The Critical Period Hypothesis for Language Acquisition and Its Implications for the Management of Communication Disorders

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The notion that a critical period for language acquisition exists is pervasive in the literature. It has been presented by some researchers as the primary factor responsible for persistent and irreversible language disorders within specific populations. However, sufficient evidence in support of this hypothesis is lacking within first and second language acquisition research. Implications for the practice of speech-language pathology and audiology are presented, as well as directions for further research regarding the nature of language acquired after the critical period.

A principal task for the field of speech-language pathology is to identify variables that influence the effectiveness of intervention efforts. One variable that might influence treatment outcome is the age of the person receiving treatment. The presence of developed cognitive and processing skills might facilitate rapid treatment gains in older children and adults. On the other hand, the existence of a neurologically determined critical period for language acquisition might inhibit or prevent optimal results in older clients.

The presence of a critical period for language acquisition has implications beyond prognosis for the field of speech-language pathology. It adds urgency to the prioritizing of speech and language intervention because of the possibly permanent consequences of delaying treatment. With regard to abnormal development, the critical period figures into causative theories of language impairment. Lesneau (1967) suggested that the critical period was responsible for the failure of children with Down syndrome to make significant linguistic progress after puberty. Moore and Sheik (1971) argued that autism was the result of a defective critical period that resolved itself too quickly. Studies concerned with the effects of otitis media during childhood have presented the existence of a critical period as reason to expect lasting detrimental consequences (Clark, 1980; Downs, 1977; Feldman & Gelman, 1986; Howie, 1977; Zinkus & Gottlieb, 1980). Likewise, the reported failure of people who are deaf to perform at the same linguistic and academic level as their peers who hear has been attributed by many to the critical period for language acquisition.

In terms of productive deprivation, there also is growing concern over the effects of tracheostomy during the early years of life on later speech and language development (Hill & Singer, 1990; Kalson & Stein, 1958; Locke & Pearson, 1990). Finally, the critical period represents a model for explaining the interactions of environmental input and biological constraints in a normal child’s acquisition of language.

But what if the critical period for language acquisition does not exist? The hypothesis is considered by many involved in second language research to be lacking empirical support (Ellis, 1985; Hakuta; 1986; Holmstrand, 1982; McLaughlin, 1987; Snow, 1983; Snow, 1987). Snow (1983) goes so far as to refer to the idea as folk-psychology that persists despite a wealth of counterevidence. Because it generally believed to be a better practice to err on the conservative side when grave things are at stake, one could argu that nothing is lost if we act as if the critical period does exist when in fact it does not. However, there are professional consequences to committing to this “Pascal’s wager.”

Clinically, counterproductive professional expectations may be raised. Some researchers have raised a parallel concern over the once widely held belief in a critical period for human social attachment and the self-fulfilling effects this belief might have had on children raised in institutions (Clarke & Clarke, 1977; Hoffman, 1987). A similar risk exists if a groundless belief in the critical period for language acquisition is used to expect and highlight failure in older clients receiving speech and language intervention.

The critical period hypothesis for language acquisition represents a significant theoretical risk. The hypothesis invites predictions and interpretations about the nature of language and development that would not be supported if endorsements for the hypothesis were absent.

The status of the critical period hypothesis has direct implications for the study and management of communication disorders. The purpose of this article is to evaluate the evidence supporting the notion of a critical period for lan-
guage acquisition. Six topics are discussed: (a) the general notion of critical periods in human development, (b) the discussion of sensitive, optimal, and vulnerable periods within the literature, (c) strong and weak versions of the hypothesis and their predictions, (d) the evidence for the critical period within first and second language acquisition, (e) the issue of irreversibility, and (f) the evidence against the critical period. Implications for the speech-language pathologist are discussed.

WHAT ARE CRITICAL PERIODS?

