Forelesning 11: Language production

Core questions

- “Language alters the nature of thought itself.” From the textbook, present one argument for and one argument against the perspective (Gilhooly, pg. 328 - 329). Come up with your own suggestion of another factor that may alter both language and thought.
- Analyze the sentences made by Genie (pg. 326) and identify how the following lexical categories of language are altered: morphemes, semantics and the lexicon, and Syntax (pg. 336 - 342). What could this reflect about her internal thought process?
- What are differences between serial and interactive models of speech production (pg. 351 - 356).
- Describe the nature of Broca’s aphasia (pg. 365-366). What challenges do novel investigations into patient Leborgne’s brain present for the explanatory power of double dissociation (pg. 23)?

Relevante eksamensoppgaver

- 2019
  (a) Navngi de minste meningsfulle lydenhetene på et språk. Når er de utviklet?
  (b) Definer produktiviteten til menneskelig språk. Hvordan er det oppnådd?
  (c) Navngi de fem stadiene av taleproduksjon foreslått av Garett (1985). Hva skjer på Funksjonsnivå?

Oppsummering

Genie Wiley was a girl who was isolated from language until she was 13 years old. When she was finally exposed to language, she didn't show patterns of over-extension, which are typically associated with children when learning and developing language. She had missing vocabulary and struggled with syntax, which reflects a potential critical period of learning language. Additionally, function words were not seen in her speech.

The lecture discussed whether language is separate or emergent from other cognitive processes. For example, William's syndrome is primarily a cardio-vascular illness that affects cognitive processes due to lack of blood to the brain. People with this syndrome have relatively intact language but impaired cognition. Similarly, specific language impairment (SLI) affects primarily language but not other cognitive processes.

However, The Sapir-Whorf hypothesis suggests that a person's native language shapes the nature of their thought, implying that pre-speaking (before learning how to speak) thought is categorically different. The lecture also provided an example of how the language used in a question can create a different mental image and affect how participants remember things.
In a classic study by Loftus and Palmer, participants were shown a video of a car accident and then asked to estimate the speed of the cars involved. Depending on which verb was used in the question "about how fast were the cars going when they___ each other" (e.g. "smashed," "collided," "bumped"), participants gave different estimates of the speed of the cars and even remembered the details of the accident differently. This suggests that the way we use language can influence not only our perception of events but also our memory of them.

The lecture then posed the question of who can use language, and mentioned Bunny the dog as an example.

It also discussed the communication of vervet monkeys, who give different calls for different predators, such as snakes, leopards, and eagles, and react differently depending on what predator the call signifies, even if it's just a recording playing back and the predator is not present.

The lecture went on to discuss the Bouba and Kiki experiment by Cwiek. This experiment explores the relationship between the sound of a word and its meaning. Participants were shown two shapes and asked to choose which one was "Bouba" and which one was "Kiki". The majority of participants associated the sharp, angular shape with "Kiki" and the rounded shape with "Bouba", indicating that the sound of a word can influence our perception of its meaning.

The lecture then went on to describe the components of language, including phonemes, morphemes, bound morphemes, free morphemes, inflectional morphemes, derivational morphemes, and allophones. Syntax, the structural organization of sentences in a language, was also discussed. It can be infinitely generated, and recursion is an example of repeated application of a rule. Semantics and speech errors, including the tip of the tongue phenomenon, were also discussed.

He also mentioned the Wernicke-Lichteim-Gerschwind model, which suggests that processing of word meaning happens in Wernicke's area and then is sent to Broca's area.

The split brain phenomenon was also discussed. Split brain occurs when the corpus callosum, the band of fibers that connects the two hemispheres of the brain, is cut. This surgical procedure is often done to treat severe epilepsy that does not respond to medication. In split-brain patients, each hemisphere of the brain is unable to communicate directly with the other. This can result in some interesting phenomena, such as the left hemisphere being able to recognize objects in the right visual field (because the left hemisphere controls the right side of the body), but not in the left visual field. The right hemisphere, on the other hand, is better at recognizing faces and emotional expressions

The lecture then discussed how people are bad at detecting lies, with only secret service agents being slightly above average in lie detection. Longer pauses, slower speech, and more speech disturbances are present in recordings of people lying, as shown in a study of a man who lied in court about a murder but later confessed. The lecture also mentioned a study of 32 public appeals, where half were honest and half were not, that looked at differences in equivocation (conveying vagueness), speech errors, word and sentence fragments, and non-verbal cues. The liar tended to avoid gaze and were more vague in their communication.

