

Biological Bases of Language Acquisition

1. Is there a common basis for language creation and language acquisition?

There are a lot of different theories which lead to the following general conclusions:

- Language is an intrinsic part of human nature
- Humans are able to learn language and can create language as well
- Especially children have the capacity to create language.

2. The anatomical preconditions

a) The human vocal tract:

- The special structure and functioning of the human vocal tract enables humans to produce speech.
- Although some structures serve other purposes (e.g. biting, chewing, taking air...) as well they seem to be perfectly designed for the task of producing speech.
- ⇒ These facts can be interpreted as a proof that speech is considered a useful survival advantage during evolution.

*Have we got a "language organ" (Chomsky) in the brain?
Is language one thing or many things?*

Neurolinguists study the relation of the brain to language functioning and might give answers to these questions.

b) Basic neuroanatomy or the human brain:

- cerebral cortex (outer layer of the brain) = controls higher functions
- subcortical structures = control more primitive functions
- the cortex is divided into two hemispheres, they are connected through the corpus callosum
- each hemisphere is connected to the opposite side of the body (collateral connections) and controls it, but there exist same-side or ipsilateral connections as well

3. Methods of neurolinguistic investigation

- lesion method
- study of split-brain patients
- dichotic listening tasks
- ERP's (event-related brain potentials)
- brain imaging techniques
- ⇒ Conclusion: the job of supporting language is concentrated in the left cerebral hemisphere.

4. Evidence of brain injury and aphasia

Aphasia is a condition in which language functions are severely impaired.

Paul Broca (a 19th century French physician) says that the loss of language is typically a result of brain injury to the left but not the right hemisphere.

- ⇒ there is a division between both hemispheres
- left hemisphere = specialized for language (regardless of the modality)

right hemisphere = specialized for processing visual-spatial processing

5. Evidence from split-brain patients

- Split brain patients have a severed corpus callosum (by accident or surgical procedure).
- a communication between the two hemispheres doesn't exist
- they have little difficulty in daily life
- neurolinguists can study each hemisphere alone

6. Evidence from studies of undamaged adults

- "right-ear-advantage" (Doreen Kiruma, 1967)
- ERP-results show greater left-hemisphere activity associated with language processing

EVIDENCE FROM PATIENTS WITH BRAIN INJURIES AS WELL AS FROM HEALTHY INDIVIDUALS POINTS TO THE CONCLUSION THAT LANGUAGE IS A LEFT -HEMISHERE FUNCTION !!

7. The role of the right hemisphere in normal language functioning

- The right hemisphere makes some contributions to normal language functioning. Evidence comes from language impairments associated with right-hemisphere damage such as difficulties in understanding jokes, sarcasm, interpreting figurative language and following indirect requests. (Weylman, Brownell, Gardner 1988). ERP-studies show that the right hemisphere is activated by semantic processing, whereas the left hemisphere is activated by syntax processing (Neville, Nicol, Barss, Forster & Garrett 1991).
- right hemisphere: semantic, pragmatic
- left hemisphere: syntax

8. More neurological facts about language

- The brain is more finely zoned into areas of specialization than the right and left hemisphere.
- Neurolinguists can find important evidence by studying different types of brain damages.

Broca's aphasia: - these patients have difficulties in producing speech
- their speech consists of nouns and verbs without grammatical morphemes

Wernicke's aphasia: - these patients can produce grammatically perfect speech; but their speech makes no sense
- some use words with a wrong meaning
- some use totally meaningless words
- "syntactically full but semantically empty speech" (Blumstein 1988)

Also special areas of the brain are named after those two scientists a proper characterization of the different linguistic jobs and a mapping onto areas of the brain is not clear. It is variable from person to person.

Current consensus:

Language functions are concentrated in the left hemisphere but there is no agreement on how the components of language function might be localized within the language regions of the left hemisphere.

