

Klaus Tichacek  
Mat. Nr.:  
Applied NLP  
Universität Osnabrück  
Wintersemester 2002 / 2003

## **The “Critical Period Hypothesis” and Pidgin and Creole languages**

### **0. Introduction**

In this paper I outline the course and content of our referat on the critical period hypothesis. Then I am going to relate the critical period hypothesis to the existence of pidgin and Creole languages. I think that pidgin and creoles provide direct evidence for the critical period hypothesis and that they can be explained on the basis of the critical period hypothesis. The critical period hypothesis seems to be the reason for the striking differences of pidgins and creoles. The fact that creoles are developed by children who are obviously still in their critical period is a clear evidence for the hypothesis. But let's start by presenting the critical period hypothesis.

### **1. The critical period hypothesis**

The critical period hypothesis states that there exists a certain time window during which language learning must occur. The idea of a critical period is fairly old and well known. For example there is a critical period in learning to really master some music instrument, especially the violin and the piano. If one starts too late the complex and fast movements of the fingers will not be learned as good as by early starters. Already at the time of Mozart music education started in early childhood because this critical period was known. Another commonly known fact is that the general cognitive abilities decay with age. Old people find many memory tasks more difficult than young people. This is also reflected in current IQ-Test where the peak of the scale is approximately between 20 and 35. In this time period you have to score higher than all other age groups to get the same IQ-value. The common knowledge of effects like these makes the assumption the there is also a critical period for language acquisition obvious. Since ages there has been an enormous interest in this question. It is said that already the ancient Egyptian king Psammetichus conducted the ultimate language-learning experiment. He placed two infants in an isolated cabin and allowed nobody to speak to them. Two years later the children spoke Phyrigian, so the story goes. Plausibility of this tale may be doubted but it clearly shows the general interest in the question about a critical period for language-acquisition. There are also numerous reports of people who grow up under inhumane conditions and did not develop language, a famous German example is “Kaspar Hauser” who clearly astonished the scientist at his time.

This enormous interest in the question about a critical period for language-acquisition has led to an extensive research in this area of linguistics and it is still a hotly debated question in the area of cognitive sciences.

While the general notion that there exist this critical period for language-acquisition is now an accepted fact it is still unclear what exactly causes it. That there are some internal changes in us seems to be obvious but exactly what happens remains unknown. It is mostly assumed that there are some maturational constraints on the development of the brain that cause the critical period. Future research and fMRI studies might further justify this assumption.

In our report we gave a rather classical report on the critical period hypothesis and the found evidence for it.

As indirect evidence we presented the classical studies by E. Lenneberg (1967) on aphasia. Lenneberg provided a first argument for the existence of a critical period in language acquisition.

As a second evidence and critical test for the hypothesis we presented some rare cases of deprived children who were “real” late learners. One of the most famous cases of this kind is Genie, a “modern day wild child” which we discussed in more detail.

As a third and final evidence we presented controlled studies on ASL signers and second language learners by E. Newport.

These evidences are now shortly recaptured

## **1.1 Age and recovery from traumatic aphasia**

In his book “Biological foundations of language” E. Lenneberg (1969) introduces the notion of a critical period for language acquisition in humans. The book summarizes and investigates several findings from clinical investigations on brain injuries and recovery patterns.

Another aspect Lenneberg considers is the age of lateralization of speech function and the confinement of certain brain functions from one hemisphere to the other after hemispherectomy (the complete removal of an entire hemisphere).

A very general and important discovery of Lenneberg is that the recovery patterns from aphasia are very different in adults and in children. On the one hand adults have a time window of three to five months during which they may recover from aphasia but after this period all remaining symptoms are irreversible. And adults show no sign of relearning their language.

On the other hand children between the ages of four to ten recover fully from aphasia and show no time window during which recovery must take place. Infants even start to relearn their language totally from the beginning. But with increasing age the recovery pattern of children quickly becomes the same as for adults. After the middle teens children may also have irreversible symptoms.

But recovery patterns from aphasia are not the only evidence Lenneberg presents. Based on data by Basser (1962) Lenneberg makes the claim that both hemispheres of the human brain are epipotential during a period in infancy. At the beginning of language development both hemispheres are involved in language learning. Only after a certain while this involvement decreases and the left hemisphere becomes the major bearer of language functions. But during this epipotential period the right hemisphere is also able to take on speech and language functions as the data of children of various ages with lesions or hemispherectomy of one hemisphere shows.

The raw data Lenneberg used to draw his conclusions was rather incomplete and several terms were used inconsistently and differently by his various sources. But the book remains nevertheless convincing. But it may only contribute indirect evidence for the critical period hypothesis. The main thing which the studies presented in this book can show is that there is a critical period for the contralateral hemisphere to take over the functions of the damaged hemisphere.

