Critical Period Hypothesis

The Critical Period Hypothesis refers to a long-standing debate in linguistics and language acquisition over the extent to which the ability to acquire language is biologically linked to age. The hypothesis claims that there is an ideal *'window'* of time to acquire language in a linguistically rich environment, after which this is no longer possible.

The Critical Period Hypothesis states that the first few years of life is the crucial time in which an individual can acquire a first language if presented with adequate stimuli. If language input doesn't occur until after this time, the individual will never achieve a full command of language — especially grammatical systems.

The evidence for such a period is limited, and support stems largely from theoretical arguments and analogies to other critical periods in biology such as visual development, but nonetheless is widely accepted. The nature of this phenomenon, however, has been one of the most fiercely debated issues in psycholinguistics and cognitive science in general for decades. Some writers have suggested a "sensitive" or "optimal" period rather than a critical one; others dispute the causes (physical maturation, cognitive factors). The duration of the period also varies greatly in different accounts. Steven Pinker, in his book The Language Instinct, states that "acquisition of a normal language is guaranteed for children up to the age of six, is steadily compromised from then until shortly after puberty, and is rare thereafter" (Pinker 1994, p. 293).

In second language acquisition, the strongest evidence for the critical period hypothesis is in the study of accent, where most older learners do not reach a native-like level. However, under certain conditions, native-like accent has been observed, suggesting that accent is affected by multiple factors, such as identity and motivation, rather than a critical period biological constraint (Moyer, 1999; Bongaerts et al., 1995; Young-Scholten, 2002).

History

The Critical Period Hypothesis was first proposed by Montreal neurologist Wilder Penfield and co-author Lamar Roberts in a 1959 paper Speech and Brain Mechanisms, and was popularised by Eric Lenneberg in 1967 with Biological Foundations of Language. Lenneberg proposed brain lateralisation at puberty as the mechanism that closes down the brain's ability to acquire language, though this has since been widely disputed. Other notable proponents of the Critical Period Hypothesis include Noam Chomsky.

Linguist Eric Lenneberg (1964) stated that the crucial period of language acquisition ends around the age of 4-5 years. He claimed that if no language is learned before then, it could never be learned in a normal and fully functional sense. This was called the "Critical period Hypothesis."

An interesting example of this is the case of Genie, also known as "The Wild Child". A thirteen-year-old victim of lifelong child abuse, Genie was discovered in her home on November 4th, 1970, strapped to a potty chair and wearing diapers. She appeared to be entirely without language. Her father had judged her retarded at birth and had chosen to isolate her, and so she had remained until her discovery.

It was an ideal (albeit horrifying) opportunity to test the theory that a nurturing environment could somehow make up for a total lack of language past the age of 12. She was unable to acquire language completely, although the degree to which she acquired language is disputed.

Detractors of the "Critical Period Hypothesis" point out that in this example and others like it, the child is hardly growing up in a nurturing environment, and that the lack of language acquisition in later life may be due to the results of a generally abusive environment rather than being specifically due to a lack of exposure to language.

A more up-to-date view of the Critical Period Hypothesis is represented by the University of Maryland, College Park instructor Robert DeKeyser. DeKeyser argues that although it is true that there is a critical period, this does not mean that adults cannot learn a second language perfectly, at least on the syntactic level. DeKeyser talks about the role of language aptitude as opposed to the critical period.

Second language acquisition

The theory has often been extended to a critical period for second language acquisition, although this is much less widely accepted. Certainly, older learners of a second language rarely achieve the native-like fluency that younger learners display, despite often progressing faster than children in the initial stages. David Singleton (1995) states that in learning a second language, "younger = better in the long run," but points out that there are many exceptions, noting that five percent of adult bilinguals master a second language even though they begin learning it when they are well into adulthood — long after any critical period has presumably come to a close.