The application of the term critical period to the development of language represents an analogy—one made by Eric Lenneberg (1967) some 20 years ago—between the development of language and the phenomenon of imprinting, an innate releasing mechanism observed in some animals. Animals like geese and ducks apparently attach (i.e., create exclusive social bonds) to the first moving object they encounter shortly after hatching (Lorenz, 1935; Hess, 1958; Jaynes, 1977). If completely deprived of social stimulation in the first hours after birth, the animal will fail to attach to anything because it was deprived of the opportunity to imprint. Konrad Lorenz (1935) referred to the time period in which imprinting is possible as a "critical period for social attachment" (p. 118); its duration, he argued, is determined by species-specific innate mechanisms.

The setting of the attached class of objects was originally thought to be totally irreversible and impervious to later reconditioning, that it in fact "could not be forgotten" (Lorenz, 1935, p. 119). Later researchers have been able to countercondition imprinted attachment under laboratory conditions (see Hoffman, 1987, for a review). For this reason, some have suggested that the degree of irreversibility is dependent upon such variables as the "naturalness" of the imprinting conditions (Hess, 1975).

The general notion of irreversibility, or the extent to which later learning is or is not possible, is a central feature of any critical period argument. In spite of the shortcomings found within the evidence on imprinting in animals (the historical and theoretical predecessor of the critical period in human development), the condition of irreversibility needs to be demonstrated if we are to accept that the acquisition of language has a critical period.

SENSITIVE, OPTIMAL, AND VULNERABLE PERIODS

Lorenz's theory of imprinting itself represents an analogy between scientific disciplines, namely ethology and embryology (Lorenz, 1935). Embryology employs the notion of critical periods to describe those stages of rapid structural development in which the embryo is sensitive to specific teratogenic agents (see Stockard, 1921, for one of the earliest applications of the term critical period in embryology). When Lenneberg used the term, the critical period referred to such varied phenomena as embryonic tissue, animal instincts, and human attributes. Those attributes considered to have critical periods included motoric skills (McGraw, 1935), personality (Scott, 1962), aggressiveness (Bloom, 1964), and sexual orientation (Money, Hampson, & Hampson, 1957).

In an attempt to distinguish the separate notions and phenomena under their study, some researchers advocate the use of specialized terminology for their disciplines (see Moltz, 1973, and Oyama, 1979, for developmental psychology; see Sluckin, 1970, for ethology). For this and other reasons, the terms sensitive, optimal, and vulnerable periods have been gaining currency in the scientific literature.

In discussions about the critical period hypothesis and its application to the field of communication disorders, terminology has been a focus of contention. Bench (1971) argued for abandoning the instinctually connotative term critical period for the neutral especially sensitive period. However, pedantic this proposition may seem to some (e.g., Northern & Downs, 1978), it represents a valid reluctance to present instinct, embryonic development, and language acquisition as parallel processes.

New terms, however, have tended to confuse the issue further. Sensitive, optimal, and vulnerable periods all have been used at one time or another in embryology, ethology, and developmental psychology, and individual researchers have differed on which term or terms to use (and if more than one are used, on the taxonomic relations between them). Although the sensitive period appears to be the current general parlance of developmental psychology (Bornstein, 1987), the critical period continues to be employed when addressing the issue of language acquisition. For this reason, it is used here.

To prevent taxonomic dispute from determining the course of this discussion, the present author will employ the use of "strong" and "weak" versions of the critical period to differentiate the degrees of maturational constraint possible within the general formulation.

STRONG VERSIONS, WEAK VERSIONS, AND THEIR PREDICTIONS

As it applies to language acquisition, the critical period can be formulated into strong versions and weak versions. Strong versions bear closer resemblance to the use of the term as an instinctual process in ethology. Weak versions, because of their relaxed criteria and predictive utility, are more analogous to the sensitive period currently used in developmental psychology.