Lastly, lateralization of function refers to the fact that different functions of the brain are often located in different hemispheres. For example, language processing is primarily located in the left hemisphere for most people, while spatial processing tends to be more dominant in the right hemisphere. However, this is not an absolute rule and there is still a lot of individual variation in brain organization.

Begreper/teorier o.l./navn/eksperimenter o.l.

Begreper

- **phonemes** - *den minste/korteste lydenheten i språk. Har ingen mening alene. Ordet "hat" har 3 phonems - "h", "a" og "t".*

  (Bilde: Hånd som gjør tegnet for "liten" + munn)

- **Allophones**: Allophones:phonetic variants of the same phoneme.

- **Morphemes**: Morphemes are the meaning units of a language. They are the building blocks of words. A single word may consist of several morphemes.
- **bound morphemes**: example ed, ing, un…
- **free morphemes:** semantic words like large, wait, car

- **inflectional morpheme**: doesn't change the word category like …s, …er, …ed
- **derivational morpheme:** A derivational morpheme is a type of morpheme that is added to a base word to create a new word with a different meaning or part of speech. Example: the suffix "-able" can be added to the base word "read" to create the new word "readable,"

- **semantics**:Morphemes make up words, which in turn make up our vocabulary. Our knowledge of words and their meanings are stored in a kind of mental dictionary called the mental lexicon. The lexicon is a part of the semantic memory system. It holds our store of words and associated knowledge, and links words with our general knowledge about concepts and the world. From this store, we normally have immediate access to target words as we construct a sentence. Only occasionally will we experience difficulty

in calling a target word to mind, a temporary failure referred to as the tip-of-the-tongue effect.
Words are symbols; they are meaningful sounds and generally have a particular referent. A word might be defined as 'the smallest unit of grammar that can stand on its own as a complete utterance'.

- **over-extension** - *A pattern used by typically developing children, using words like "pen" for pens, pencils, crayons and other objects of similar shape.*

- **syntax**:
  We construct novel sentences when we speak; we do not generally repeat back or 'parrot' previous productions. This reflects the productivity of human language; we do not rely on rote or stock phrases, or on memory for practised utterances. Instead we create new sentences as and when we need them. This is evident from the earliest stages of syntactic development in young children.

  The term syntax describes the rules that determine the construction of phrases and sentences in a language. Sentences follow a hierarchical structure and are made up of two parts: a noun phrase (NP), which contains a noun, often the subject of the sentence, and a verb phrase (VP), which contains the verb and conveys the 'action' of the sentence.

  One key property of syntax underlies the productivity of sentence construction. Recursion refers to the repeated application of a rule and, using recursion, the same rule can be applied again and again to create a novel utterance. Recursion has been argued to be an essential property of human language (e.g., Chomsky, 1986). Embedded sentences make use of this property, and sentences can in principle (though not in practice) be extended indefinitely.
- **Recursion:** a process in which certain grammatical rules can be repeatedly applied, with the output of each application being input to the next, in principle indefinitely.

- **TOT (Tip of the Tounge)**: a temporary inability to access a word from memory

- **lateralization of function**:Different functions are associated with the left and right cortical hemispheres. When a cognitive function is lateralized, one cortical hemisphere is dominant for that function; this is referred to as lateralization of function. Language is largely a left hemisphere function while the right hemisphere is specialized for functions related to spatial/holistic processing, such as face recognition.

  Information from the left ear is processed in the right hemisphere

- **split brain:**

Lateralization of function is particularly apparent when we consider the effects on cognitive processing of a set of conditions that gives rise to the split brain phenomenon. When the band of fibres connecting the two hemispheres, the corpus callosum, is severed, the functions of the two hemispheres can be isolated and studied. In rare cases, these fibres are severed surgically, to treat epilepsy for example. In such cases, the difference in the hemispheres' functions becomes more visible.

--> you get split brian syndrom:
Left hemisphere dominant for language
Using their right hand objects can be named but not with their left hand.

the 'split-brain patient' behaves surprisingly normally, considering such a radical operation has been performed. However, on careful testing, it is apparent that the left and right hemispheres no longer communicate and are effectively working independently.

The left hemisphere is dominant for language in most people. The left hemisphere also controls, and gets input from, the right arm. If an object is placed in the right hand of a (blindfolded) split brain patient, he or she can name the object, as the information is relayed to the left hemisphere and it can make contact with the speech areas. However, if the object is placed in the left hand, the patient cannot name it. The patient can, however, pick a matching object from an array of objects, using the same hand. A picture that is presented to the right visual field can be named; a picture presented to the left visual field cannot, although again the object can be matched given an array of choices. Interestingly, when information is presented to the right hemisphere and cannot be named, the person reports not seeing it, suggesting a close alliance between language and subjective experience and consciousness (e.g., Cooney & Gazzaniga, 2003; Gazzaniga, 1980; Marinsek et al., 2016; Gazzaniga & Sperry, 1967). However, the patient can select a related picture using the left hand, but, unaware of what the right brain saw, he or she may invent a reason for the selection, a tendency referred to as confabulation (see Figure 10.9).

