?



Origins of Language

- James-Mark Baldwin
 - Species capable of learning are better at evolving
 - Language is an efficient tool for learning



Origins of Language



- Susanne Langer (1942)
 - Ritual and magic are symbolic activities that, from an animal's point of view, are hopelessly senseless
 - An animal would never dance around a fire the way a man dances around a fire to make something happen
 - Animals have a direct relationship to events in their world.
 - Humans construct huge symbolic universes that separate them from reality.

Origins of Language

- Susanne Langer (1942)
 - The reason humans do such strange things with symbols is that humans are symbolic systems at a biological level
 - We just cannot help abstracting the world (i.e., thinking).
 - We abstract everything into symbols



Origins of Language

- Susanne Langer (1942)
 - Speech is the most economical way of rapidly producing many symbols via bodily movement
 - Speech only requires movements of the lips and the tongue.
 - Verbal language is not the only "language" we employ.
 - It is just the most efficient.



Origins of Language

- Susanne Langer (1942)
 - Communication is a by-product of symbolization
 - Our brains create symbols all the time
 - At the physical level no two people see the same thing but all people form the same symbol
 - It turns out that symbols constitute a very effective way to communicate
 - Language's mission is to transform experience into symbols (concepts)



Origins of Language

- Susanne Langer (1942)
 - Babies tend to babble spontaneously, whereas other primates don't
 - A child has to learn to speak the language of the parents, but the child is already speaking from the very first moment of life
 - Her babbling constitutes a language, albeit a language that only that child can understand
 - Her parents teach the child a language that is to be shared with the community.
 - They don't teach the child to speak: they teach the child to speak a specific language.



Origins of Language

- Susanne Langer (1942)
 - Singing and dancing came first
 - The language of children fluctuates violently in tone
 - Singing and speaking became two different things; and today we teach children not to scream, not to cry, not to jubilate, and so forth, thus progressively eliminating the "singing" quality of language
 - Humans are singing and dancing animals



Questions?



Origins of Language

- Ralph Holloway (1967): Language and the brain coevolved
- Nicholas Humphrey (1983): A by-product of socialization
- Philip Lieberman (1984): An evolutionary accident



Origins of Language



- Symbolic representation (Derek Bickerton, 1992)
 - Syntax is what makes our species unique
 - Other species can also "symbolize", but none has shown a hint of grammar
 - Thus **language is not due to socialization**, otherwise it would also have developed in other primates
 - The combinatorial power of human language is what makes it unique

Origins of Language



- Symbolic representation (Derek Bickerton, 1992)
 - Animal communication is holistic: it communicates the whole situation
 - Human language breaks down the situation
 - Animal communication is limited to what is relevant to survival
 - Humans can communicate about things that have no relevance at all for our survival
 - Human and animal communication are completely different phenomena

Origins of Language



- Symbolic representation (Derek Bickerton, 1992)
 - Human language did not evolve from animal communication but from representation systems
 - It has a different purpose and it requires a different brain region
 - Human language was so advantageous that it drove a phenomenal growth in brain size
 - The emergence of language even created the brain regions that are essential to conscious life

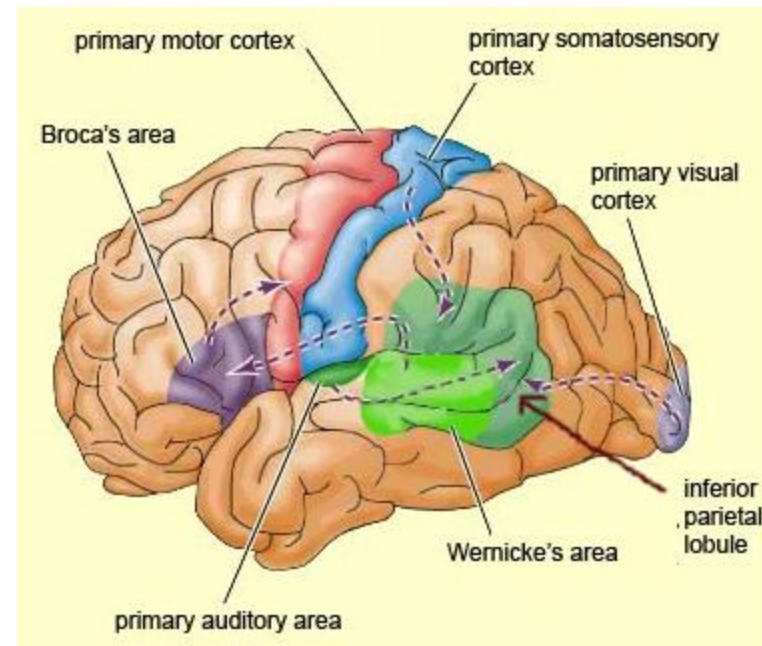
Origins of Language



- Symbolic representation (Derek Bickerton, 1992)
 - We cannot recall any event before we learned language
 - We can remember thoughts only after we learned language
 - Language seems to be a precondition to all the other features that we rank as unique to humans
 - Language created consciousness

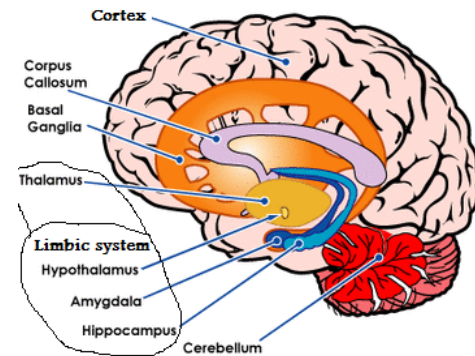
Origins of Language

- An evolution of emotions (Rhawn Joseph, 1993)
 - The inferior parietal lobe of the left hemisphere is one of the youngest regions of the brain
 - It is also one of the last organs to mature in the child
 - It is massively connected with the auditory, visual, and somatosensory cortices
 - Its neurons are “multimodal”: they can simultaneously process different kinds of inputs (visual, auditory, movement, etc).



Origins of Language

- An evolution of emotions (Rhawn Joseph, 1993)
 - This lobe enables us to understand a word as both an image, a function, a name and many other things at the same time.
 - This lobe enabled language, tool making, art
 - The same organ enables the language of gesturing, that we share with many animals
 - The original site of language was the limbic system, that we share with other mammals
 - Originally, language was purely emotional
 - The limbic system embodies a universal language that we all understand, a primitive language made of calls and cries



Origins of Language

- Cementing the group (Robin Dunbar, 1996)
 - Language brings more benefits to the listener than to the talker
 - If that were the main purpose of language, it would have caused the evolution of a race of listeners, not of talkers, and far less of gossipers.
 - Language served to cement the group
 - Humans who spoke had an evolutionary advantage (the group) over humans who did not



catholicteenapologetics.com

Origins of Language

- Cementing the group (Robin Dunbar, 1996)
 - Apes cement social bonds by grooming the members of their group.
 - Humans "gossiped" instead of grooming each other.
 - Later humans began to use language also to communicate information
 - Dialects developed for a similar reason: to rapidly identify members of the same group



Origins of Language

- A by-product of the hand (Frank Wilson, 1998)
 - The evolution of the human hand to **handle objects** enabled a broad range of new activities...
 - ... that, in turn, fostered an evolution of the brain (the brain could think new thoughts)...
 - ... that resulted in the brain of modern humans
 - The human brain (and only the human brain) organizes words into sentences, i.e. does syntax, because of the hand



Origins of Language



- A Sexual Organ (Geoffrey Miller, 2000)
 - Individuals should have no motivation to share key information since they are supposed to compete (survival of the fittest)
 - Individuals who simply delivered knowledge to competitors would not have survived.
 - Humans, instead, compete to be heard
 - Also: what has evolved dramatically in the human brain is not the hearing apparatus but the speaking apparatus.

Origins of Language

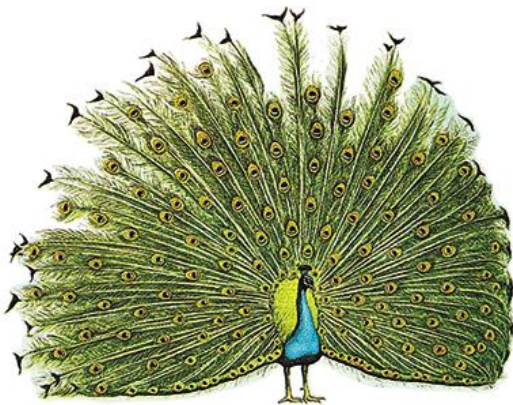


- A sexual organ (Geoffrey Miller, 2000)
 - Language is a form of sexual display just like any other organ (bull horns or peacock tails) that served that function
 - When language appeared, it quickly became a key tool in sexual selection, and therefore it evolved quickly.
 - Culture, in general, and language, in particular, are simply ways for males and females to play the game of sex
 - The human mind was largely molded by sexual selection and is therefore mainly a sexual ornament.

