THE LANGUAGE ACQUISITION RIDDLE AND FACTORS SHAPING THE PROCESS AND ITS OUTCOME

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Keywords: *Language acquisition, Chomskyaninnativism, Neuro-constructivism, Perceptual magnet effect*

The Riddle of Language Acquisition

Chomsky's work has stirred controversies beyond mainstream linguistics and philosophy is no exception where his work has added fuel to fire to the age-old nature-nurture debate. Also, as has often been noted by scholars, there appears no area of research where nature-nurture debate plays out with greater aggression than the nature of language and its acquisition (Aslin, Saffran, & Newport, 1999). When it comes to the question of language acquisition, Chomsky and his followers (hereinafter referred to as Chomskyans) have been found to be undermining the role of experience with the native language input to which all humans are exposed as a matter of their day-to-day upbringing in any society (Scholz & Pullum, 2006, 60). The primary role of experience for Chomskyans is just to trigger one of the options from a pre-specified restricted list of possible values (Crain, 1991; Gibson & Wexler, 1994; Scholz & Pullum, 2006, 63). The experience for them only affects the "reduced residue of phenomena" (Chomsky, 2005, 7) and language acquisition is often talked in terms of growth of bodily organs rather than because of learning (Chomsky, 2005, 5; Chomsky, 1980; Chomsky, 1975).[1] The language acquisition for them thus primarily amounts to "a matter of selection among options made available by the format provided by UG …allowing relatively few options" (Chomsky, 2005, 8) or "parameter setting" (Chomsky, 2005, 9; Chomsky, 1980, 38). The UG is thus the "the initial state" of the language learner.[2] Another reason

[1] As has been forcefully argued by Chater & Christiansen (2012), this however leaves the question of how the principles of UG got embedded into the genetic make-up of the organism in the first place unaddressed.
[2] It however needs to be noted that in more recent pronouncements by Chomskyans a great deal of what was earlier considered to be part of the necessary baggage of UG has been surrendered and all that largely remains is recursion (see, Hauser et al., 2002; Chomsky, 2005, 2010; Boeckx, 2012).

for appeal to a genetically specified knowledge of language (Chomsky, 1965, 1968, 1980 &1986; Piattelli-Palmarini, 1989; Anderson, 2012; Boeckx, 2012) has been because of Chomskyans' reliance on the poverty of stimulus arguments which in its essentiality means that the achievements of any typical language learner far exceed what their supposed 'limited' exposure and their equally limited cognitive capacities will permit.[3]

The trouble however is that Chomskyans have been found to be wanting in specifying the processes which their account would require for realization of the purported goal of mastery of one's native/ambient language. The only thing that they have ever offered in this regard has been in terms of their hypothesizing of existence of a dedicated Language Acquisition Device (LAD) that makes the learning of the language possible. That regular exposure to a language may permit any learner of a language to learn to utilize different cues from the linguistic input, learning strategies that they may adopt, cultural ethos that the individuals are exposed to is accorded no value. Any details about the neuronal processing mechanisms responsible for actualization of different linguistic cognitive tasks at hand across different developmental timescales as well as different biological constraints that may be at play at every stage and affecting the process of language acquisition are also hard to come by and such lacuna in their accounts is never adequately addressed**.** Also, the attributed 'ease' of acquisition of language is never provided any scientifically testable content. Similar is the case with Chomskyans' another vague claim that language acquisition happens "without the need for explicit instruction" (Anderson, 2012, 362). The amount of linguistic data that infants must be processing from their surroundings and the time that most humans take for mastering their native tongue can hardly be termed "effortless" (Boeckx, 2012, 493) without sounding ironic.

When we look at the process of language acquisition and empirical facts surrounding it, then we find that no satisfactory account appears possible without taking cognizance of the role of the linguistic input and mechanisms involved in processing it. For instance,

[3] There is rich literature on the topic and the interested reader can look at (Laurence & Margolis, 2001; Pullum & Scholz 2002; Scholz & Pullum 2002; Scholz & Pullum 2006) to get a flavour of the equally acrimonious debate surrounding the poverty of the stimulus arguments between Chomsky, his followers and their opponents.

language acquisition requires rapid deployment and disengagement of attentional mechanisms by the infant. Hence, when we look at cases of atypical development characterized by diagnosis of different kinds of neuro-developmental disorders, like, Down syndrome, fragile X syndrome, Williams syndrome, etc., then we find that lack of control of attentional mechanisms in cases of infants diagnosed with developmental disorders is found to affect their mastery of language severely (D'Souza et al., 2017 & 2020; D'Souza & Karmiloff-Smith, 2016a; Dekker & Karmiloff-Smith, 2010; Thomas & Karmiloff-Smith, 2003). Let us look at some factors that seem to affect the process of language acquisition in very significant ways.