Children and language acquisition

1. Lateralization of language to the left hemisphere

- greater left-hemisphere activity in response to speech sounds and greater right-hemisphere activity in response to nonspeech sounds
- after age 2, brain development consists primarily of losing connections→ as connections are lost, redundancy is lost; particular functions are located in special areas → connections that are used become fixed or stabilized, unused connections are eliminated.
- two proposals:
 - brain changes: maturation of those areas of the brain that serve language in the adult → child initially uses both hemisphere more because the language centers in the left hemisphere aren't ready yet
 - brain doesn't change: children change the way they process language (children acquire grammar)
- daily use of the left hemisphere for language appears to stabilize language in the left hemisphere and allows elimination of the redundant right-hemisphere capacity

2. Children recover from aphasia more quickly and more completely than adults. Why?

- aphasia almost always follows left-hemisphere injury and rarely right-hemisphere injury (children+ adults the same)
- delay of language development, but catching up and later comparable to other children of their age→ the earlier the damage, the better the recovery
- follow a different type of aphasia → more often nonfluent aphasia (Broca-type)
- neural plasticity:
 - ability of parts of the brain to take over functions they ordinarily would not serve
 - recovery of language function→ other areas of the brain must take over the functions previously carried out by the damaged portions of the left hemisphere
 - the ability of the right hemisphere to take over language functions for a damaged left hemisphere is greater in children than in adults→ better recovery from aphasia

3. The critical period hypothesis

- biologically determined period during which language acquisition must occur
- environmental input is necessary for normal development, but biology determines when the organism is responsive to that input → critical period = sensitive period = period of responsiveness
- "wild" children: life in wolves' dens, forests, or sadistic parents' backyards

i. Victor of Aveyron

ii. Isabelle: discovered in a dark room with only her deaf-mute mother for contact→ trained to speak→ was cognitively normal

iii. Genie: minimal interaction and no talk→ no language at age of 13; was exposed to language too late for the normal process of acquisition of language as a left-hemisphere function.→ acquired language with right hemisphere→ left hemisphere has lost its capacity.

- late acquisition of American Sign Language (ASL):

- o adults exposed to ASL after early childhood didn't perform as well as those who had been exposed as infants (Newport)

→ evidence from wild children and from studies of sign language acquisition suggests that young children are better at acquiring a first language than older children and adults

- advantage of children at learning language: their perceptual and memory abilities are limited→ it's easier to figure out the structure of language if you analyze small chunks than if you analyze longer stretches of speech → "less is more" hypothesis

- evidence in support for the critical period hypothesis for second language acquisition:

- o age at which learners are first exposed to a second language predicts their ultimate achievement in that language

- evidence against the critical period hypothesis for second language acquisition:

- o many studies have found age-of-arrival effects well past puberty
- o the input condition for children and adults are likely to be very different→ children have greater exposure to input in the new language

→ switching the dominant language is what causes the differences, not age per se (dominant language switch hypothesis)

4. Is the human language genetically based?

- twin study:

- o MacArthur Longitudinal Twins Study: only a small portion of the variance in children's receptive and expressive language skills was heritable
- o syntactic development in particular is the result of the unfolding of a genetic blueprint; vocabulary development is more paced by environmental factors
- o language impairment: children who are language impaired are far more likely than typically developing children to have family members who are also language impaired)

Language and other species

What constitutes a language? Crucial features are:

- 1.) reference (symbols that stand for things),
- 2.) syntax (a productive system for combining symbols to express new meanings)
- 3.) intentionality

Different communication systems of other species:

- **East African vervet monkey:** production of different distinct alarm calls
- **bees:** communicating by dancing instead of making noises
- **birds:** songs to communicate

Similarities between birds and humans:

- requirement of an adult to learn a language / a song
- early stages (according to humans: babbling, according to birds: subsongs)
- both need to be able to hear their own early productions for normal development
- for both there exists sensitive periods during which the ability to learn is at its maximum
- the production of song and speech are lateralized in the left hemisphere of the brain

The history of attempts to teach language to apes:

- The first efforts to teach human language to a chimpanzee used spoken English as the target language and took place in 1930. **Gua**, grown up in a family, was treated like a human child but didn't learn to talk.
- In the 1950 another family raised an infant chimp called **Viki**. They tried to teach her to produce words; after 6 years Viki could approximate the sounds of *mama*, *papa*, *cup* and *up*.