Origins of Language



- A sexual organ (Geoffrey Miller, 2000)
 - Language is unique to humans the same way that the peacock's tail is unique to peacocks
 - It is pointless to try and teach language to a chimpanzee the same way that it is pointless to expect a child to grow a colorful tail.



Questions?



Jokes

- Jokes?
 - What is a joke?
 - Why do we tell jokes?
 - What is in a joke?
 - In order to understand a joke one must master the whole power of the language

Doctor: You're overweight.

Patient: I think I want a second opinion.

Doctor: You're also ugly.

Break



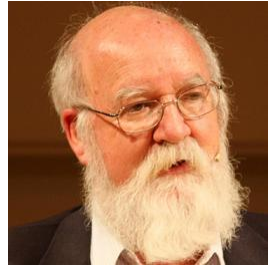
*"Those who can make you believe absurdities
can make you commit atrocities"*
(Voltaire)

Tools

- Richard Gregory (1981)
 - Language is but one particular type of "tool"
 - A human is both a tool-user and a tool-maker
 - Tools are extensions of the limbs, the senses and the brain
 - There are "hand" tools (such as level, pick, axe, wheel, etc) and "mind" tools, which help measuring, calculating and thinking (such as language, writing, counting)

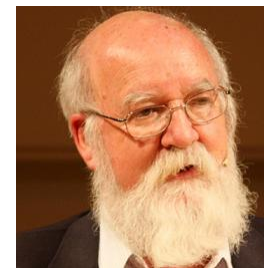


Tools



- Daniel Dennett (1998)
 - "Darwinian creatures" (all living beings) were selected by trial and error on the merits of their bodies' ability to adapt
 - "Skinnerian creatures" (which are capable of learning from trial and error) were also capable of independent action and therefore could enhance their chances of survival by finding the best action
 - "Popperian creatures" (most mammals and birds) can play an action internally in a simulated environment before they perform it in the real environment and can therefore reduce the chances of negative effects

Tools



- Daniel Dennett
 - "Gregorian creatures" (humans) are capable of creating tools, in particular they master the tool of language
 - Gregorian creatures benefit from technologies invented by other Gregorian creatures and transmitted by cultural heritage
 - Human intelligence (the intelligence of Gregorian creatures) is due not to a larger brain but to the ability to "off load" as much as possible of our cognitive tasks into the environment (the tools)

Tools

- Timothy Taylor (2010)
 - Humans should not have survived evolution at all because reproduction is so dangerous, complicated and (in the past) lethal (for both baby and mother), and then because children require so much attention
 - It seems irrational that the most vulnerable ape ended up dominating every other species
 - Technology is the solution to this apparent contradiction.



VS



Tools

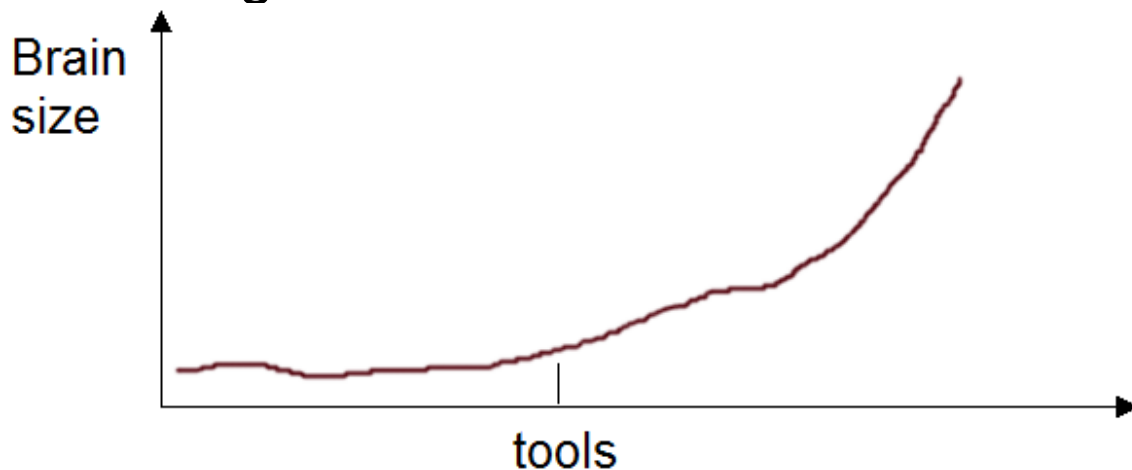
- Timothy Taylor (2010)
 - The upright posture freed the hands, and allowed humans to make tools
 - That altered the normal course of evolution
 - Technology introduced a parallel (non blind) algorithm next to Darwin's (blind) algorithm
 - Technology evolved humans
 - Humans got weaker while becoming more dependent on technology ("self-domestication")



Tools



- Timothy Taylor (2010)
 - Survival of the weakest is made possible by tools
 - Brain size started increasing after technology happened
 - The rapid growth of the human brain was due to competition for technological supremacy.
 - Tools made possible larger brains. Tools made possible intelligence.



Tools

- Vilayanur Ramachandran (2011)
 - Different specialized areas for lexicon, syntax (Broca's area) and semantics (Wernicke's area)
 - Language evolved by exaptation (from functions that originally evolved for different purposes, not communication purposes)
 - The inferior parietal lobe evolved originally for cross-modal abstraction, since it has to mediate signals coming from the touch, vision and hearing regions of the brain; and then later this feature became an independent skill, the ability to think abstract thoughts.
 - The brain "translates" an image into a sound simply because the brain-maps that represent the two are adjacent and interfere

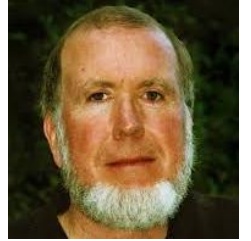


Tools

- Vilayanur Ramachandran (2011)
 - By exaptation, the brain function of building tools out of parts evolved into the brain function of constructing sentences out of words
 - The original language may have been the language of building tools, not the language of speaking words.



Tools



- Kevin Kelly (2010)
 - The "technium" is the set of all interconnected technologies collectively created by humans.
 - The evolution of the technium is driven by forces that are similar to the ones that drive the evolution of life
 - Technology parasites on human minds in order to survive, reproduce and evolve

Questions?



Metaphor: How We Speak

That conference was a zoo

I don't see the end of the tunnel

You're a weasel

She's a tiger

Cross that bridge when you get there

The needle in a haystack

The bottleneck

She's a walking dictionary

This job is a piece of cake

This is a nightmare

He's a vampyre



*"Good news.
The test results show it's a metaphor."*

Metaphor: How We Speak

- Metaphor: to transfer properties from a “source” to a “destination”
- Metaphor is pervasive
- Paradox: if the speaker tries to make communication as "rational" as possible, why would she construct a metaphor instead of just being literal?

Metaphor: How We Speak

All thought is metaphorical
(George Lakoff, 1980)



Metaphor was pivotal for the
development of the human
mind (Steven Mithen, 1996)



Metaphor: How We Speak

Metonymy: when a term is used to indicate something else

“The White House pledged not to increase taxes”

Metaphor is a way to conceive something in terms of another thing

Metonymy is a way to use something to stand for something else

Metaphor

- Fairy tales
 - Every time we tell children a fairy tale, we are lying to them. Those characters do not exist. Santa Claus does not exist.
 - Children "learn" something from those fairy tales, but what they learn is not the literal meaning of those stories
 - Children understand that what they are supposed to learn is not the literal meaning

Metaphor

- When learning a foreign language, we tend to use simple sentences with no metaphors
- Metaphorical language requires mastering the language skills first, and is proportionate to those skills
- This is what the traditional theory predicted: metaphor is for poets, for language specialists

Metaphor: How We Speak

- Understanding metaphors:
 - how do we determine its truth value (taken literally, metaphors are almost always false)
 - how do we recognize an expression as a metaphor (metaphors have no consistent syntactic form)

Metaphor

- Michel Breal (1897)
 - Metaphor is indispensable to express a concept for which words do not exist in the language
 - Entire domains are mapped onto other domains for lack of appropriate words
 - For example, the domain of character is mapped into the domain of temperature: a hot temper, a cold behavior, a warm person, etc.