Snow (1987) identified five general claims involved in the formulation of strong versions of the critical period. They are as follows (pp. 154–155):

1. there is a period in which people are particularly responsive to linguistic input (namely birth to the onset of puberty)
2. the same input that during the critical period supports language development is ineffective outside the critical period in producing the same kind of learning
3. the learning that occurs during the critical period is stable and irreversible by subsequent non-critical period learning
4. the existence and timing of the critical period is controlled by biological maturation
5. the critical period is universal within the species [Homo sapiens]

The “strongest” version, as Snow points out, has never seriously been proposed. It holds that any language learning after the critical period is impossible. Obviously, we are not imprinted in this sense to our native language because we all can learn something of a foreign language. In general, what strong versions do hold is that after the critical period, we never can approximate nativeness in a foreign language (e.g., Lenneberg, 1967; Lieberman, 1984). The explanation for this is that as adults we lose the neurological malleability we once had as children and therefore cannot learn as proficiently, efficiently, or naturally as we once could.

Proponents of strong versions hold that if circumstances were to prohibit primary linguistic exposure through the duration of the critical period, a functional level of language would fail to be acquired, despite subsequent linguistic exposure. Weaker, or “less strong,” versions might permit some first language learning after the critical period but certainly nothing that would develop into “normal” language use.

Weak version formulations are essentially arguments that have relaxed or limited elements of the strong versions. Ironically, this makes them more demanding in terms of the extent to which counterevidence needs to be demonstrated. For example, an explicit claim in the strong version formulations is that the critical period for language acquisition is a universal aspect of the human species and therefore should be manifested within all members of the species. It would be sufficient to present one countereexample to discredit a critical period formulated in this manner. On the other hand, weak version formulations have been presented by Scolv (1988) and Seliger (1981). These allow for the existence of countereexamples (e.g., adult learners of a second language who learn to near-native levels of proficiency, or learners deprived of linguistic exposure during childhood who acquire a first language after puberty), but they do so by placing them as extreme countereexamples two or three standard deviations above the norm. Before the hypothesis can be rejected, this formulation requires demonstration of (a) the existence of countereamples and (b) their existence as the normal state of things.

Another manner in which Scolv’s (1988) and Seliger’s (1981) formulations differ from the strong versions is that the critical period applies only to phonological skills (see Oyama, 1976), whereas strong versions generally predict that critical period effects will be manifested within all linguistic domains. This raises an interesting methodological issue, namely, how much language is language? Should we require from the evidence a demonstration that all linguistic domains (syntax, semantics, phonology, morphology, pragmatics) are affected before we can justify crediting the existence of a critical period for language? Would it be sufficient if we were able to establish the effect within a majority of the domains? Does a critical period for language exist as long as it is present within one area?

This depends not only on one’s theoretical commitments, but also on how important the distinction between speech and language is for the discussion at hand. For example, when considering appropriate approaches to second language instruction, the fact that only phonological skills are affected might not be enough to warrant early immersion programs. However, when considerations are made on the appropriateness of non-speech modes of language for the sensorially or motorically impaired, it is important to distinguish between the impact on speech and the impact on language.

In any case, it is a better practice—and certainly a more productive one—to specify the domains that appear to be affected, as well as the domains that appear to be unaffected, rather than simply to prove or disprove the existence of a critical period for “language.”

A final comment on weak versions: It is possible to posit a very weak version of the hypothesis, one that makes no claims about second language acquisition but that limits itself to the argument that a first language needs to be acquired before puberty. This formulation, as Snow (1987) points out, fails to occur with any regularity in the critical period hypothesis literature. It does present the field of communication disorders with an interesting consideration, however, and demonstrates that even the weakest formulations continue to have direct implications for the understanding and treatment of persons with speech and language disorders.

EVIDENCE FOR THE CRITICAL PERIOD

Second Language Acquisition

The majority of discussions on the critical period have focused on the hypothetical predictions made on the nature of second language acquisition. If the critical period exists, it follows that the younger learner (pre-critical period) will be superior to the older learner (post-critical period) in acquiring the various aspects of a second language. Furthermore, native-like mastery of the language should be possible only for the youngest learners.