The Role of Linguistic Input and the Creation of Perceptual and Attentional Biases

One of the prominent issues that figures in the controversy surrounding language acquisition is the nature and existence of different processing biases. The surprising thing about the discussion on the nature of perceptual mechanisms is that even researchers who otherwise do not subscribe to the Chomskyan doctrine tend to uncritically accept the nature of many of our perceptual abilities to be innate. One common reason that is often cited in most discussions on the topic for such uncritical acceptance is that existence of certain biases has to be accepted as given, among other things, for the successful meeting of the Quinean challenge (1960) concerning the under-determinacy of the word-to-world mappings. That the rationale for postulation of innate biases is to meet Quinean dilemmas appears to be quite unconvincing as language is never learned in a vacuum or a context insensitive situation for such dilemmas to arise in the first place. There are no word-to-world dilemmas if we do not overlook the obvious fact that language learning always takes place in real life situations suffused with multiple cues that guide the infant in limiting the search space. The questions of learning dilemmas faced by any language learning infant *a la* Gold's (1967) unbiased learner just do not seem to arise.[4] There is no problem of choosing the right rule from infinite set of possible rules because infants and children are biased learners in the sense

[4] For a more recent rehearsal of power of stimulus arguments as they relate to language acquisition, see, Laurence & Margolis (2001),Pullum & Scholz (2002), Scholz & Pullum (2002 & 2006).

of sensitivity to information that they bring to the task of language learning. As Hirsh-Pasek and Golinkoff (1996) point out, language learners are not only biased in the sense of their sensitivity to linguistic input but they also utilize a coalition of cues, both linguistic and otherwise, in learning a language. In an important sense, the job of language acquisition researchers is "to determine what information in the language input infants and toddlers are sensitive to and how these sensitivities are reflected in the strategies that these children use to learn their native tongue" (Hirsh-Pasek and Golinkoff, 1996, 4).

In this context the work of Patricia Kuhl, Linda Smith and their co-workers[5] is most significant in directly addressing and contributing towards identification and explication of the issues surrounding creation of perceptual biases (Iverson & Kuhl, 1995; Kuhl, 1991, 2000 & 2004; Ramírez *et al*., 2017; Smith, 1999 & 2001). Kuhl's work on infants has for instance been noteworthy in trying to develop a perspective that shows how language input is not a mere trigger to kick start the inherited language template. Given the insistence by Chomskyans, Kuhl has specifically directed her efforts at demonstrating how linguistic input "goes beyond setting the parameters of prespecified options" (Kuhl, 2000, 101). For this, she has studied infants who are just hours old to document linguistic sensitivities that they are born with. This is done to identify capacities that are innate in nature. By studying infants raised in different linguistic environments, Kuhl has been able to ascertain how infants' experiences with a specific language influence the very nature of their perceptual mechanisms that are required for processing language of their primary caregivers. This helps her map how infants' perceptual abilities "begin to diverge as a function of experience with a particular language" (2000, 100). What is interesting about Kuhl's results is the extent to which infants' very early experiences are found to colour their perceptual abilities for life. Her findings are striking because they demonstrate how the nature of our perceptual abilities

[5] Keeping in view the demands of the current task, I have discussed their work as well as that of others strictly to the extent to which it bears on the clarification of the problem of language acquisition in the context of issues raised by Chomsky and his followers. The scope of their work is undoubtedly much broader but falls beyond the focus of the present essay.

is an outcome that comes into being more as a result of developmental processes rather than being their cause. The main findings of Kuhl's work relevant for our immediate purpose are:

1. That initially all infants can discern differences between all the phonetic units used in the world's languages. Infants are endowed with such a capacity regardless of their linguistic environment.