The efforts to get a chimpanzee to talk were complete failures.

Chimpanzees have a vocal tract that makes speech production essentially impossible.

Do chimps have the brain for language?

- Another experiment avoided the problem of speech and focused on sign language as the target language. Everybody communicating with **Washoe** only used sign language; after 4 years Washoe had learned to produce 132 signs and she has been observed to produce many sign combinations.

In 1979 a group of researchers worked on an experiment with **Nim Chimpsky** and as with Washoe, Nim's caretakers used only sign language in interactions with him. They realised that Nim's language acquisition was very different from a human child's and that Nim did not increase his mean utterance length. Children's utterances get longer because children express more content in each utterance, but Nim's longer utterances tended to say the same thing again and again, so there were lots of repetitions in his language. Another important thing is that he didn't produce his utterances by himself; so what he was saying was very dependent on his teachers' previous utterance. Nim frequently signed while his teacher signed as well and his conversational use of signing was inappropriate. The researchers analyzed tapes of Washoe and they found the same phenomenon.

Why can't chimpanzees acquire language?

- Language is the expression of a domain specific mental faculty that humans have and that apes do not.
- Chimpanzees may be limited in language by their limited production abilities. Chimpanzees cannot produce the number of discriminably different sounds that humans can.
- The final proposal is that chimps know nothing about culture – culture as socially transmitted behaviour. That means that the chimps have a lack of the social/cognitive ability to learn through interaction with others.

Glossary

intrinsic	wesentlich, intrinsisch
cerebral cortex	die Großhirnrinde
corpus callosum	der Gehirnbalken
lesion	die Verletzung, Schädigung
aphasia	die Aphasie
plasticity	die Formbarkeit
impairment	die Schädigung
spatial	räumlich

Definitions of Pidgin and Creoles

A **Pidgin**, or contact language, is the name given to any language created, usually spontaneously, out of a mixture of other languages as a means of communication between speakers of different tongues. Pidgins have rudimentary grammars and restricted vocabulary, serving as auxiliary contact languages. They are improvised rather than learned natively. Pidgins can develop to become creole languages. This requires the pidgin to be learned natively by children, who then generalize the features of the pidgin into a fully-formed, stabilized grammar (see Nicaraguan Sign Language). At this stage the language is no longer a pidgin, as it has acquired the full complexity of a human language, and becomes a creole. Often creoles can then replace the existing mix of languages to become the native language of the current community (such as Krio in Sierra Leone and Tok Pisin in Papua New Guinea). However, pidgins do not always become creoles—they can die out or become obsolete. Caribbean pidgin is the result of colonialism. As tropical islands were colonised their society was restructured, with a ruling minority of some European nation and a large mass of non-European laborers. The laborers, both natives and slaves, would often come from many different language groups and would need to communicate. This led to the development of pidgins.

A **creole** is a language descended from a pidgin that has become the native language of a group of people. The majority of creole languages are based on English and other Indo-European languages (their *superstrate* language), with local or immigrant languages as *substrate* languages. Study of Creole languages around the world (in particular by Derek Bickerton) has suggested that they display remarkable similarities in grammar, lending support to the theory of a Universal Grammar; critics, however, argue that his examples are largely drawn from creoles derived from European languages, and that non-European-based creoles such as Nubi or Sango display fewer similarities.

Literature:

Hoff, E. 2002. *Language Development*. (2nd edition) Australia etc.: Wadsworth. p. 36-91.