Metaphor



- Max Black's "interactionist" theory (1955):
 - Literal language: two concepts can be combined to obtain another concept without changing the original concepts (e.g., "fun" and "class" form "fun class")
 - Metaphorical language: two concepts are combined so that they form a new concept (e.g., "this class is hell")
 - The two concept change each other (both "class" and "hell" acquire a different meaning)
 - The two concepts trade meaning
 - A metaphor consists in **a transaction between two concepts**

Metaphor



- George Lakoff (1980)
 - All language is metaphorical
 - All metaphors are ultimately based on our bodily experience

Metaphor



- George Lakoff (1980)
 - Metaphor grounds concepts in our body
 - Metaphor enables us to reduce (and therefore understand) abstract concepts to our physical experiences in the world
 - Metaphor is an intermediary between our conceptual representation of the world and our sensory experience of the world

Metaphor



- George Lakoff (1980)
 - Metaphor relates an entire conceptual system (eg, traveling) to another conceptual system (eg, love) - "our marriage isn't going anywhere"
 - Metaphor projects the cognitive map of a domain onto another domain for the purpose of grounding the latter to sensory experience

Metaphor



- George Lakoff (1980)
 - Most concepts are understood in terms of other concepts
 - A more abstract domain is explained in terms of a more concrete domain
 - The more concrete the domain, the more "natural" it is for our minds to operate in it

Metaphor



- George Lakoff
 - Metaphor = the process of experiencing something in terms of something else
 - All metaphors are ultimately based on our bodily experience
 - All our concepts are of metaphorical nature and are based on our physical experience
 - We understand the world through metaphors, and we do so without any effort, automatically and unconsciously
 - Mental life is fundamentally metaphorical in nature

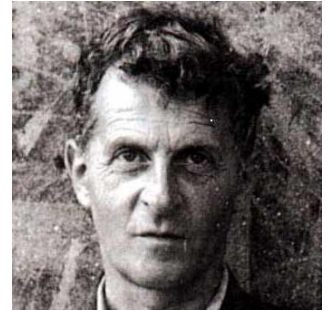
Questions?



Pragmatics: Why We Speak

"The size of the lie is a definite factor in causing it to be believed"
(Adolf Hitler)

Pragmatics : Why We Speak



- Ludwig Wittgenstein (1940s):
 - To understand a word is to understand a language
 - To understand a language is to master the linguistic skills

Pragmatics: Why We Speak

The pragmatic goal of language is to
understand the “reason” of a speech

What are the speaker’s motive and goal?

"Do you know what time it is?"

Pragmatics: Why We Speak

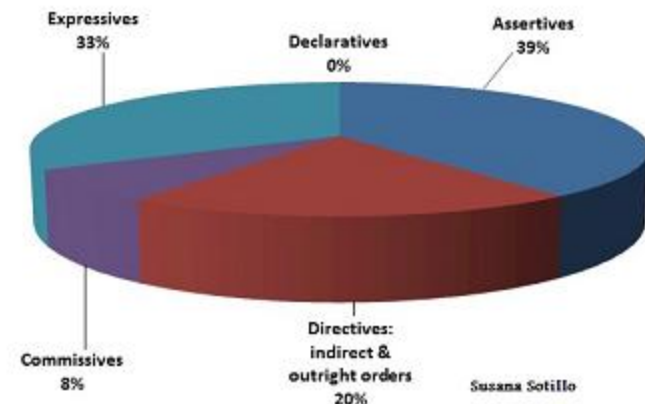
- Speaking involves two people
- Language is cooperation
- Speaker's motive and goal are part of meaning
- There is no speech without a context
- The purpose of a speech in a given context is to generate some kind of action

Pragmatics: Why We Speak



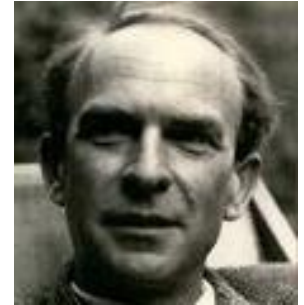
- John Langshaw Austin (1962):
 - "Locutionary" act (the words employed to deliver the utterance)
 - "Illocutionary" act (the type of action that it performs, such as warning, commanding, promising, asking)
 - "Perlocutionary" act (the effect that the act has on the listener, such as believing or answering)

Figure 1. Types of Illocutionary Acts



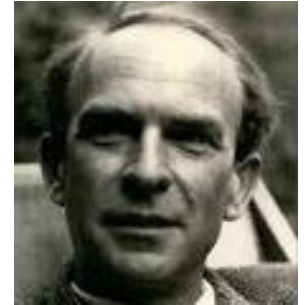
Pragmatics: Why We Speak

- Paul Grice (1975)
 - Language has meaning to the extent that some conventions hold within the linguistic community
 - The speaker and the hearer cooperate
 - The speaker wants to be understood and cause an action
 - There is more to a sentence than its meaning: a sentence is "used" for a purpose
 - The significance of an utterance includes both what is said and what is implicated (implicatures)



Pragmatics: Why We Speak

- Paul Grice (1975)
 - Four maxims help the speaker say more than what she is saying
 - Provide as much information as needed in the context, but no more than needed (quantity)
 - Tell true information (quality)
 - Say only things that are relevant to the context (relation)
 - Avoid ambiguity as much as possible (manner)



Pragmatics: Why We Speak

- "Conduit Metaphor":
 - Linguistic expressions are vehicles for transporting ideas along a conduit which extends from the speaker to the listener
 - Each word contains a finite amount of a substance called meaning
 - The speaker assembles the meaning, loads the vehicle and sends it along the conduit
 - The listener receives the vehicle, unloads it and unscrambles the meaning



Pragmatics: Why We Speak

- Michael Reddy (1979)
 - The transfer of thought is not a deterministic, mechanical process.
 - It is an interactive, cooperative process



Pragmatics: Why We Speak

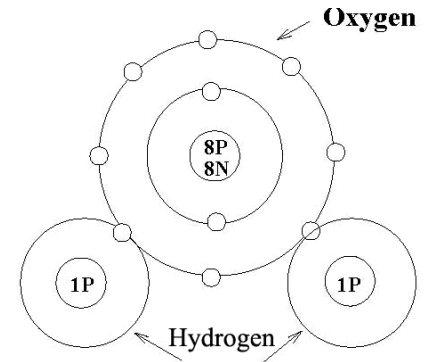
- Dan Sperber and Deirdre Wilson (1995)
 - Understanding an utterance consists in finding an interpretation that is consistent with the principle of relevance
 - The hearer is out to acquire relevant information
 - The speaker tries to make his utterance as relevant as possible
 - “Relevance” constrains the coherence of a discourse and enables its understanding
 - The process of comprehending an utterance is a process of hypothesis formation and confirmation

Questions?



Meaning

- What is the meaning of “water”?
 - H_2O
 - Substance that makes you wet
 - Liquid that flows in rivers
 - Ice when it warms up
 - One of the four fundamental elements with fire, air and earth
 - A drink



Meaning

- What is the meaning of “clock”?
 - An object whose function is that of marking the time (which could be a sundial)?
 - Or an object whose structure is round, has two hands and 12 numbers (which could be a toy clock that does not perform any actual function)?



Meaning

- Problems:
 - “I am Piero Scaruffi” is true or false depending on who utters it
 - “I am right and you are wrong” has two completely opposite meanings depending on who utters it
 - What is the meaning of “I am lying”?

Holism

- Pierre Duhem
 - Hypotheses cannot be tested in isolation from the whole theoretical network in which they appear There are infinite interpretations of a discourse depending on the context



Holism



- "Under-determination" theory (Willard Quine)
 - There are infinite interpretations of a statement depending on the context
 - Verification of a statement within a theory depends on the set of all other statements of the theory
 - Each statement in a theory partially determines the meaning of every other statement in the same theory.
 - The meaning of a sentence depends on the interpretation of the entire language

Against Holism



- Externalism (Hilary Putnam)
 - Inhabitants of Earth and Twin Earth think of two different substances both called “water” that look and feel the same
 - They are thinking about two different things, while their mental states are absolutely identical
 - Meaning is not in the mind
 - If some day we found out that Chemistry has erred in counting the electrons of the atom of gold, this would not change what gold is
 - The meaning of the word “gold” is the social meaning that a community has given it.

Questions?