2. The effect of different cultures starts showing up quite early as by the age of one-year infants lose their ability to distinguish different linguistic contrasts of foreign languages. That is, they lose their early capacity to distinguish foreign language contrasts as they move forward in mastering language of their primary care givers.

3. Once infants/children learn a language, they begin to become more and more like adults belonging to their culture as they start failing to distinguish or perceive sound differences not found in the language of their environment.[6] Similar transitions are found to be occurring in speech production where infants begin their life producing universal set of utterances and soon change over to producing speech patterns that are specific to the culture in which they are being raised. In speech perception as well as its production there is thus a remarkable transition from a universal pattern to a particular one.

4. It is infants' experience with a particular language that "alters the brain's processing of the signal, resulting in the creation of complex mental maps. The mapping 'warps' underlying dimensions, altering perception in a way that" is helpful in learning the target language (Kuhl, 2000, 102). That is, exposure to ambient language produces "mapping that alters perception" (102).

[6] Following the work of Best, McRoberts, and Sithole, Werker*et al.* (1996) have argued that sensitivity to only those contrasts is lost that in some way share native language phonology. Because of this overlap, the reorganisation of the perceptual system results in the assimilation of such non-native contrasts to native phonology. Accordingly in cases where there is no such overlap, for example in the case of English and Zulu, the discrimination abilities for perceiving non-native contrasts are not lost.

Kuhl accounts for these changes in terms of a "perceptual magnet effect" and treats them to be a product of "phonetic prototypes" (Iverson & Kuhl, 1995; Kuhl, 1991 & 2000; Kuhl *et al.*, 1992). In this regard, she cites evidence from cross-linguistic studies to support her contention that perceptual magnet effect is the product of linguistic experience. Such a reading appears reasonable, as phonetic prototypes differ across languages. This means that long before infants learn or begin to produce their first words their perceptual and language producing mechanisms have been modified to conform to the requirements of their ambient language. That is, "language input sculpts the brain to create a perceptual system that highlights the contrasts used in the language, while de-emphasizing those that do not" (Kuhl 2000, 103). Studies on monolingual American and Japanese listeners in fact show that both group of listeners fail to perceive the actual physical differences between the sounds that are not found in their language. Instead, what they perceive are similarities and contrasts that are in conformity with their ambient language. Undoubtedly, it is the experience with their respective languages that seems to alter perception of physical sounds of infants (Saffran*et al.*, 2006).

Given the extent of early linguistic exposure and the magnitude of resultant changes, it appears natural to suppose that these similarity/contrast islands should later function as highly tuned filters and direct the infant's attentional mechanisms in the direction necessary for the mastery of ambient language. That is, they will help infants focus only on those aspects of acoustic signal that are relevant for the language being learnt. The postulated perceptual magnet effect thus seems to alter the initial acoustic space by reconfiguring it according to the requirements of the ambient language. Not only are the old boundaries erased by experience, but new ones are drawn to suit the actual demands of the language being learnt to result in increased sensitivity to native language contrasts (Kuhl *et al.*,2006).

Kuhl and Meltzoff's research (1997) on language specificity of categorical perception also demonstrates how innate perceptual boundaries are radically modified by exposure to ambient language and how exposure to a language comes to colour our perceptual abilities in significant ways. Moreover, the fact of variation in responses to categorical

perception of adults from different linguistic groups is explainable only in terms of language exposure and not differences in genetic endowment. This is all the more evident from the fact that categorical perception is also possible for non-speech signals (Aslin, Jusczyk&Pisoni, 1998). Moreover, humans are not the only species who can make such a discrimination as evidence for such an ability is available from the behaviour of other species (e.g., chinchilla, Japanese quail, etc.). Findings of Kuhl and her co-workers are significant because categorical perception for adults "occurs only for sounds in their native language" (Kuhl & Meltzoff, 1997, 9). This is in stark contrast to infants' response that demonstrates categorical perception not only "for the sounds of their own native language but also for sounds from many foreign languages" (10-11). So, while adults appear to be "culture bound", infants' response demonstrates as if they are "citizens of the world" (11). What is remarkable about these findings is not merely the fact that there is evidence for categorical perception in infants to sounds of foreign languages early in life, but also that subsequent modification of this ability results in the supposed loss of this sensitivity.