## 1.2 “Wild children” – evidence from rare cases

The best evidence for the existence of a critical period would be of course an experiment like the Egyptian king Psammetichus conducted. But luckily this is not possible due to moral conventions of the society. Unfortunately there are sometimes cases where children were deprived from linguistic input for various reasons. These cases are then particularly interesting for linguistic research. We presented three cases of such cases, Isabelle, Genie and Chelsea.

Isabelle was raised by a speechless mother and had not learned any language when she was found at the age of six. Within only one year Isabelle learned to speak at the level of her 7 year old peers. As Isabelle was still within the time window of the critical period her quick language acquisition is exactly what was expected by the hypothesis.

The second child, Genie, was found at the age of 13. Genie was kept by her parents in the attic and beaten constantly. She grew up totally isolated in her room and was never spoken to. When she was found there were great attempts to teach her language. Genie made great progress but never managed to acquire normal language abilities. Her development suggests that there are some aspects of language which can be learned after the critical period but also some which must be learned during the critical period. One of the things Genie mastered was the basic word order. This seems to be a feature which still can be learned after the critical period. But Genie performed only very poorly on proforms, movement rules, passive constructions, noun verb agreements, auxiliary structures and reflexives. She also never used functional category words.

The study of Genie's development is also particularly interesting as one can compare her use of language with the grammatical structure of so-called pidgin languages. The most astonishing finding is that pidgin languages typically lack the same structures as Genie does. I will discuss this topic later in more detail.

Besides from the fact that Genie did not develop normal language abilities she was also abnormally slow at language learning. This might suggest that she could be retarded or have some serious damages from her childhood. But this was not the case, on the contrary in tests which rely entirely on the right hemisphere Genie scored higher than normally intelligent persons. This suggests that Genie most of the time uses her right hemisphere to solve cognitive tasks and also for language processing. S. Curtiss who did most of the studies with Genie concluded that “the cortical tissue normally committed to language and related abilities may functionally atrophy” if language is not acquired at the appropriate time.

This idea is also in accordance with the findings of Lenneberg. He had records of patients who confined language to the right hemisphere after hemispherectomy. Their performance was comparable to Genie's. This strongly suggests that Genie's left hemisphere lost its functional abilities as it was never triggered to perform these functions during the critical period.

But this also changes the view on the critical period. Now we should see the critical period not as a period for language acquisition but as a period for functional development of the left hemisphere. The left hemisphere seems to be more specialized for language learning and

some other tasks while the right hemisphere seems to be more flexible in taking on various tasks but performs them not as good as the left hemisphere.

The third and last case we discussed was a woman, Chelsea, at the age of 31. Chelsea was deaf but mistakenly diagnosed by doctors as retarded. When her deafness was recognized at the age of 31 she had not learned any language. She acquired a sizeable vocabulary and produced multiword utterances but her sentences do not even have the rudimentary grammatical structure of Genie's. As Chelsea was already way beyond the critical period this was exactly what the hypothesis would predict.

These three cases of late language learners give strong evidence for the existence of a critical period hypothesis and also provide some insight in the internal mechanisms of language acquisition.

### **1.3 Controlled studies**

In the last part of our referat we presented some controlled studies on language acquisition conducted by E. Newport.

The first series of studies was performed on deaf children who provide a unique opportunity to study the differences in language acquisition at different ages. Only a small part of all deaf children are born to deaf parents and exposed to ASL, a natural language, from birth. There is a wide variation for the age of ASL acquisition in the deaf community. These experiments can therefore provide direct evidence for the critical period as they are done under controlled conditions with a rather homogenous group of subjects.

Newport formed three major groups of subjects in her experiments. She distinguished native learners who were exposed to ASL from birth, early learners (first exposure around age 4 – 6) and late learners (first exposure after the age of 12).

The data of the experiments shows that the late learners performed significantly worse than the early learners. Moreover it was shown again that some properties of language like basic word order are not affected by the age of the first exposure while others are.

This is exactly what was also found in Genie's language abilities. The late learners did not master the same structures as Genie. Later I will discuss this topic further as this can also be observed in the creation of Pidgin languages.

Some tasks on morphology give strong evidence for a steeply declining performance of the late language learners. Also the typical types of errors performed by the groups of learners were very different. The late learners showed a highly variable use of ASL including inconsistencies in individual responses. Again this is some feature which also is present in the Pidgin languages.

Newport's second experiment focused on second language learning. The phenomenon of a declining performance with increasing age was also found in second language learning. The subjects were native Chinese or Korean speakers who learned English as a second language. Again groups in dependence of the age were formed as age is the interesting variable here. The results show that in general subjects who started learning English earlier performed better than those who started later.