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Summary

- Communication is pervasive in nature. We are not the only ones who communicate: everything does.
- Human language is unique though in many ways
- Speech is continuous and still we figure out how to partition it into words
- Our competence vastly exceeds our performance
- Chomsky, Pinker, etc: we are born with a language instinct
- We speak multiple languages and don't understand other people's languages
- We use things like metaphors (fairy tales are technically lies)
- We still retain the animal-kind of communication (screams, smiles, etc)

Summary

- There are hypotheses that human language is more than communication
 - Sapir & Whorf: language delivers an entire culture to the child who learns it
 - Cementing the group (one's accent and expressions reveal her birthplace)
 - Sexual selection
 - A vast symbolic apparatus at work (Langler's theory)
- Phonetics
- Syntax
- Semantics
- Pragmatics

Language

"I told him to be fruitful and multiply, but not in those words"
(Woody Allen)

Piero Scaruffi
www.scaruffi.com

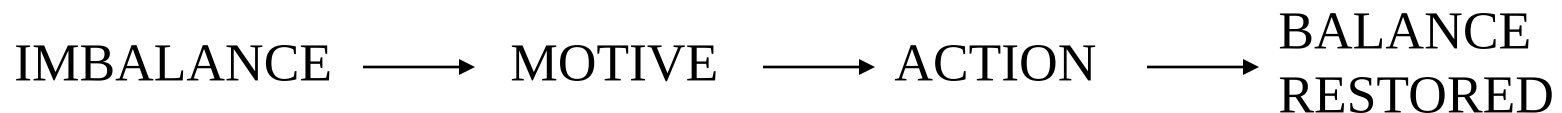
Dreams and Emotions

The Interpretation of Sleep

- Why do we sleep in the first place?
 - Evolutionary reason: Natural selection rewarded individuals who were capable of hiding still at the time of the day when they were most vulnerable
 - Energetic reason: Sleep optimizes an individual's energies at the time of the day when it is least efficient to search for food
 - Restorative reason: During sleep the body performs maintenance (muscle growth, tissue repair, protein synthesis, etc. occur during sleep)
 - Cognitive reason: During sleep the brain self-organizes.

Prehistory of Dreaming Science

- Classical world of psychology (eg, Wilhelm-Max Wundt, 1874)
 - Actions have a motive
 - Motives express an imbalance in the mind, between desire and reality
 - Action is an attempt to regenerate balance by changing the reality to match our desire



Prehistory of Dreaming Science

- Classical world of
 - Dreams?

IMBALANCE → MOTIVE → ACTION → BALANCE
RESTORED

Prehistory of Dreaming Science

- The subconscious
 - Schopenhauer's will
 - Nietzsche's covert instinct
 - Johann Herbart's "Textbook of Psychology" (1816): the mind arises from the dialogue between conscious and unconscious processes
 - Eduard von Hartmann's "Philosophy of the Unconscious" (1868)

Prehistory of Dreaming Science



- Sigmund Freud (1900)
 - All mental life is driven by motives/desires
 - There is a repertory of motives that our mind, independent of our will, has created over the years, and they participate daily in determining our actions
 - A dream is meaningless if interpreted from the point of view of conscious motives
 - However, the dream is a perfectly logical construction if one also considers the unconscious motives
 - It appears irrational only because we cannot access those unconscious motives.

Prehistory of Dreaming Science



- Sigmund Freud
 - Unfortunate consequence of Freud's work: psychiatrists look for the "meaning" of dreams, rather than for the process of dreaming
 - How is the unconscious created?
 - How are some motives selected over others?
 - How are motives repressed but kept active?
 - Dreams remain outside the sphere of science for five decades

Prehistory of Dreaming Science

- Classical model of Psychology
 - Dreams are actions caused by motives
 - Motives of dreams have been created in our mind while we were not aware of it
 - Motives were caused by traumas
 - A dream is an attempt to regenerate balance

TRAUMA → UNCONSCIOUS MOTIVES → DREAM → BALANCE RESTORED

IMBALANCE → MOTIVE → ACTION → BALANCE RESTORED

Prehistory of Dreaming Science



- Carl Jung (1912)
 - Dreams reflect the "collective unconscious", a shared repertory of archaic experience represented by "archetypes" which spontaneously emerge in all minds
 - Predispositions by all human brains to create some myths rather than others (compare with Chomsky's theory that there is a predisposition by all human brains towards acquiring language)

Prehistory of Dreaming Science

- Erich Fromm: “The Forgotten Language” (1951)
 - There is a universal language of symbols, expressed through dreams and myths
 - Modern people have forgotten that language, but not when they sleep
 - The subconscious understands the deeper layer, the conscious self understands only the surface layer



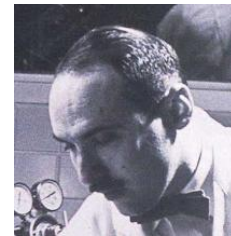
Prehistory of Dreaming Science

- Norman Malcolm (1959)
 - The accuracy of dream reports cannot be verified
 - "The only criterion of the truth of a statement that someone has had a certain dream is, essentially, his saying so."



The Interpretation of Dreams

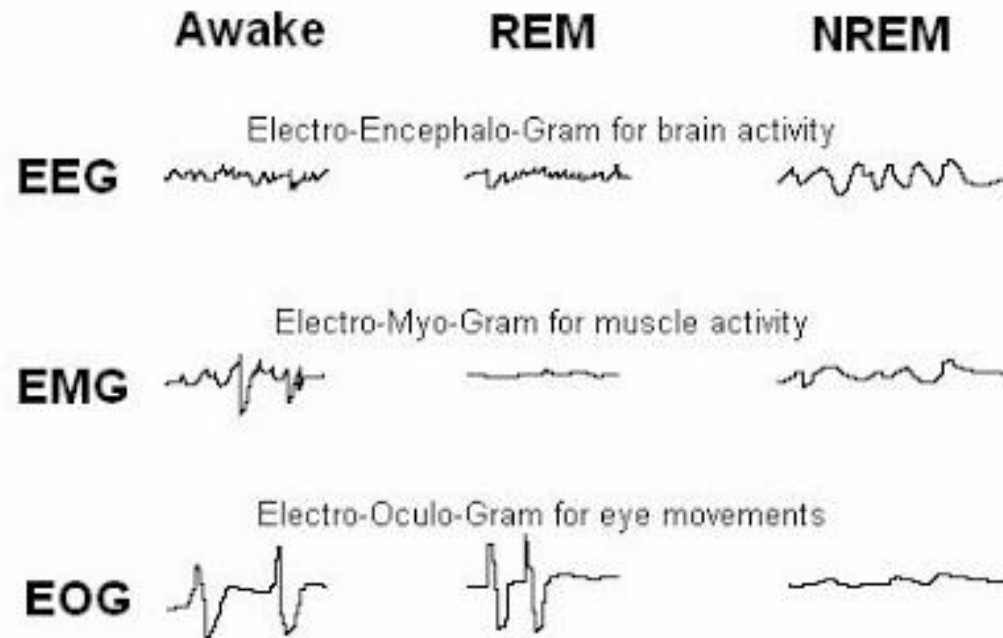
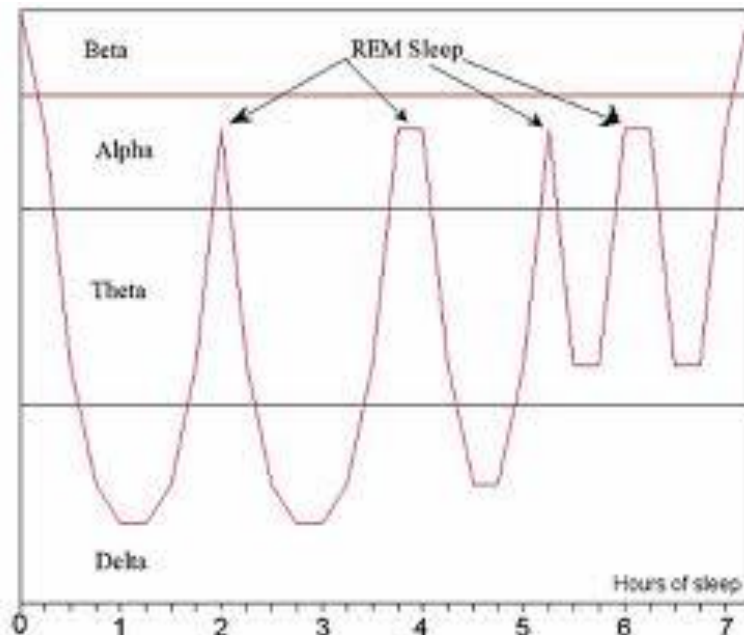
- Eugene Aserinsky / Nathaniel Kleitman's "Rapid Eye Movement" sleep (1953)
 - A low level of brain activity
 - Inhibition of muscle tone
 - Waves of excitation from the pons
 - Rapid eye movement
 - A brain enters REM sleep 4 or 5 times per night, at approximately 90 minute intervals, and each period lasts about 20 minutes



The Interpretation of Dreams

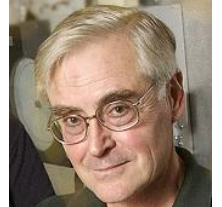


- William Dement (1954)
 - Sleep consists of cycles of different stages of sleep, repeated four or five times a night



The Interpretation of Sleep

- Craig Heller and Joel Benington(1995)
 - Sleep helps to restore the brain's energy
 - Most of the cells in the brain are actually not neurons but glia: they store and release glycogen
 - The wakeful processes of perception, thought and action use up the glycogen stores
 - The brain releases adenosine whenever the energy reserves are low
 - Adenosine is an inhibitory neurotransmitter
 - Eventually adenosine reaches a level that inhibits signal propagation and triggers non-REM sleep
 - In this state the brain is less active, consuming much less glycogen and energy can be replenished with new glycogen.