Most investigations have focused on the question of whether it is possible for the older learner to acquire native-level pronunciation of the non-native speech sounds. In fact, as Seliger (1978) pointed out, the hypothesis of a critical period for language should be more accurately referred to as the critical period for phonology.

Substantial evidence does exist that when adults who have had the same amount of experience in a second language are asked to produce non-native phonemes, later learners will be rated as non-native by native judges more often than early learners (Major, 1987; Oyama, 1976; Tahta, Wood, & Lowenthal, 1983).

Few studies have examined non-phonological skills, but support for the notion of a critical period for syntactic skills exists (Patkowski, 1980; Johnson, 1986). Patkowski found
that subjects exposed to the non-native language earlier generally wrote more syntactically correct essays as assessed by native judges. Johnson, cited in Snow (1987), found similar results when subjects were asked to make perceptual judgments of grammatical accuracy in samples of non-native script. However, closer examination of Patkowski reveals serious design limitations that weaken its support of the critical period hypothesis for syntax. For instance, no native control samples were employed, and the native judges were not “blind,” but actually aware of the fact that they were assessing non-native script.

First Language Acquisition

Although most recent research has been directed at second language evidence, the general notion of a critical period for language originally was derived from early studies of populations with communication disorders (see Lenneberg, 1967). Much of Lenneberg’s formulations represent extrapolations of clinical observations made by Basser (1962). Basser observed that traumas that produce lasting and severe aphasia in adults often produce only transitory and less severe language loss in children. Recent reports of the development of near-native language proficiency in hemidecorticated infants (Mehler, Morton, & Jusczyk, 1984) provides further evidence for a neurolinguistic plasticity in childhood.

More direct support for the notion of a critical period for the acquisition of a first language comes from a recent study performed by Newport and her colleagues (Newport, 1988). The language skills of 30 adults who were deaf and who had been using American Sign Language (ASL) as their first and dominant language for at least 30 years were compared. The subjects varied according to onset of exposure to ASL and were divided into three groups: those exposed at birth, those exposed between the ages of 4 and 6, and those who were not exposed until after 12 years of age.

Each subject’s performance was compared to the way native signers (i.e., exposed at birth) responded on various linguistic tasks, including the production and comprehension of ASL morphological features. Results indicated that performance was highly related to the age of first exposure. This finding also held true regardless of the nativeness of the subject’s models (parents or teachers who were deaf or hearing). The later learners were more likely to use “frozen forms,” errors that made their productions different from those who learned earlier. Similar results were found by Woodward (1973), who reported that certain rules of ASL were used only by those who learned ASL before the age of 6.

Conclusion on Evidence for the Critical Period

In sum, support for the notion of a critical period for language comes largely from studies within second language research—studies that report better phonological skills in early learners when compared as a group to older learners, with both groups having had the same amount of exposure to the non-native language. Support for the notion from studies on first language acquisition has been limited to a small number of reports that adults who are deaf and who have been exposed to ASL early (before age 6) tend to produce more native-like morphology than those exposed later.

THE ISSUE OF IRREVERSIBILITY

All of the studies cited above had conclusions based on comparisons of some measured linguistic skill in adult groups of older and younger learners. Before a critical period can be accepted as being responsible for these differences, it is necessary to demonstrate that these differences are in fact somewhat “irreversible”—in other words, resistant to remediation.

Very few studies have addressed this issue, and these have been limited to the effects of training adults on non-native phonological productive and perceptual skills. Neufield (1978) demonstrated that adult native speakers of English with no knowledge of Chinese or Japanese could be trained to imitate utterances of up to 16 syllables in length well enough to be identified as native by native judges. The effect of Neufield’s experimental regimen, which included 9 hours of silent listening followed by 9 hours of producing whispered, then vocalized imitation, did not extend beyond the imitation conditions. Werker and Tees (1984) found a similar limitation in their perceptual training study when their subjects were tested on their ability to perceive non-native contrasts within natural contexts.