The work of Linda Smith and her co-workers also further compliments the above conclusions (1999; 2001). In their studies they specifically aimed at investigating this aspect. Their findings reveal as if there is more of a reorganization of perceptual mechanisms than a loss of abilities to discriminate different speech signals. Consideration of factors that are capable of influencing the functioning of different perceptual mechanisms tends to bestow an important role for early linguistic input in language acquisition. It appears as if early linguistic input modifies perceptual systems by tuning them to the requirements of ambient language. Such an interpretation is further substantiated by several studies done by Aslin, Jusczyk, Saffran and their co-workers. Their studies demonstrate how sensitivity to discriminate foreign language contrasts can be retained by training (Aslin, Jusczyk, Pisoi, 1998). The point that researchers like Kuhl, Aslin, Jusczyk and others are trying to make through their studies is not that speech is not a special signal. But one of the important findings of their work is to show that speech is processed by mechanisms that are not specifically designed for processing

speech. Additionally, categorical perception is found to be not merely limited to speech signals nor is such a perception a uniquely human endowment. Linda Smith and her co-workers, for instance, have closely looked at the very basis of different attentional biases that infants extensively rely upon for different language learning tasks (1999 & 2001). The main findings of relevance of Smith's work are:

Firstly, it rigorously demonstrates that the attentional biases that language learning relies upon are not innate but learnt. Secondly, while it may be tempting for us to expect that language learning must also be making use of some attentional mechanisms that are specific to language, Smith's work reveals that this is actually not the case.[7] On the contrary, what Smith's work shows in the specific context of language learning is that the domain-specific knowledge of language "emerges from very general learning processes, processes that in and of themselves have no domain-specific content" (1999, 282). So, what come to be characterized later in life as domain-specific biases that are peculiar to language are not domain-specific to begin with. They have their origin in domain-general processes. As a matter of fact, Smith considers the "general processes of attentional learning" to be providing "an explanation of the origins and mechanisms of word learning biases" (1999, 281). That is, "domain-general processes when at work in particular learning contexts self-organize to form context-specific learning biases" (Smith, 2001, 102). This means that domain-specificity is not the cause but product of development, a product that shapes further development (128). Such an approach to language learning definitely raises several issues including those concerning the nature of different 'socially acquired' biases and forces guiding them.

In this regard, it is useful to note that contrary to Chomskyans' predisposition of taking recourse to innate factors for explaining such outcomes, Smith has successfully accounted for the existence of different biases in terms of what she terms as an "Attentional Learning Account" (1999, 281). The main guiding principle of this account

[7] If this was to be true, then one possibility, following the domain-specificity arguments is that different languages may require different built-in attentional biases -- something which clearly appears beyond both the means and the time available with the evolutionary processes.

is that if a certain cue is regularly associated with or predicts existence of some other object, properties, events, or actions then, after certain repeated experiences, the occurrence of the first cue will automatically come to recruit attention on the regularly associated objects, properties, events, or actions. On the basis of this account Smith has proposed five hypotheses and has also confirmed each one of them in turn by specifically designed studies. In a nutshell these hypotheses and the results of studies to test them are:

1. "The shape bias hypothesis": This hypothesis states that "Early nouns refer to categories of similarly shaped objects" (383). Smith accounts for such a shape bias on the basis of statistical regularities inherent in the names that children first learn. The support for this comes from a study of 45 children aged 19 to 30 months by Smith and her co-workers. The results of the study demonstrate that most of the count nouns known to children tested in the above sample named objects on the basis of their shape rather than the material or colour of the objects.

2. "The shape bias does not pre-exist word learning" (284): This means that the shape bias emerges as a consequence of word learning. That is, the shape bias is a "product of an associative link between naming and attending to shape" (286). To test this hypothesis Smith first tested infants around the age of 15 months, that is before they have learned words, and then tested them again once they had crossed the 50 words mark. Such an exercise serves two purposes. Firstly, it allows us to see how early word naming leads to shape bias. Secondly, it will demonstrate whether this shape bias, once it is in place, supports and helps rapid word learning or not. The actual data from the longitudinal study done by Smith are on expected lines and support the hypothesis.

3. "The shape bias is lexically specific when it first emerges" (286): This was tested and confirmed in a cross-sectional study of 64 children on naming and non-naming categorization tasks. The results show a definite "rise in shape choices as a function of vocabulary growth" (286).