The Interpretation of Sleep

- Dale Edgar and William Dement (1992)
 - This homeostatic process works **independently from the circadian** clock that, instead, keeps us awake during the day, even when we get tired
 - Other animals don't have such opposing clocks and sleep whenever they need energy restoration.



The Interpretation of Dreams



- Frederick Snyder (1966)
 - REM sleep came first and dreams came later
 - REM sleep of mammals and birds is generally followed by a brief awakening
 - **The sentinel hypothesis:** *REM sleep wakes up an animal periodically* to scan the environment for possible predators
 - REM sleep had a useful function for survival: it kept the brain alert and ready to react to emergencies even during sleep
 - REM sleep was available and was used to host dreams

Questions?



The Interpretation of Dreams

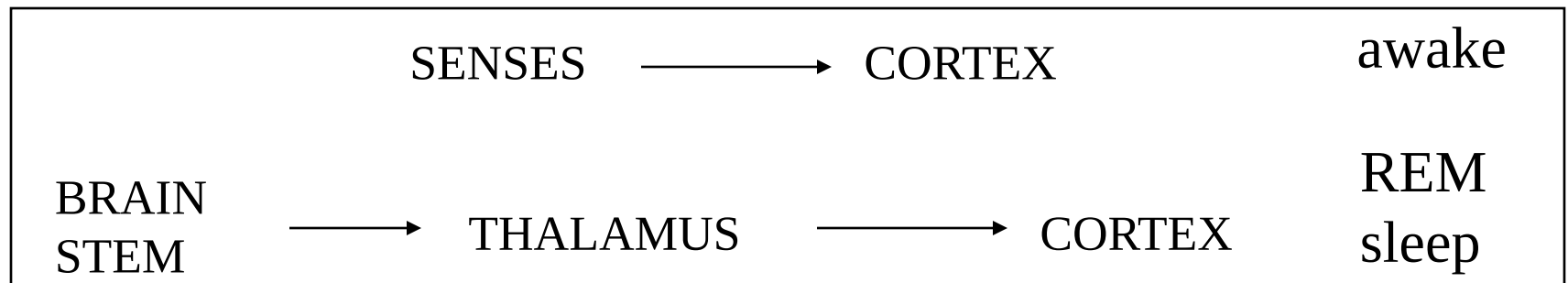
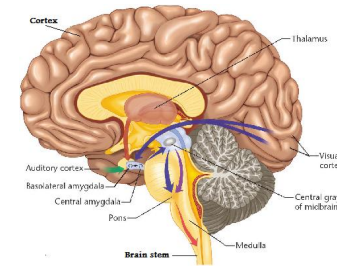
Dreams might be a window on some processing that goes on in the brain while we sleep



The Interpretation of Dreams



- Michel Jouvet (1962)
 - REM sleep originates in the brain stem
 - The pons sends signals and excites eye muscles (causing rapid eye movement), the midbrain (causing a low level of brain activity), and the thalamus.
 - The cortex receives a valid sensory signal from the thalamus and interprets it as if it were coming from the senses



The Interpretation of Dreams



- Michel Jouvet (1962)
 - During REM sleep several areas of the brain are working frantically, and some of them are performing exactly the same job they perform when the brain is awake.
 - The only major difference is that the stimuli they process are now coming from an internal source rather than from the outside world
 - REM sleep is pervasive among mammals and birds. *Whatever its function is, it has to be the same for rats and humans.*

The Interpretation of Dreams



- Michel Jouvet
 - A dream is the vehicle employed by an organism to **cancel or archive** the day's experiences on the basis of a genetic program
 - REM sleep provides a means to combine genetic instructions with experience
 - *Sleep and dreaming are a survival strategy*

The Interpretation of Dreams

- Allan Hobson and Robert McCarley (1977)
 - Dreams originate from random brain activity during REM sleep ("continual activation")
 - *The brain tries to make sense of a flow of random "thoughts"*
 - Dreams have no meaning



The Interpretation of Dreams

Dreams may represent a window on some processing that goes on in the brain while we sleep

- The brain is rapidly processing a huge amount of information in whatever order
- Our consciousness sees flashes of the bits that are being processed
- These bits seem to compose stories of their own, and the stories look weird
- Remembering and forgetting occur during dreams
- REM sleep is important for consolidating long-term memories

The Interpretation of Dreams



- Jonathan Winson (1985)

- Clues:

- At birth, the hippocampus is needed to retrieve information stored in long-term memory, but, after about three years, the brain somehow learns how to access directly such information

0-3 years long-term memory → hippocampus → awareness

>3 years long-term memory → awareness

- Lower mammals exhibit a theta rhythm in the hippocampus only on two occasions: whenever they perform survival-critical behavior, and during REM sleep



The Interpretation of Dreams



- Jonathan Winson (1985)
 - Early mammals had to perform all their "reasoning" on the spot, e.g. integrate new information (sensory data) with old information (memories) immediately to work out their strategies.
 - Brains invented a way to "postpone" processing sensory information by taking advantage of the hippocampus: REM sleep.
 - Instead of taking input from the sensory system, the brain takes input from memory
 - Theta rhythm is the pace at which that off-line processing is carried out.
 - Theta rhythm disappeared in primates, but REM sleep remained

The Interpretation of Dreams



- Jonathan Winson
 - During REM sleep, the hippocampus processes the day's events and stores important information in long-term memory
 - During REM sleep the brain relates recent memories to old memories
 - During REM sleep the brain derives "tips" for future behavior

The Interpretation of Dreams



- Jonathan Winson
 - *Dreams are a window on this "off-line processing" of information*
 - Dreaming is essential to learning
 - Dreams represent "practice sessions" in which animals (not only humans) refine their survival skills

The Interpretation of Dreams



- Francis Crick (1983)
 - The function of dreams is to "clear the circuits" of the brain, otherwise there would not be enough space to register each day's events
 - The brain, in the face of huge daily sensory stimulation, must:
 - understand what matters
 - understand what does not matter
 - remember what will still matter
 - forget what will never matter again
 - Dreams help eliminate useless memories.
 - We dream what is worth forgetting

The Interpretation of Dreams



- Allan Hobson (1989)
 - We dream hypothetical situations so that we will be prepared to face real situations of the same kind.
 - When a waking situation occurs, it has hopefully already been played at least once in our dreams, and we know what to expect.
 - By dreaming, we train our brain: **dreams are mental gymnastics.**
 - In order to see something, we must first create the vision of that something in our mind.
 - **We dream what is worth remembering**

The Interpretation of Dreams

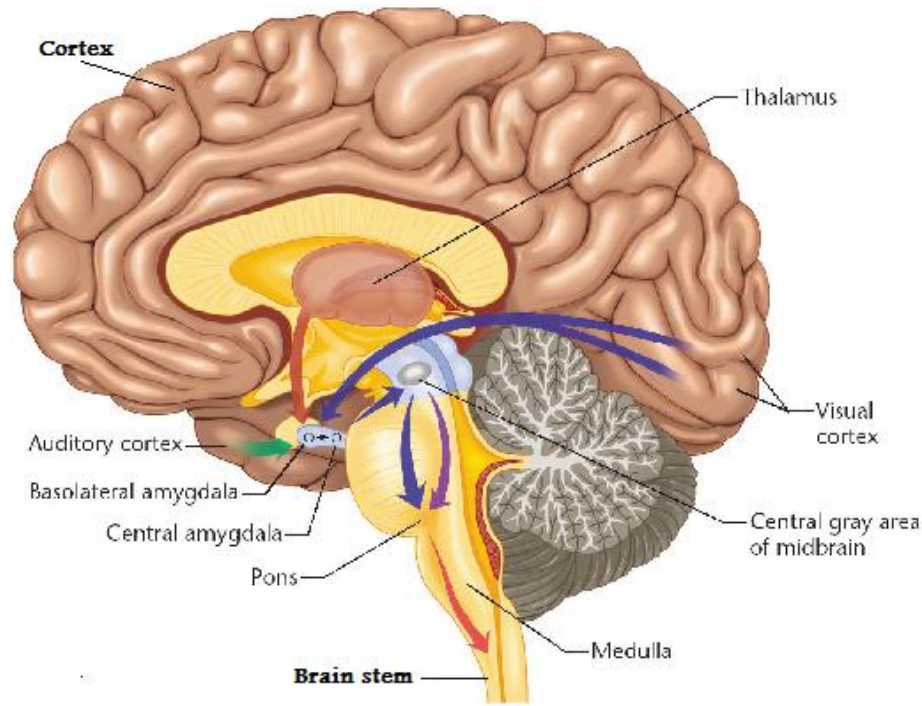


- Allan Hobson
 - Awake process = sleep process
 - The input, the output, the processor and the working space of the awake brain are replaced by something else; but the “software” is the same.
 - Waking and sleeping are controlled by two distinct populations of neurons in the brain stem