Both Neufield (1978) and Werker and Tees (1984) demonstrated that, contrary to most critical period predictions, it is possible to train older learners to perform as “native” in some non-native phonological tasks with relatively little training. Further research directed toward generalization and maintenance of these skills into more normal contexts may demonstrate further degrees of reversibility in accent speech.

EVIDENCE AGAINST THE CRITICAL PERIOD

Second Language Acquisition

If we consider competence in acquiring a second language to be the composite of various language skills, it appears that the older learner may actually have an advantage over the younger learner. Burstall (1975), in one of the few longitudinal designs addressing the hypothesis and its pedagogical ramifications, reported on the results of a 10-year study conducted on second language instruction in French for English-speaking schoolchildren in Great Britain. Subjects were followed for as many as 8 years and included over 6,000 children. Achievement measures included standardized tests as well as teacher’s assessments and student
questionnaires. The research findings showed that pupils taught at the age of 8 or earlier failed to perform substantially better in terms of final achievement than those who began instruction 3 to 5 years later. In fact, it was found that older learners achieved more in less time.

This result of "no difference" or "difference in favor of the older learner" has been replicated in cross-sectional designs, in which the performances across language skills are collapsed into a composite performance measure (Asher & Garcia, 1969; Morris & Gerstman, 1986; Snow & Hoefnagel-Hohle, 1978).

Evidence against the critical period for second language acquisition also can be found in the studies intending to support the hypothesis. Group trends are reported as evidence against the hypothesis. In every case previously cited, counterexamples or outliers exist within the data. For some subjects, it appears that significant linguistic sensitivity persists into adulthood. In addition, early exposure does not seem to be sufficient to guarantee success in a second language. Ioup (1989) reported on students enrolled in a college (ESL) class. Some of the students in the study had immigrated to the United States as early as 6 years of age. Subjects were given a battery of syntactic and semantic tests that included both productive and receptive tasks. Age of exposure was not a significant determinant of success on these measures. One of the highest performances in the study belonged to a 35-year-old man who had been exposed to English for only 5 years.

Finally, if a critical period exists for phonological skills, an abrupt downward shift in performance should occur after a discernible time period (e.g., from birth to puberty). The general decline in native-like pronunciation with increasing age of onset documented in studies like Oyama (1976) does not represent an abrupt shift, but rather a consistent gradual decline. It would be difficult to implicate a neurological process responsible for such a pattern.

First Language Acquisition

As stated earlier, Lenneberg's (1967) formulation rests upon theories of neural plasticity and upon observations others have made about the nature of recovery from neural assaults in children and adults (Basser, 1962). However, if we consider the fact that adults and children tend to suffer from neural assaults for different reasons (children, for example, do not usually have strokes), then the validity of the comparison that this hypothesis requires is questionable (Finger, 1978). Likewise, Taylor (1984) produced evidence that children who experience early neural assault actually may demonstrate linguistic deficits later that were not evident earlier.

Another element of Lenneberg's (1967) formulation that has been undermined by subsequent research was his notion that the process of cerebral lateralization, which he argued was incomplete until puberty, was responsible for the critical period. Kinsbourne (1981) and Whitaker, Bub, and Leventer (1981) provided evidence that lateralization is actually complete at birth. In response, Scovel (1981) argued that myelination may be the factor responsible because it appears to continue over the first decade of life. However, as Snow (1987) pointed out, it is not clear how this would effect language growth because no data exists demonstrating a connection between deficiencies in myelination and deficiencies in language acquisition.

Counterexamples to critical period predictions exist within the literature for the acquisition of a first language. Finger and Stein (1982) reported on the dramatic recoveries observed in some aphasic adults that could not be accounted for by the critical period. Likewise, Schaller (1991) reported on the success of an adult who is deaf, "Ildefonso," an illegal immigrant to the United States from rural Mexico, in acquiring ASL. Ildefonso was born deaf and deprived of exposure to sign or any language until the age of 27. In spite of this, Schaller (1991) reported anecdotal evidence that he learned his first language well enough to pass as a native.