Teorier/modeller/metoder/syndromer

- **William's syndrome**:Relativiely intact Language but impaired cognition, but language is still below the norm.
- **Specific Language Impairment (SLI):** primarily language is affected but not other cognitive processes.
- **Sapir-Whorf hypothesis:**
  Native language that a person speaking shapes the nature of thought
  Implies pre-speaking thought is categoricaly different.
  the proposal that language affects thought and, in a strong form, that the way we think is determined by the language we use.

- **Hockett's Design Features for Language:**

Feature	Description
1. Vocal–auditory communication channel	The sender vocalizes and the receiver hears the spoken signal
2. Broadcast transmission and directional reception	The speech signal is transmitted out from the source and is localized in space
3. Rapid fading	The spoken message fades after production
4. Interchangeability	The sender can also be a receiver, and vice versa
5. Feedback	The speaker has access to the message and can monitor its content
6. Specialization	The energy expended in producing the message does not alter the meaning of the message
7. Semanticity	Sounds within speech refer to objects and entities in the world: words have meaning
8. Arbitrariness	The relationship between the spoken word and its referent in the world is arbitrary
9. Discreteness	The speech signal is composed of discrete units
10. Displacement	Language can be used to refer to things that are displaced from the present situation, either in time or space
11. Productivity	Language allows us to create novel utterances; this is also called openness or generativity
12. Cultural transmission	A language is learned through interaction with more experienced users of the language within a verbal community
13. Duality of patterning	Meaningful elements are created by combining a small set of meaningless units
14. Prevarication	Language can be used to deceive and lie
15. Reflexiveness	Language can be used to communicate about language
16. Learnability	A language can be learned by a speaker of another language

- **Hintons “hjul”**
- **Wernicke-Lichtheim-Geschwind model:** The Wernicke–Geschwind model, originally proposed by Karl Wernicke (1874), and also referred to as the Wernicke–Lichtheim–Geschwind model, notes a number of key areas for language (see Figure 10.8) and presents a simplified account of their role in language processing. The model proposes that we repeat a heard word by processing of the following sequence of brain areas. Following processing of the word in the auditory cortex, information about word meaning is processed in an area referred to as Wernicke’s area and the output is sent to a more anterior region known as Broca’s area via a band of connecting fibres called the arcuate fasciculus (see Figure 10.8). Broca’s area prepares the speech output, and a motor programme for output is then articulated via the motor cortex. When we read a word out loud, a similar sequence is involved, with processing starting at the back of the brain in the primary visual cortex and continuing into Wernicke’s area via the connections of the angular gyrus. While this model represents a simplification of the processing involved, it does provide a useful overview of the principal cortical brain areas for language and their functions.

- **Broca’s aphasia:**
- One of the first cortical areas involved in language production to be identified occupies the left inferior frontal gyrus and is known as Broca’s area (see Figure 10.8). In 1861, a French doctor, Paul Broca, localized language to the left hemisphere, and attributed the production of speech to the area now named after him. (A paper by Marc Dax, dated to 1836, is now acknowledged as the first to identify the left hemisphere as the seat of language.) Broca’s account was based on the aphasic disorder of a patient he encountered at the Bicêtre hospital in Paris. This man, named Leborgne, presented in his twenties with a severe reduction in speech output. Over the subsequent years he gradually lost the use of his right arm and leg, an impairment confirming left hemisphere damage, as limb movement is largely controlled by the contralateral cortical hemisphere.

After Leborgne's death, his brain was examined by autopsy and a large abscess was observed in the area now known as Broca's area. Broca concluded that this area of the brain was responsible for speech production.

While it initially seemed that the problem was one of production and not comprehension, it is now recognized that there are some comprehension problems associated with the disorder that is now known as Broca's aphasia, and these problems are particularly apparent when test sentences move beyond simple syntax (e.g., passive voice constructions). It is also now clear that it is the abstract representation of speech that is impaired in Broca's aphasia and not just the output mechanisms of speech; in deaf signers with aphasia, the linguistic components of sign language are similarly affected.

Patients with Broca's aphasia show deficits ranging from severe mutism to dysfluency or laboured speech. Broca's aphasia is one of a number of disorders that can be categorized as non-fluent, expressive or productive aphasia. Speech output is reduced and non-fluent, but word selections tend to be meaningful. Function words (those that do the grammatical work in a sentence) rather than content words tend to be compromised.

