NATURALNESS IN PHONOLOGY

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Naturalness in phonology can be generally defined as a property of any constructs in the theory which is physiologically plausible and thus can be expected to exist in natural language. If something is natural, it is acquired easily and early by children. That is, it is generally a requisite in the phonological system of a language and thus found at a greater frequency in languages of the world. This can also be called naturalness in phonetic sense, the concept which is determined by the human's physiology. One sound is, for example, considered more natural than another if it is easier to be articulated : [a] is more natural than [i] because the speaker requires less effort to pronounce [a] than when he does [i]. As a result, children learn to pronounce [a] before they can acquire [i] (Jakobson, 1941).

Yet phonologists use the term 'naturalness' in a relative sense. For example, sound is said to be more or less natural when compared with another sound as [i] is said to be less natural than [a] but more natural than [$\tilde{i}$]. In the same way, rule a is said to be more natural than b since numerous languages convert /ki/ to [$\check{c}$i], while apparently no language converts /$\check{c}$u/ to [ku].

a. k → $\check{c}$/ __ {i, e, æ}

b. $\check{c}$ → k/ __ {u, o, a}

This notion is expressed in different theoretical terms. Jakobson (1941) expresses it in terms of 'implicational universals' in which the presence of certain segments in a language implies the presence of other segments but not vice versa. For instance, voiced stops imply voiceless stops so there are no

languages that have voiced stops without having voiceless stops, while there are some languages that have voiceless stops but not voiced stops. This is done by cross-linguistic comparisons, in which certain sounds are found in more languages than others. Jakobson also mentions in his article that in all languages sound segments tend to be learned in a relatively fixed order by children, and that there is a correlation between the order in which sounds are acquired by children and the implicational universals noted on the basis of phonological inventories.

For Chomsky and Halle (1968), naturalness seems to be equated with the concept of 'markedness'. The notion of markedness was developed first within the Prague School of linguistics and has recently been introduced by Chomsky and Halle with a somewhat different interpretation. In the Prague School conception, markedness is a language-specific property which is found when there is neutralization--when two phonemes are neutralized in a given position, it is the 'unmarked' member of the opposition which is found phonetically. For example, in German, in which the voiceless obstruents, /p,t,k,f,s/, and the voiced ones, /b,d, g,v,z/, are neutralized as [p,t,k,f,s] in final position, the voiceless obstruent series is said to be unmarked. But for Chomsky and Halle markedness values are universal and innate. The marked member represents the more complex and less natural state while the unmarked member represents the less complex, the more natural, or the expected one. This concept corresponds to Jakobson's concept of implicational universals as shown in the example of voiceless-voiced stops. In Generative Phonology, voiceless stops, as suggested by Jakobson's implicational universals, are less marked than voiced stops. It derives its support from studies of universals in language acquisition, language change, linguistic typologies and directions of implication. In language acquisition, more highly marked segments are generally acquired only after less marked ones have developed. For example, French children acquire nasalized vowels, which are theoretically marked, after

oral ones, which are unmarked. In language change, sounds are seen as changing from marked to unmarked as in German in which voiced obstruents, which are more highly marked, become voiceless, which are less marked, in word final position. In linguistic typologies, unmarked sounds, like voiceless stops, are generally required in the inventory of sounds of a language before marked sounds, like voiced stops, voiceless fricatives, etc., can be added.

For Stampe (1973), the concept of naturalness plays a very important role in his theory of Natural Phonology. It is used as a criterion to differentiate rules and processes. Processes are said to be phonetically motivated, innate, productive and tend to apply involuntarily and unconsciously while rules do not have synchronic phonetic motivation and are not productive. In other words, processes are natural while rules are not. The child is believed to have all natural processes as part of his 'faculté de langage' the same way as other linguistic universals. In the first stages of language acquisition, he applies them all, which accounts for the very restricted phonological repertoire he shows in these early stages. Later, he learns to modify this primitive phonological component in order to get the complete phonological inventory of his own language. The important point to be made here is that processes are not learned, but rather are naturally acquired by the child as an innate property. This can be illustrated in the example of German's devoicing rule. While the Generative phonologists say that the German children have to learn the final obstruent devoicing rule, Stampe will explain that there is a universal process of final devoicing since it is a part of human nature to devoice final stops, so the German children do not have to learn to devoice them. On the contrary, the children other than German have to learn to suppress this process.

Naturalness is required to be a property of many phonological constructs: feature, segment, phonological rules, rule ordering, and underlying structure.

Feature is required to have phonetic foundation : either articulatorily as [coronal] ; acoustically as [sonorant] ; or perceptually as [stress], because it is used for characterizing important phonetic differences of human sounds. For example, the Italian r, which is phonetically a dental trill, must be distinguished from Standard French r, which is a uvular trill, by the feature system. Moreover, the feature system is designed to form natural classes of sounds since segments which share the same phonetic traits often undergo the same phonological processes. For example, /m,n,ŋ/ constitute a natural class because they are often found to undergo the same rules, e.g. :

$$V \rightarrow \tilde{V} / \_\_ \{m,n,ŋ\} \quad \text{OR} \quad V \rightarrow [+\text{nasal}] / \_\_\_ [+\text{nasal}]$$

As these classes of sounds are required to be natural in the sense that they undergo the same natural processes, the feature system forming these classes is required to be natural too.