But this does not mean that older people generally can't learn a second language. There were also some good late learners among the subjects but their performance is possible due to their general great cognitive performance. The group of early learners performed more homogeneously and they also showed a strong correlation between age of acquisition start and performance.

An inspection of the performed error patterns in the older subjects showed again the same findings as the ASL study and the research on Genie. The older learner's mastered word order

and the use of the morpheme -ing but virtually all other aspects of English morphology and syntax showed a rather inconsistent and highly variable use. Also a striking feature of the language of the late learners was that they used “frozen” structures which they seemed to have learned as whole and did not analyze their internal structure.

The young learners on the other hand showed mainly componential errors and selective omission of some morphemes.

This interesting phenomenon led Newport to the “Less is more hypothesis”. This hypothesis assumes that the reason for the differences between adult and child language learners is the way in which children perceive and store the linguistic input.

The general idea behind this hypothesis is that componential analysis is required in language learning and that children are better in this because cognitive abilities of adults are too good. Children seem to be a privileged language learner as they are the less informed learner. Their smaller “width” of short term memory might be the reason why the task of mapping meaning to single morphemes is easier for children as they perceive only smaller parts of the complex input.

Adult learners are able to store larger chunks of the complex input and therefore have to do the mapping on the whole complex expression which is a computationally very demanding task.

The presented experiments strongly imply that language learning depends upon the age of the learner. There seems to be a biologically defined critical period hypothesis.

I will now consider the creation of pidgin and Creole languages which seem to provide another direct evidence for the critical period hypothesis.

## **2.0 Comparison of the CPH and Pidgin and Creole languages**

In the following I’m going to relate our referat and the critical period hypothesis to the first referat on pidgins and creoles.

The referat on pidgin and Creole languages introduced the general idea of pidgins and creoles, outlined their specific features, presented a paper by D. Bickerton and showed a study done in this area as well as the “Language Bioprogram Hypothesis” by Mufwene.

The study was again performed by E. Newport. Together with C. Hudson the phenomenon of regularization in Creole languages was examined. The main question behind this study was to find out whether adults are responsible for this process and able to learn rules. To investigate this issue adult subjects were exposed to an pidgin like language and later tested on their comprehension and production ability of this language. The actual finding of this study was that adults are able to learn rules when they are exposed to variable input but they do not generate rules. The only rules adults would develop are rules which would further reduce the complexity of the language.

The “Language Bioprogram Hypothesis” by Mufwene was only outlined shortly as the time during the talk was already over. The group mainly presented criticism against this hypothesis.

In the following I will concentrate on the general features of pidgin languages outlined by the group. These general features allow a very good explanation for the existence of pidgin and Creole languages on the basis of the critical period hypothesis and with such an explanation the pidgin and Creole languages can be seen as further evidence for the critical period hypothesis.

## **2.1 Pidgin languages**

A pidgin language is a language which is based on another language or to be precise on several other languages. A pidgin language develops among people and becomes a means of communication among people who speak different native languages. But in contrast to normal natural languages a pidgin language shows only a very poor grammar and a sharply curtailed vocabulary.

The mayor ingredients of a pidgin language come from the native languages of the pidgin speakers. The language with the strongest influence on the pidgin is called the superstrate language and all other contributing languages are called the substrate languages.

The vocabulary is mainly drawn from the superstrate language whereas the grammar is a compound product of all involved languages.

Slavery and colonization were a major force for the formation of pidgin languages. For example the slaves brought to America did not necessarily speak the same language but had to communicate with each other. To accomplish this they invented a pidgin language with English as superstrate language.

What is typical for pidgin languages is that their use is highly variable and due to the small vocabulary many concepts are expressed in whole sentences.

By its definition a pidgin language is native to none of its speakers.

## **2.2 Creole languages**

When a pidgin is used in a community and the next generation learns this pidgin as a native language a process called creolization begins. This is done by the children who receive the pidgin language as their only input and basis for language acquisition. Here a remarkable thing happens, the children do not learn this easy and poor language but they tremendously extend it and transform it into a real natural language with full complexity and a uniform use among its speakers. This newly developed language has a complex grammar and an extended vocabulary. When this Creole adopts more and more features of the superstrate language it becomes a variety of the standard of this superstrate language, this process is called decreolization. If the Creole language develops to completely new language this process is called hypercreolization.

Linguists have noted similarities in grammatical structure among all Creole languages around the world. This is remarkable as most of these languages developed totally independent of each other with little or no contact at all.

This feature of Creole languages suggests that there are biological reasons for this similarity among these languages. Maybe the same biological reasons which account for the critical period hypothesis? I will discuss this idea in the later part of this paper.