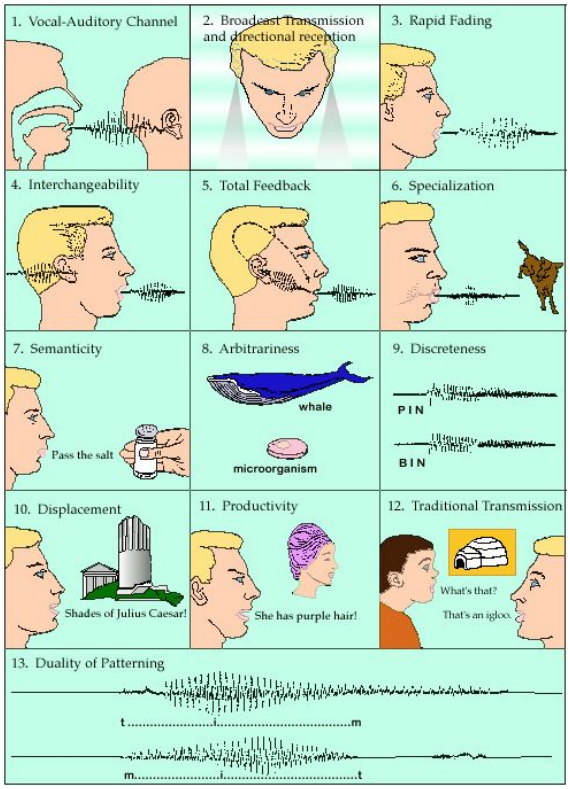
First, reduced output is apparent. This type of speech output is sometimes known as telegraphic speech because the sentences are reduced to the most basic units required to convey meaning – the content words such as nouns and verbs. The selection of content words is correct, showing that the patient can access the words from the lexicon. The function words are by comparison relatively sparse – inflections such as verb endings, conjunctions (e.g., and, but) and prepositions (to, under) are absent.

Goodglass and Geschwind (1976) defined Broca's aphasia as a condition 'marked by effortful, distorted articulation, reduced speech output, and agrammatic syntax but sparing of auditory comprehension' (p. 237). However, as mentioned above, while comprehension of simple sentences within everyday conversation may be relatively intact, people with Broca's aphasia have difficulties in understanding complex syntax. When comprehension depends on processing and understanding the syntactic structure of the sentence, it fails (Cornell et al., 1993).

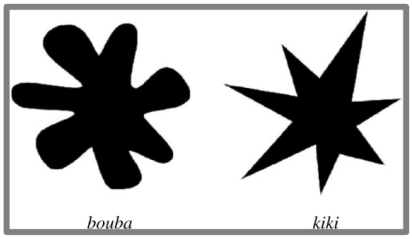
Navn

- **Genie -** *Jente som ble isolert, holdt fanget og utsatt for omfattende misbruk av faren, fra hun var 20 måneder til hun var 13 år. Utviklet veldig svakt språk.*
  isolated from 20 months old and was discouraged from speaking
  Didn't show pattern of over extention: a normal pattern of error in language development whereby children use the same word for a wider class of objects than is appropriate, for example using the term 'bird' for all flying things.
  Didn't understand common words
  Struggled with Syntax

- **Bunny** - *Hund fra YouTube-klipp som kommuniserer med eieren sin ved hjelp av knapper som spiller av lyder.*
- Aitchison - *Fant hovedtrekk ved alle språk (1996).*
- **Hocket-**Hocketts designfunksjoner er et sett med funksjoner som karakteriserer menneskelig språk og skiller det fra dyrs kommunikasjon.:

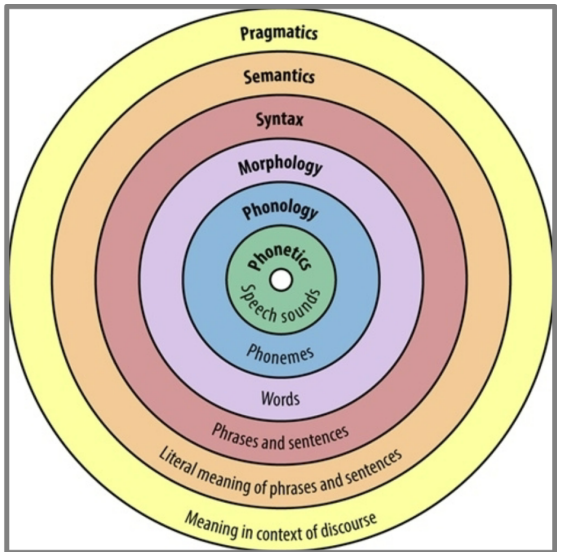


- **Cwiek**
  Bouba/kiki-effekten - assosiasjonen av ordet bouba med en rund form og kiki med en piggete form - er en type samsvar mellom talelyder og visuelle egenskaper med potensielt dype implikasjoner for utviklingen av talespråk. 25 språk som representerer ni språkfamilier og 10 skrivesystemer. Totalt sett fant man bevis for effekten på tvers av språk, med bouba som fremkalte mer kongruente svar enn kiki.