While the window for learning a second language never completely closes, certain linguistic aspects appear to be more affected by the age of the learner than others. For example, adult second-language learners nearly always retain an immediately-identifiable foreign accent, including some who display perfect grammar (Oyama 1976). Some writers have suggested a younger critical age for learning phonology than for syntax. Singleton (1995) reports that there is no critical period for learning vocabulary in a second language. Robertson (2002) observed that factors other than age may be even more significant in successful second language learning, such as personal motivation, anxiety, input and output skills, settings and time commitment.

On reviewing the published material, Bialystok and Hakuta (1994) conclude that second-language learning is not necessarily subject to biological critical periods, but "on average, there is a continuous decline in ability [to learn] with age."

The critical period research to date

How children acquire native language (L1) and the relevance of this to foreign language (L2) learning has long been debated. Although evidence for L2 learning ability declining with age is controversial, a common notion is that children learn L2s easily, whilst older learners rarely achieve fluency. This assumption stems from 'critical period' (CP) ideas. A CP was popularised by Eric Lenneberg in 1967 for L1 acquisition, but considerable interest now surrounds age effects on second language acquisition (SLA). SLA theories explain learning processes and suggest causal factors for a possible CP for SLA, mainly attempting to explain apparent differences in language aptitudes of children and adults by distinct learning routes, and clarifying them through psychological mechanisms. Research explores these ideas and hypotheses, but results are varied: some demonstrate pre-pubescent children acquire language easily, and some that older learners have the advantage, whilst others focus on existence of a CP for SLA. Recent studies (e.g. Mayberry and Lock, 2003) have recognised certain aspects of SLA may be affected by age, whilst others remain intact. The objective of this study is to investigate whether capacity for vocabulary acquisition decreases with age.

A review of SLA theories and their explanations for age-related differences is necessary before considering empirical studies. The most reductionist theories are those of Penfield and Roberts (1959) and Lenneberg (1967), which stem from L1 and brain damage studies; children who suffer impairment before puberty typically recover and (re-)develop normal language, whereas adults rarely recover fully, and often do not regain verbal abilities beyond the point reached five months after impairment. Both theories agree that children have a neurological advantage in learning languages, and that puberty correlates with a turning point in ability. They assert that language acquisition occurs primarily, possibly exclusively, during childhood as the brain loses plasticity after a certain age. It then becomes rigid and fixed, and loses the ability for adaptation and reorganisation, rendering language (re-)learning difficult. Penfield and Roberts (1959) claim children under nine can learn up to three languages: early exposure to different languages activates a reflex in the brain allowing them to switch between languages without confusion or translation

into L1 (Penfield, 1964). Lenneberg (1967) asserts that if no language is learned by puberty, it cannot be learned in a normal, functional sense. He also supports Penfield and Roberts' (1959) proposal of neurological mechanisms responsible for maturational change in language learning abilities. This, Lenneberg maintains, coincides with brain lateralisation and left-hemispherical specialisation for language around age thirteen: infants' motor and linguistic skills develop simultaneously, but by age thirteen the cerebral hemispheres' functions separate and become set, making language acquisition extremely difficult (Lenneberg, 1967).

Cases of deaf and feral children provide evidence for a biologically determined CP for L1. Feral children are those not exposed to language in infancy/childhood due to being brought up in the wild, in isolation and/or confinement. A classic example is 'Genie', who was deprived of social interaction from birth until discovered aged thirteen (post-pubescent). She was completely without language, and after seven years of rehabilitation still lacked linguistic competence. Another case is 'Isabelle', who was incarcerated with her deaf-mute mother until the age of six and a half (pre-pubescent). She also had no language skills, but, unlike Genie, quickly acquired normal language abilities through systematic specialist training.

Such studies are however problematic; isolation can result in general retardation and emotional disturbances, which may confound conclusions drawn about language abilities. Studies of deaf children learning American Sign Language (ASL) have fewer methodological weaknesses. Newport and Supalla (1987) studied ASL acquisition in deaf children differing in age of exposure; few were exposed to ASL from birth, most of them first learned it at school.