The Interpretation of Dreams



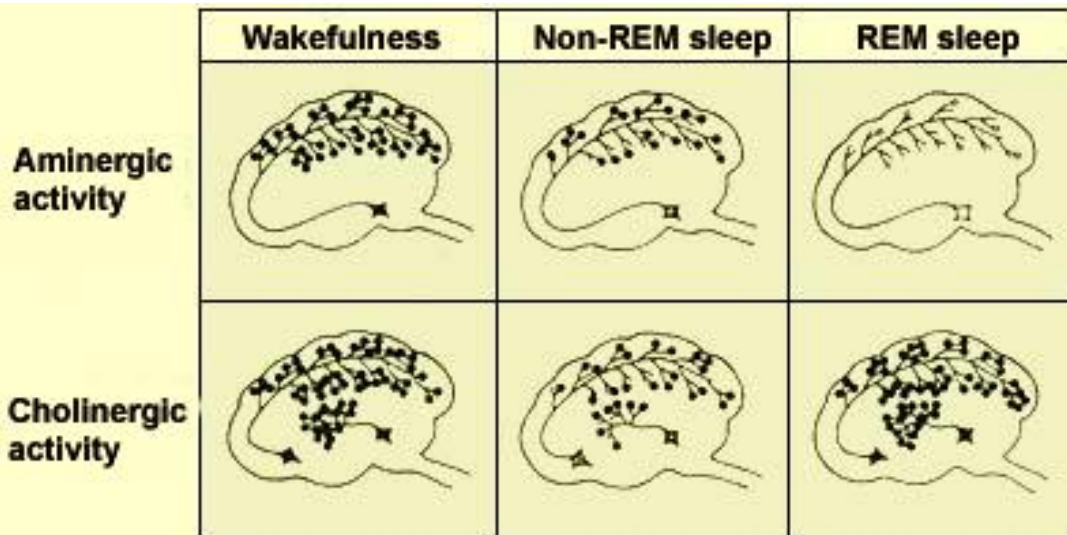
- Allan Hobson
 - Struggle between two rival neurotransmitter pathways
 - Aminergic neurotransmitters originate in the brain stem and terminate in the amygdala.
 - Cholinergic neurotransmitters originate in the basal forebrain and terminate in the cortex.



The Interpretation of Dreams



- Allan Hobson
 - During waking states, the brain is controlled by aminergic neurotransmitters
 - During sleep, the brain is controlled by cholinergic neurotransmitters



The number of black dots is proportional to the activity of the aminergic and cholinergic systems

The Interpretation of Dreams

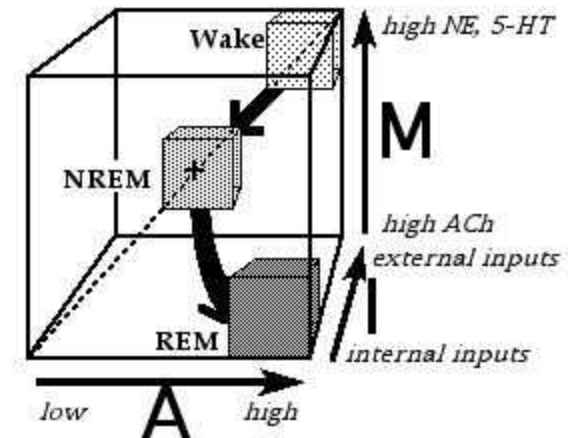
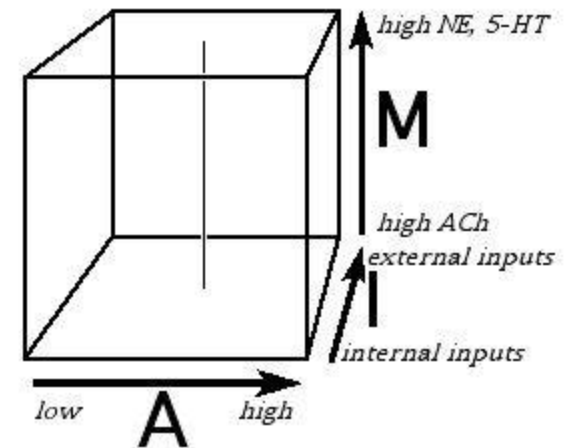


- Allan Hobson
 - Wake and sleep are two different chemical systems hosted in the same processor
 - Dynamic equilibrium: if one chemical system retracts, the other advances
 - The brain never truly sleeps
 - Our consciousness can fluctuate between two extremes, in which either of the chemical systems totally prevails

The Interpretation of Dreams



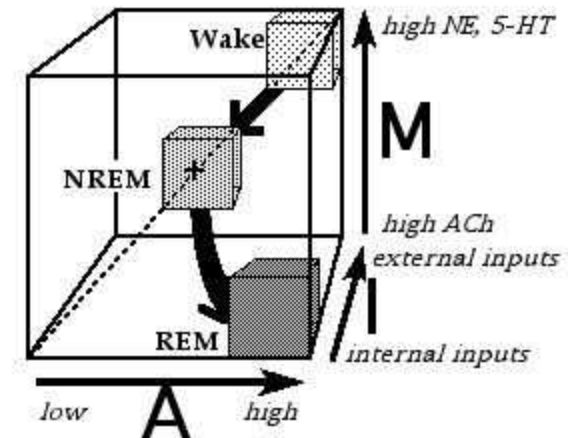
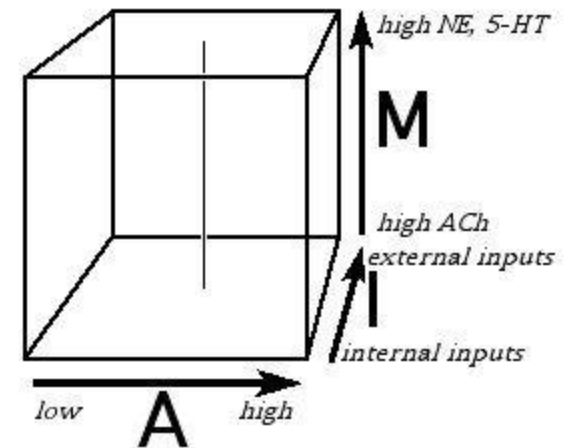
- Allan Hobson (1989)
 - The brain states of wake and sleep are only two extremes
 - Between them there exists a continuum of aminergic-cholinergic interactions, and therefore a continuum of brain states
 - The brain is in awake, dream or (non-REM) sleep mode depending on whether amines are prevailing, cholines are prevailing, or amines and cholines are "deadlocked"
 - Normally, both external and internal sources contribute to cognitive life, and both amines and cholines contribute to the brain state.



The Interpretation of Dreams



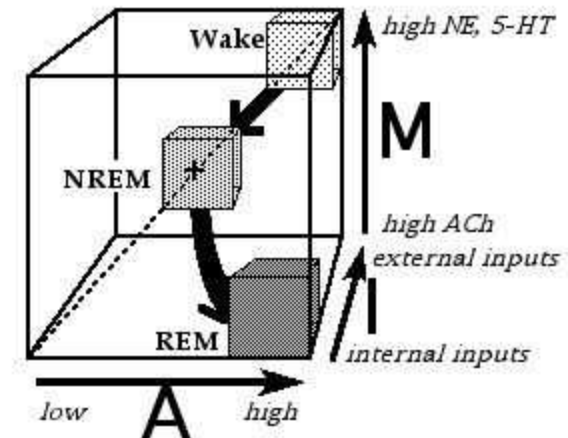
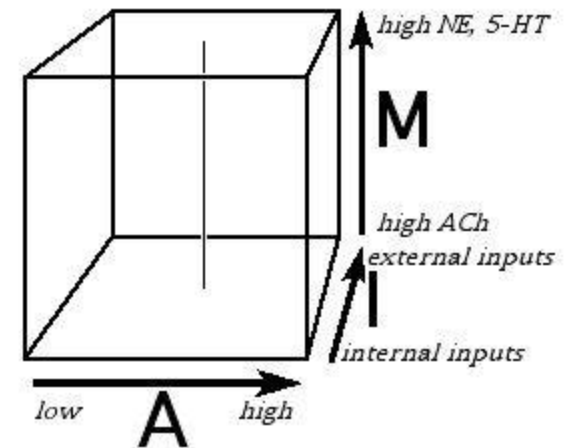
- Allan Hobson's unified theory of brain behavior
 - Brain behavior: activation energy (amount of electrical activity) + information source (internal or external) + chemical system (amines or cholines)
 - Wake: activation energy is high, the information source is external and the mode is aminergic
 - Sleep: activation energy decreases, the external information source fades away and amines and cholines balance each other