Other anecdotal evidence that has been recruited against the critical period for the acquisition of a first language exists within the feral child literature. This literature represents a loose collection of historical reports from the 18th and 19th centuries. These reports consist of sensationalist accounts of children raised in isolation or by wild animals who managed to regain some degree of linguistic competence (see Malson, 1972, for a historical review of the literature). The most famous examples include Victor the Wild Boy of Aveyron (Lane, 1976), Kaspar Hauser of Nuremberg (Simon, 1978), and Kamala the Wolf Girl of India (MacLean, 1979). In the cases of Victor and Kamala, language use never developed into anything that could be characterized as normal. In contrast, Kaspar was able to learn language to such an extent that he was able to function within normal society and even write his own memoirs.

In recent times, Curtis (1977) reported on the language development of Genie, a child discovered in her parents' closet at the age of 13. Although some language use was recovered after restoration to society, much like Victor and Kamala, Genie's language failed to develop into normal language.

Because some language was acquired in all cases just cited, it is tempting to conclude that strong versions of the hypothesis are disproven. On the other hand, the language that did develop remained pathological in all but one case. Because linguistic deprivation for these children was concomitant with severe malnutrition and emotional abuse, it is probably safest to conclude, as Lenneberg (1967) himself did, that the feral child is a poor test of the general notion of critical period for the acquisition of a first language.

**Conclusion For The Evidence Against The Critical Period**

A strong version of the critical period hypothesis does not seem defensible. Age of onset does not appear to be a sufficient variable to predict success in a second language. Additional variables, such as motivation, social circum-
stance, and quality of exposure, probably combine to make a learner more or less successful. Studies on the acquisition of a second language have demonstrated that older learners outperform younger learners if one considers proficiency across many linguistic skills. Methodological inadequacies within the studies on syntactic development leave the notion of a critical period for syntax untested. Evidence that non-natives can be trained to perform as natives on both productive and receptive tasks weakens support for the notion of a critical period for phonology.

Counterexamples to the claim that a critical period exists for the acquisition of a first language have been largely anecdotal. The most serious shortcoming for the hypothesis involving first language has been the inability for researchers to posit a plausible neurological cause for the critical period.

There is not enough evidence to make a definitive statement about the status of weak version formulations of the critical period hypothesis. More information about the distribution of successful and unsuccessful learners within various linguistic domains is needed. In addition, a sufficient test of the hypothesis must address the issue of irreversibility. Measurements of group proficiency at a particular point in time do not reveal the extent to which it is possible to improve performance with directed training.

**IMPLICATIONS FOR THE SPEECH-LANGUAGE PATHOLOGIST**

Strong versions of the critical period hypothesis can be rejected for the reasons provided above. Weak versions of the hypothesis remain empirical questions awaiting data. This has several implications for the speech-language pathologist.

Given the dearth of evidence currently available, it seems untenable to utilize the critical period hypothesis to develop theories of language disorders or to make prognostic statements. Likewise, the critical period should not be employed to add urgency to early intervention. This statement should not be interpreted as a claim that without the critical period, early identification and intervention have no theoretical justification, but, rather, that early identification and intervention should rely more on the demonstration that they are effective in alleviating and preventing communication disorders.

The clinical researcher in speech-language pathology can contribute much to the present data base. Group- and single-subject treatment designs are familiar to the speech-language pathologist. The field of communication disorders has researchers most qualified to provide data on the effects of directed remediation on non-native phonology (accent reduction) and other linguistic skills acquired after the critical period. Without such research efforts, the critical period for language acquisition will remain a hypothesis that makes prodigious claims about the nature of normal and abnormal language development in the absence of empirical support.

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