Results showed a linear decline in performance with increasing age of exposure; those exposed to ASL from birth performed best, and 'late learners' worst, on all production and comprehension tests. Their study thus provides direct evidence for language learning ability decreasing with age, but it does not add to Lennerberg's CP hypothesis as even the oldest children, the 'late learners', were exposed to ASL by age four, and had therefore not reached puberty, the proposed end of the CP. In addition, the declines were shown to be linear, with no sudden 'drop off' of ability at a certain

age, as would be predicted by a strong CP hypothesis. That the children performed significantly worse, however, suggests the CP may end earlier than originally postulated.

Other work has challenged the biological approach; Krashen (1975) reanalysed clinical data used as evidence and concluded cerebral specialisation occurs much earlier than Lenneberg calculated. Therefore, if a CP exists, it does not coincide with lateralisation. Despite concerns with Lenneberg's original evidence and the dissociation of lateralisation from the language CP idea, however, the concept of a CP remains a viable hypothesis, which later work has better explained and substantiated.

Contrary to biological views, behavioural approaches assert that languages are learned as any other behaviour, through conditioning. Skinner (1957) details how operant conditioning forms connections with the environment through interaction and, alongside Mowrer (1960), applies the ideas to language acquisition. Mowrer hypothesises that languages are acquired through rewarded imitation of 'language models'; the model must have an emotional link to the learner (e.g. parent, spouse), as imitation then brings pleasant feelings which function as positive reinforcement. Because new connections between behaviour and the environment are formed and reformed throughout life, it is possible to gain new skills, including language(s), at any age.

To accommodate observed language learning differences between children and adults, Felix (1985) describes that children, whose brains create countless new connections daily, may handle the language learning process more effectively than do adults. This assumption, however, remains untested and is not a reliable explanation for children's aptitude for L2 learning. Problematic of the behaviourist approach is its assumption that all learning, verbal and non-verbal, occurs through the same processes. A more general problem is that, as Pinker (1995) notes, almost every sentence anybody voices is an original combination of words, never previously uttered, therefore a language cannot consist only of word combinations learned through repetition and conditioning; the brain must contain innate means of creating endless amounts of grammatical sentences from a limited vocabulary. This is

precisely what Chomsky (1965) argues with his proposition of a Universal Grammar (UG).

Chomsky (1965) asserts that environmental factors must be relatively unimportant for language emergence, as so many different factors surround children acquiring L1. Instead, Chomsky claims language learners possess innate principles building a 'language acquisition device' (LAD) in the brain. These principles denote restricted possibilities for variation within the language, and enable learners to construct a grammar out of 'raw input' collected from the environment. Input alone cannot explain language acquisition because it is degenerated by characteristic features such as stutters, and lacks corrections from which learners discover incorrect variations.

Singleton and Newport (2004) demonstrate the function of UG in their study of 'Simon'. Simon learned ASL as his L1 from parents who had learned it as an L2 after puberty and provided him with imperfect models. Results showed Simon learned normal and logical rules and was able to construct an organised linguistic system, despite being exposed to inconsistent input. Chomsky developed UG to explain L1 acquisition data, but maintains it also applies to L2 learners who achieve near-native fluency not attributable solely to input and interaction (Chomsky, 1965).

Although it does not describe an optimal age for SLA, the theory implies that younger children can learn languages more easily than older learners, as adults must reactivate principles developed during L1 learning and forge an SLA path: children can learn several languages simultaneously as long as the principles are still active and they are exposed to sufficient language samples (Pinker, 1995). The parents of Singleton and Newport's (2004) patient also had linguistic abilities in line with these age-related predictions; they learned ASL after puberty and never reached complete fluency.