Ćwiek (2021)

- **Hinton** Components of Language



Eksperimenter o.l.

- Vervet monkeys-studien:

The alarm calls of vervet monkeys (Chlorocebus pygerythrus) have been studied for many decades as a classic example of semantic communication in non-human animals. In order to communicate about a threat, vervet monkeys give acoustically distinct calls for different predators. These sounds bear an arbitrary relationship to their referent – they are not, for example, a mimicking of the predator. When other members of the group hear the alarm call, their responses are appropriate to the predator referred to. Seyfarth et al. (1980) demonstrated that there are distinct calls for leopards, eagles and snakes, which can be readily distinguished and which produce appropriate reactions in other group members.

Seyfarth et al. conducted a detailed observational study over a period of 14 months with three groups of free-ranging vervet monkeys in Amboseli National Park in Kenya. The groups contained a mean of 4 adult males and 7.6 adult females, 6.2 juveniles and 6.5 infants. The researchers collected recordings of vocalizations over an extended period of time while observing the individual monkeys verbalizing in context. This resulted in field recordings of more than 100 alarm calls. These could be categorized into acoustically distinct patterns for various predators; three of the most used calls referred to leopards, eagles and snakes. The researchers observed an appropriate adaptive response associated with the distinctive calls. The recordings of alarm calls were then played back to the monkey groups in the absence of the predator to examine whether it was the call itself or the predator's presence that elicited the adaptive response. The recordings were played back on occasions when the monkeys were on the ground and in the trees. Issues such as amplitude and call length were controlled for.

The results showed that alarm calls elicited two types of response. After a recording was played back, male and female monkeys of all age groups looked towards the sound and scanned their surroundings. They also produced a distinct set of responses, with different behaviours for different predators and depending on whether they were on the ground or in the trees. For example, when the monkeys were on the ground, the 'leopard' call caused them to run into the

trees and snake alarms caused them to look downwards. Analysis of the calls themselves showed that younger monkeys gave alarm calls for a wider variety of species including species that posed no threat. By adulthood, the monkeys produced alarm calls only for salient threats. Similarly, infants used the snake alarm call for snakes and long thin objects. By adulthood, the call was confined to snakes.

Seyfarth and colleagues' seminal study showed that vervet monkey alarm signalling demonstrated semanticity and arbitrariness, two features of symbolic communication. It also showed the development of calls over age groups, with error patterns reminiscent of the over-extension errors seen in human language development. A more recent study by Price et al. (2015) provided a detailed quantitative analysis of the acoustic structure of vervet alarm calls and confirmed that the calls are predator- and context-specific. These studies show that elements of language-like communication exist in other species. They also, however, demonstrate some key differences in the communication systems of humans and non-human animals.

- Whelan and colleagues (2014)
  Studien undersøkte forholdet mellom nevropsykologiske funksjoner og strukturelle hjerneendringer hos personer med schizofreni gjennom hjerneavbildningsteknikker og nevropsykologiske.
  Studien viste at personer med schizofreni hadde redusert volum av flere hjerneområder, inkludert prefrontal cortex, hippocampus og corpus callosum, som var assosiert med kognitive utfordringer som oppmerksomhet, arbeidsminne og problemløsning. Studien konkluderte med at det er en klar sammenheng mellom strukturelle hjerneendringer og nevropsykologiske funksjoner hos personer med schizofreni.
- Cornell et al. 1993

Sang

"Snakk"
Mel: Coldplay - "Talk"

Oh Genie, du kan, du får det ut
Men du overextender, mangler ord, har feil i din syntax
Oh Genie, hva kan du lære oss?
Er språket vårt et produkt, eller er det helt uavhengig fra
Andre prosessesseeeeeeeer

Hvordan er tanker, før du, har lært deg noen ord?
Helt forskjellig, det er, hva Sapir-Whorf tror
Og når vi snakker, gjør vi, det steg for steg?

Hocket, Hinton, Cwiek, Leborgne
Hva skjer? Når vi samtaler og ler?

(To be continued…)