4. “The shape bias can be taught” (287): This hypothesis was tested by designing studies that examine children who initially show no evidence for shape bias; make them learn names for shape-based categories; and test how such a group of subjects fares in comparison with controls. That is, the study tests whether “children who have not yet developed a shape bias will acquire one from learning names for shape-based categories” (287). Smith reports a study done on two groups of children, one trained on naming shape-based objects and another one constituting the controls, showed that children trained for seven weeks on naming shaped based objects generalized to other shape-based objects demonstrating facilitative role of emerging shape bias for word learning. The results of the study are very significant because while children trained for seven weeks showed a spurt of 166% in their vocabulary of count nouns, in the case of controls it was just 73%.

5. “Learning about other kinds of words creates other attentional biases” (292): This hypothesis in a way highlights how the facilitative role of contextual cues in creating attentional biases is not limited to just shape-specific input and applies equally well to other properties as well in so far as appropriate contextual cues are there to recruit attentional mechanisms. While the fact of count nouns to bias attention to shape of named objects was utilized by Smith to test other hypotheses, the fact that learning of adjectives does not show any such regularity was exploited to test this hypothesis. Smith’s study on 40 children from the 19-35 months age group shows that while initially children tended to generalize to novel tasks on the basis of shape, after learning about 50 adjectives children shifted their attention away from shape and utilized texture of objects as a new exemplar (294-5). The findings of this study are significant in the sense that they highlight how attentional biases change with age/development and grow stronger and specific with time (Smith, 2001).

The last two hypotheses and their confirmation are particularly significant because they demonstrate that shape-based bias is not merely correlational but “causally bidirectional” (295). Learning to attend to shape not only helps learn other count nouns but learning of words that do not require any such engagement of attention leads to utilization of other

contextual cues for the purpose. Therefore, what appears to be really noteworthy about Smith's work is the clear demonstration of the developmentalist thesis that "Development is the process of getting something new from the cascading effects over time of more general processes" (298). In a different but related context, strong positive correlations have also been reported between high frequency of light verbs in the language input, ease of their acquisition and frequency of their usage. Similar correlation is available for shorter form of high frequency verbs as well, a fact that further enhances their learning, accessibility, ease of production and comprehension. Goldberg (1999) also cites evidence from studies that show that high frequency of light verbs in the linguistic input results in early language learners' use of such verbs more often even in situations where some other verb fits the occasion better and the learner is aware of the use of such a verb. The important conclusion from these studies is that the "high frequency in the input begets high frequency in children's speech" (Goldberg, 1999, 203). Locke (1993) and Werker*et al.* (1996) also report changes in infants' perceptual abilities as a consequence of exposure to ambient language. It is also important to note that evidence for prenatal familiarization with linguistic stimulation and infants' preference for mother's voice as reported by Mehler and his co-workers (Mehler*et al.*, 1996; Mehler & Christophe, 2000) is likely to extend the beginning of the role of linguistic input even further back. Karmiloff & Karmiloff-Smith (2001) also recognize the fact that "the fetus is able to extract information about some of the invariant, abstract features of its mother's voice that transcend the muffling effect of the amniotic fluid…the characteristic of speech that will enable growing infants to become progressively sensitive to the phrase structure and word boundaries of their native tongue" (44-45).

Concluding Remarks:

From the review of extensive research on language acquisition, it is clear that infants not only tend to lose their initial ability to discriminate foreign language contrasts with the passage of time but their exposure with a particular language also modifies their perceptual mechanisms in a very significant manner. The young children's ability to

retain such sensitivities through training as well as the language specificity of categorical perception is demonstrative of how innate perceptual boundaries can be radically altered and how exposure to a particular language comes to colour the very nature of different perceptual mechanisms. The literature on how different languages employ and shape different attentional resources further emphasise how domain specific knowledge of language could be emerging from mechanisms that are not domain specific to begin with. The studies aimed at investigating the role of different cues including communicative factors as well as the changing nature of the significance of these factors with time further highlight the facilitative nature of these aspects in language acquisition. Consideration of these facts tends to considerably strengthen the neuroconstructivist account as articulated by Karmiloff-Smith and others (Karmiloff-Smith, 1998; Karmiloff-Smith *et al.,* 2002; Quartz, 1993; Quartz & Sejnowski 1997) as a more plausible and satisfactory approach for understanding the process of language acquisition.

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