There are, however, problems with the extrapolation of the UG theory to SLA: L2 learners go through several phases of types of utterance that are not similar to their L1 or the L2 they hear. Other factors include the cognitive maturity of most L2 learners, that they have different motivation for learning the language, and already

speak one language fluently. Other studies also highlight these problems: Deheane (1999) investigates how cerebral circuits used to handling one language adapt for the efficient storage of two or more. He reports observations of cerebral activation when reading and translating two languages. They found the most activated brain areas during the tasks were not those generally associated with language, but rather those related to mapping orthography to phonology. They conclude that the left temporal lobe is the physical base of L1, but the L2 is 'stored' elsewhere, thus explaining cases of bilingual aphasia where one language remains intact. They maintain that only languages learned simultaneously from birth are represented, and cause activity, in the left hemisphere: any L2 learned later is stored separately (possibly in the right hemisphere), and rarely activates the left temporal lobe.

This suggests that L2 may be qualitatively different from L1 due to its dissociation from the 'normal' language brain regions, thus the extrapolation of L1 studies and theories to SLA is placed in question. A further disadvantage of UG is that supporting empirical data are taken from a limited sample of syntactic phenomena: a general theory of language acquisition should cover a larger range of phenomena. Despite these problems, several other theorists have based their own models of language learning on it; amongst others Felix' (1985) 'competing cognitive systems' idea. These ideas are supported by empirical evidence, which consequently supports Chomsky's ideas. Due to this support and its descriptive and explanatory strength, many theorists regard UG as the best explanation of language, and particularly grammar, acquisition.

Piaget (1926) is one psychologist reluctant to ascribe specific innate linguistic abilities to children: he considers the brain a homogeneous computational system, with language acquisition being one part of general learning. He agrees this development may be innate, but claims there is no specific language acquisition module in the brain. Instead, he suggests external influences and social interaction trigger language acquisition: information collected from these sources constructs symbolic and functional schemata (thought or behaviour patterns). According to Piaget, cognitive development and language acquisition are life-long active processes that constantly update and re-organise schemata. He proposes children develop L1 as they build a

sense of identity in reference to the environment, and describes phases of general cognitive development, with processes and patterns changing systematically with age. Piaget assumes language acquisition is part of this complex cognitive development, and that these developmental phases are the basis for an optimal period for language acquisition in childhood. Interactionist approaches derived from Piaget's ideas supports his theory. Some studies (e.g. Newport and Supalla, 1987) show that, rather than abrupt changes in SLA ability after puberty, language ability declines with age, coinciding with declines in other cognitive abilities, thus supporting Piaget.

Several researchers, however, remain unconvinced that language acquisition is part of general development: Felix (1985) claims cognitive abilities alone are useless for language learning, as only vocabulary and meaning are connected to cognition; lexicology and related meanings have conceptual bases. Felix' criticism of the assumption that L2 fluency simply requires skilful applications of the correct rules is supported by the lack of psychological empirical evidence for Piaget's idea.

Although Krashen (1975) also criticises this theory, neither discredit the importance of age for second language acquisition. Krashen (1975), and later Felix (1985), proposed theories for the close of the CP for L2 at puberty, based on Piaget's cognitive stage of formal operations beginning at puberty, as the 'ability of the formal operational thinker to construct abstract hypotheses to explain phenomena' inhibits the individual's natural ability for language learning.

The term "language acquisition" became commonly used after Stephen Krashen contrasted it with formal and non-constructive "learning." Today, most scholars use "language learning" and "language acquisition" interchangeably, unless they are directly addressing Krashen's work. However, "second language acquisition" or "SLA" has become established as the preferred term for this academic discipline.

Though SLA is often viewed as part of applied linguistics, it is typically concerned with the language system and learning processes themselves, whereas applied linguistics may focus more on the experiences of the learner, particularly in the

classroom. Additionally, SLA has mostly examined naturalistic acquisition, where learners acquire a language with little formal training or teaching.

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