## **3.0 The critical period hypothesis and Pidgin and Creole languages**

The form and structure of pidgin languages are very simple. Upon further analysis one can discover that their grammar und usage resembles very much the language used by Genie or Chelsea and that the errors performed by late language learners also seem to be a present feature of pidgin languages.

Pidgin languages are generally learned by adults therefore. It is no big surprise that the adults who “invent” the pidgin invent it by incorporating the errors that late first and second language learners usually make. Also a striking feature of the pidgin languages is that they

show a highly variable use of grammar, exactly what has been found in the error patterns of late learners in the studies by Newport (1990) presented by us.

This suggests that the poor grammatical structure of Pidgin languages is mainly due to the fact that the “learners” of the pidgin are adults who are beyond their critical period for language acquisition. In this sense a pidgin has a very high similarity to a learned second language spoken by some poorly performing adult. If you encounter a German in France who learned French very poorly and late in life the structure of his sentences should resemble a Pidgin with French as superstrate and German as substrate language, as much French vocabulary as possible but used with a rather German grammar. At least this is what I would assume.

But when children learn the pidgin language as their native language they start to change it. On the basis of the critical period hypothesis this occurs because the children are still able to fully grasp the complexity of a natural language. They start the process of creolization and learn a complex Creole language with an uniform grammar across its speakers.

This is also what was found out by Newport (1990), early learners showed a highly consistent use of their grammar and rather made componential and omission errors. This similarity suggests that children are solely responsible for this regularization process of the pidgin grammar. This idea is also further supported by the findings of Newport and Hudson mentioned above.

But the “Less is more Hypothesis”, an explanation for the CPH also presented by Newport, does not account for the fact that the children extend the grammar of the pidgin language so much. It seems that there is more about the critical period hypothesis than just a plain computational advantage for the uninformed learner about the critical period hypothesis. Somehow it seems that the internal constraints on language acquisition have a certain preference for a grammar with the complexity of natural language grammars. This might be due to some internal “bio program” as proposed by Mufwene but I prefer the classic idea of a universal grammar proposed by Chomsky. I cannot explain how children come to invent such complex grammatical features on their own without having any input as basis. But nevertheless the finding that all Creole languages around the world have similarities in their grammatical structure strongly suggests that an internal mechanism, program or constraint is present which drives our language development. And this internal structure is only active during the critical period as Creole languages are only developed by them. Adults can only produce the simple Pidgins.

And this has nothing to do with learning a first or a second language. Chelsea and Genie learned English as their first language and nevertheless showed the structural deficits also found for Pidgin languages.

Also the experiments on second language learners conducted by Newport (1990) show that they late learners performed the same error patterns although they had different native languages. The experiment was actually only done on subjects with either Chinese or Korean as native language but as the same error patterns were also found for late ASL learners I think that the generalization to all second language learners with different native languages can be made.

This contradicts the so called “Fundamental difference hypothesis” which suggests that second language learning is based on the native language. To some extent this might be true, especially if the first and the second language are very similar. But the finding that people from different language backgrounds perform the same errors in second language learning strongly suggests that these errors are due to something internal to all humans that does not correlate strongly with the native language of the speaker. Chelsea and Genie are also evidence for this as they performed the same errors and showed the same deficits without having a native language before their acquisition of English.

I think that these findings pretty much explain the structure of Pidgin languages. Also the process of creolization is well explained by this, the children are simply still in their critical period and therefore able to capture the complex structures. As Isabelle showed this can happen very quickly without any effort on the side of the children what suggest that this is a natural process.

#### **4.0 Conclusion**

As I have outlined above the critical period hypothesis is at least partially able to explain the existence and structure of Pidgin and Creole languages. These two phenomenons, the invention of Pidgins and their evolution to Creoles, are exactly what one would expect if the critical period hypothesis is correct.

Therefore these two topics of language acquisition are very strongly related and should always be considered together if features them are examined. It cannot be by pure accident that adults are worse at language learning and that Pidgins are produced or “invented” by adults. And it is also not an accident that children who learn a language that easily start the process of creolization.

I think that the connection of these two topics is obvious and should be examined in the future. A hypothesis for language acquisition which includes these two approaches is likely to be more biologically plausible than the presented “Less is more hypothesis” or any other of the mentioned hypothesises.

I therefore conclude that the critical period seems to be a feature of humans which ultimately leads to Pidgin creation and Creole creation. By this mechanism nature manages to produce an elaborate language system with complex grammatical features which might need to evolve over some generations but is finally a much regularized system with clear cut rules. I think that this can be followed from the evidence for the critical period hypothesis and from the facts about Pidgin and Creole languages.