The Interpretation of Dreams



- Allan Hobson
 - Dreaming: activation energy is high, the information source is internal and the mode is cholinergic
 - Hallucination: activation energy is high, the information source is internal and the mode is aminergic
 - Coma: activation energy is low, the information source is internal and the mode is cholinergic
 - Normal state: interplay of amines and cholines, interplay of external and internal sources (perceptions are mediated by memory), interplay of high and low activation energy



The Interpretation of Dreams



- William Calvin (1996)
 - The brain works all the time just like Nature works all the time at producing and selecting species
 - The brain is a small ecosystem of “thoughts” that are continuously produced in countless variations and then selected
 - **We dream all the time.**
 - When we are awake, the rational part of the brain selects the “dreams” that make sense and disposes of the ones that don’t make sense.
 - When we are asleep, that “rational” center is not working and therefore our mind is flooded with random dreams

Questions?



NREM Dreaming



- Mark Solms (1997)
 - Dreaming is possible without REM
 - The dopaminergic system (originating in the ventral tegmental area) is the neurochemical basis for dreaming
 - Only REM originates in the pons
 - Dreams and REM are physically controlled by two different regions of the brain.

Neurobiology and Genetics of Dreams

- 1996: Clifford Saper identifies the “sleep switch” in the hypothalamus
- 2009: Ying-Hui Fu discovers the gene that regulates sleep length in mammals



Amita Sehgal & Emmanuel Mignot: “Genetics of Sleep and Sleep disorders” (2011)

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3153991/>

Questions?



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Hobson, Allan: THE CHEMISTRY OF CONSCIOUS STATES (Little & Brown, 1994)

Jouvet, Michel: THE PARADOX OF SLEEP (Jacob, 1992)

Winson, Jonathan: BRAIN AND PSYCHE (Anchor Press, 1985)

Break



*I play the notes, in order, as they are written.
It is God who makes the music*
(Johan Sebastian Bach)

Emotion and Cognition

- Robert Zajonc (1980)
 - Contrary to popular belief, *emotion tend to prevail over cognition in decision making*



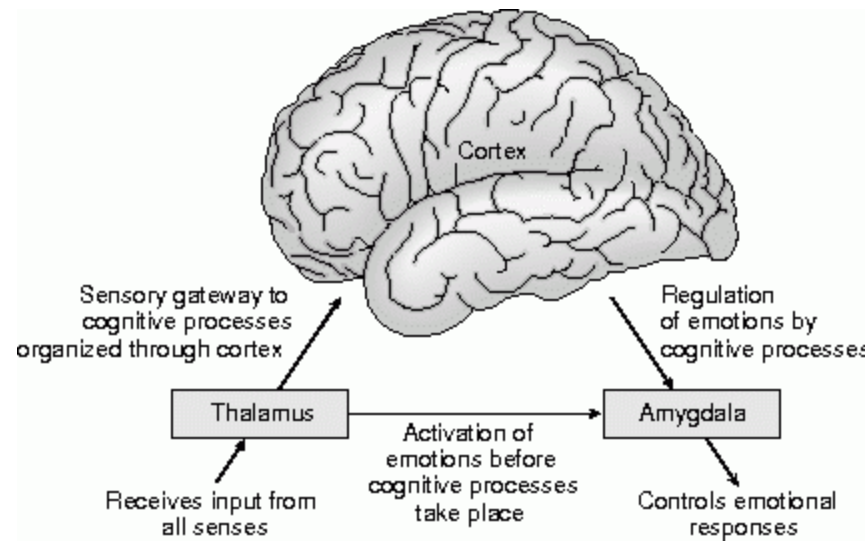
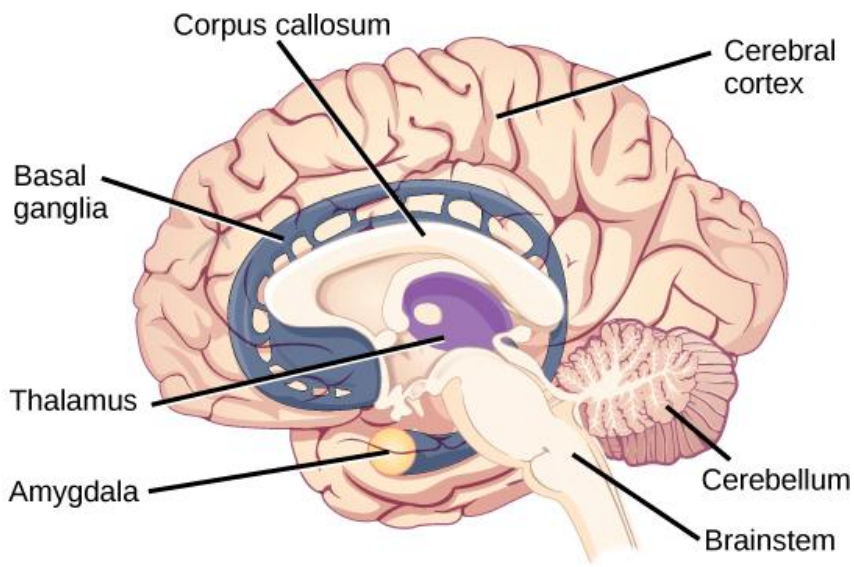
Emotion as Survival Instinct

- Joseph LeDoux (1996)
 - *Emotions help us make fast decisions in crucial situations*
 - Emotions are inferential short-cuts
 - Fear helps act faster than if we used our logical faculties

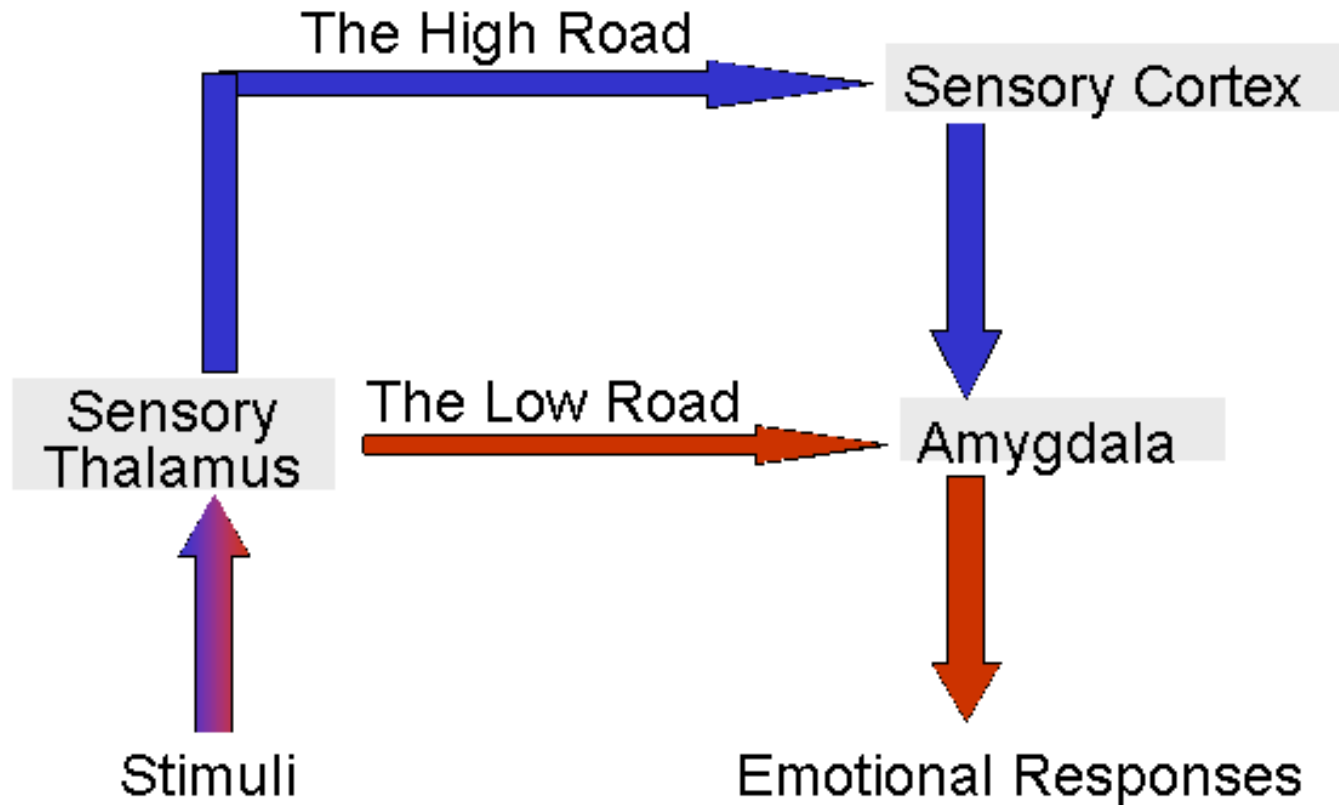


Emotion as Survival Instinct

- Joseph LeDoux (1996)
 - The central processor for emotions is the "amygdala"
 - The thalamus connects senses to the cortex, and the cortex to the muscles
 - The route from senses to amygdala to thalamus to muscles is much faster than from senses to thalamus to cortex to muscles



Emotion as Survival Instinct



LeDoux: Tracing Emotional Pathways (NY Times Nov. 5, 1996)

Emotion as Communication



<http://blog.sciseek.com>

Emotion as Communication

- Allan Hobson (1994)
 - Emotions are the fastest way that we can communicate with members of our group
 - Emotions are signals between animals of the same species that communicate one's brain state to another
 - *Emotions may predate language itself as a form of communication*

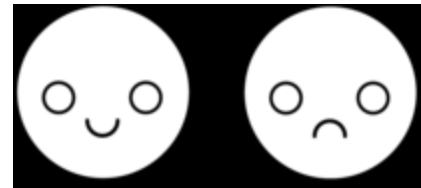


Emotion as Communication

- Ray Birdwhistell (1952)
 - “Kinesics”, paralinguistic body communication, such as facial expression
 - All movements of the body have some kind of meaning
 - Non-verbal behavior obeys its own grammar, with a "kineme" being the kinesic equivalent of the phoneme.
 - Facial expression is inevitable like language and universal like language



Emoticons:



Universal Emotions?

- There evolved fundamental emotions that all humans share, regardless of cultural influences:
 - Charles Darwin
 - Paul Ekman
 - Robert Plutchik (8 emotions shared by ALL animals)

Adaptive behavior		Emotion
Protection	The behavior that occurs in response to pain or threat of destruction.	Fear, terror
Destruction	"Behavior designed to destroy a barrier that prevents the satisfaction of an important need" (1984, p. 202).	Anger, rage
Reproduction	Any behavior associated with sexual activity, including "approach [and] maintenance-of-contact tendencies" (1984, p. 202).	Joy, ecstasy
Reintegration	Behavior that is in response to a loss of something "pleasurable or nutrient" (1980, p. 145).	Sadness, grief
Incorporation	The acceptance of a stimulus.	Acceptance, trust
Rejection	The removal of something that has been accepted, but has turned out to be harmful.	Disgust, loathing
Exploration	The behavior displayed when organisms explore or examine their environment.	Expectancy, anticipation
Orientation	The brief response—stopping or freezing—when a new stimulus, which has not yet been classified as beneficial or harmful, is encountered.	Surprise, astonishment

Emotion as Rationality



- Aaron Sloman (1982)
 - The relation between emotional states and cognitive states is the need to draw conclusions when cognition would face combinatorial explosion of possible reasoning threads
 - Complementarity between reason and emotion
 - “Why Robots Will Have Emotions” (1981)

Emotion as Heterostasis

- Harry Klopf (1982)
 - Organisms are not hiding in the environment, trying to minimize action and change
 - Organisms actively seek stimulation
 - "Heterostasis" is the seeking of maximum stimulation
 - All parts of the brain are independently seeking positive stimulation (or "pleasure") and avoiding negative stimulation (or "pain")
 - *Emotion provides the sense (a measure) of what the organism needs, cognition provides the means for achieving those needs*

Emotion as Homeostasis



- Ross Buck (1984)
 - The system of emotions is a biologically shared signal system
 - It was created over millions of years through the evolutionary process
 - Communicating an emotion is easy, communicating a theorem is not easy at all
 - Emotions have the important function of speeding up *communication of crucial information* among members of the same species

Emotion as Homeostasis



- Ross Buck (1984)
 - Emotion communicates a "measure" how much goals have been satisfied, how far the organism is from equilibrium with the environment
 - For example, fear is a measure of safety
 - *Emotions are measurement tools*
 - The ultimate function of emotions is homeostasis

Emotion as Cognition



- George Mandler (1984)
 - The function of the emotion (“desire bananas”) is to provide the individual with *the most general view of the world that is consistent with current needs, goals and situations*

Emotion as Survival Strategy



- Peter Lang (1985)
 - Evolutionarily speaking, the brain regions that preside over emotions are older
 - Emotions encode survival strategies that developed over the course of evolution
 - Elementary emotions of pleasure and pain evolved into a whole repertory of emotions
 - *First brains started feeling emotions, then they started thinking*

Questions?



Emotion as Self-communication

- Jose Jauregui (1990)
 - *An emotion makes a detailed explanations of the cause redundant because the emotion contains its own correction mechanism*
 - The emotional life of an individual is mathematically calculated to achieve exactly the kind and degree of response needed for the well-being of the individual
 - If the self disobeys it, the brain may increase the intensity of the message
 - It is emotion, not reason, that directs and informs the daily actions of individuals
 - Emotions: the communication channel between the brain and the self



Emotion as Body-self communication

- Antonio Damasio

- An emotion is registered by the brain when a stimulus is recognized as useful for well-being or damaging for well-being
- Evolution has endowed us with a basic repertory of emotions that help us survive
- Emotion is a response to a stimulus, a response that causes a change of state in order to cope with the stimulus
- The immune system produces antibodies to fight invading viruses; or, better, the invading virus selects the appropriate antibody
- *An emotional response is the antibody that reacts to an invading stimulus*, and is selected by that stimulus



Emotion as Body-self communication

- Antonio Damasio
 - The brain's original purpose is to manage the wealth of signals that represent the state of the body ("soma")
 - A somatic markers is a link between a body change and an emotion
 - The somatic marker works either steering us away from choices that experience warns us against or steering us towards choices that experience makes us long for



Emotion

- Summarizing Hobson, Lazarus, Jauregui and Damasio:
 - Specific circuits in the brain are devoted to handling emotions
 - They communicate the "emotion" to the rest of the body via the bloodstream and the nervous system
 - They cause a change in the state of the body
 - The emotion works as an "amplifier" of a signal that came from the body
 - A change of state in the body causes an emotion that causes an action that causes a change of state in the body
 - Emotion is about homeostatic regulation

Emotion as Memory



- John Aggleton (1992)
 - The brain contains two reasoning systems that perform in different manners and use different circuits
 - *We have not one but two brains*, that operate in parallel on the same input but may generate completely different output.

Emotion as Memory



- Edmund Rolls (1999)
 - Emotions have several functions
 - the production of an autonomic response (i.e., faster heart beats)
 - the production of an endocrine (i.e., adrenaline)
 - the production of motivated behavior (that will last a lifetime)
 - communication to other members of the group
 - storage of "important" memories
 - etc

Emotion as Cognition



- Keith Stenning (2002)
 - Emotions are a way to abstract situations
 - Similar emotions are used to classify situations and objects into concepts and categories
 - The solution to Wittgenstein's paradox (we all know what a "game" is, but there is no simple definition of what a "game" is): we know what a "game" is because we know what the emotion related to a game is
 - The reason it is so easy for us to learn something so difficult as language is that language reflects the way our emotions work
 - *Emotions are the foundation of our mental life*

Emotion as Cognition



- Robert Solomon (2007)
 - People whose emotional life has been damaged (e.g. by a stroke) are no longer capable of making rational decisions despite the fact that the rest of their brain is functioning like before
 - They do not "care" for the consequences of the decision and therefore are incapable of making a rational one.
 - It is our emotions that guide us in this world
 - Emotions help us conceptualize and evaluate

Emotion as Cognition

- Lola Canamero's emotional robot (2010)



Questions?



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Frijda, Nico: The Emotions (1986)

Griffiths, Paul: What Emotions Really Are (Univ. of Chicago Press, 1997)

Jauregui Jose: The Emotional Computer (1990)

Lazarus, Richard: Emotion And Adaptation (Oxford Univ Press, 1991)

Stenning, Keith: Seeing Reason (Oxford Univ Press, 2002)

Emotions

*"Humans - who enslave, castrate, experiment on, and fillet other animals - have had an understandable penchant for pretending animals do not feel pain."
(Carl Sagan)*

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