Besides features, naturalness also plays an important role in segments since some segments are said to be more natural than others. For example, the vowels /i/ and /u/ are considered more natural than the vowels /ü/ and /ɯ/ because generally a language will not have /ü/ or /ɯ/ unless it already has /i/ and /u/. This is supported by evidences in language learning and language change. In language learning, Turkish children who learn their language which has all these four vowels acquire /ü/ and /ɯ/ after they have already developed /i/ and /u/. For language change, it is found that in Yiddish, /ü/, which is a less natural segment, has become /i/, which is more natural. The segments are said to form

natural classes if they are found to undergo the same phonological rules. These natural classes are said to be more or less natural when compared with other classes. This fact must be captured by a good phonological theory because the degree of naturalness of natural classes determines the degree of naturalness of the phonological rules which these classes undergo. Realizing the importance of naturalness in segments, linguists put a lot of effort in trying to account for it. Chomsky and Halle (1968) first propose the simplicity metric, which makes use of feature counting as a criterion to be used as an evaluation procedure. The basic assumption is that classes which require fewer features to specify them are more natural than the ones requiring more features. Although this sometimes turns out to be true, there are many cases where this simplicity metric does not work. This can be seen in the following two classes :

1. /i,e,u.o/ = [α back, α round, -low]
2. /e, ɸ, u, ɯ/ = [α back, α high, -low]

According to the simplicity metric, these two classes are of equal naturalness because they have the same number of features. But in reality, the first class is considered more natural than the second one, which is highly unnatural and unexpected in languages. To remedy this kind of situation, Chomsky and Halle adopt the marking conventions, which will judge [α back, αround] as more natural than [α back, α high].

The degree of naturalness is important in natural classes because it helps to determine the degree of naturalness of the phonological rules. In phonological theory, it is extremely important that the theory provide an evaluation measure to distinguish a more natural rule from the less natural ones because phonological rules are linguists' artefacts which are claimed to be the property of natural language. In general, rules which linguists agree to be natural are all phonetically

motivated. For example, the rule

3. $k \rightarrow \overset{\vee}{c} / \_\_ i$ OR $[+\text{back}]_{C} \rightarrow [-\text{back}] / \_\_ \begin{bmatrix} +\text{high} \\ -\text{back} \\ V \end{bmatrix}$

is considered natural since the velar consonant has a natural tendency to be palatalized before a high front vowel. But when comparing this rule with rule 4.

4. $k \rightarrow \overset{\vee}{c} / \_\_ \{i, e\}$ OR $[+\text{back}]_{C} \rightarrow [-\text{back}] / \_\_ [-\text{back}]_{V}$

we can see that although rule 3 is more natural than rule 4 since the palatalization process will always take place first before /i/, which has the highest tongue position among the three vowels, rule 4 is judged to be more highly valued than rule 3 by the simplicity metric. As in the case of natural classes, a conflict occurs between maximally simple and maximally natural rules. The more simple is less natural while the more natural rule is less simple. This makes the linguists to reconsider their theory. Finally they come to a conclusion that simplicity may no longer be an exclusively good criterion for an evaluation procedure in the theory of phonology. The more promising criterion seems to be 'naturalness' instead, so they again use the concept of markedness to capture the naturalness of certain phonological rules. In addition, Chomsky and Halle (1968) introduce 'linking conventions', Schachter (1969) 'natural assimilation rules', and Schane (1972) the concept of 'preferred syllable structure' as the constraints on naturalness of rules.

Naturalness in rule ordering is mentioned by Kiparsky (1968). First, he makes the distinction between feeding and bleeding rule ordering. The former is the order of rules in which one rule creates the environments for the other rule to apply, e.g.

5. $t \rightarrow s / \_\_ i$

6. $s \rightarrow z / V \_\_ V$

The latter is the order in which one rule removes the environments that could have undergone the other rule. e.g.

7. $n \rightarrow \phi / \_\_ C\#$

8. $V \rightarrow \tilde{V} / \_\_ n$

Since Kiparsky believes that the order in which the rules shift so as to allow their fullest utilization is more natural than the opposite, he assigns 'unmarked order' to feeding and 'marked order' to bleeding. So according to him feeding order naturally tends to maximize and bleeding order to minimize. In his later article, Kiparsky brushes aside the concept of feeding-bleeding rule ordering, and proposes instead the concept of rule opacity and rule transparency. He claims that opacity is a property of rules that makes them and the underlying forms to which they apply harder to learn, or less natural, and that rules tend to be ordered so as to become maximally transparent. By introducing the concept of naturalness to rule ordering, Kiparsky is able to explain the two historical phenomena--rule reordering and rule loss. For rule loss, his explanation is that rules are susceptible to loss if they are opaque since opaque rules are hard to learn.

Naturalness is also important for the underlying representation. It helps to determine a better solution between two solutions. For example, there are at least two possible solutions to the following set of data : [s̬i], [s̬e], [su], [so], [sa].

Solution 1 : The underlying representations are /si, se, su, so, sa/ and the phonological rule is $s \rightarrow \overset{v}{s} / \_\_ \left\{ \begin{matrix} i \\ e \end{matrix} \right\}$.

Solution 2 : The underlying representations are /si, se, su, so, sa/ and the phonological rule is $\overset{v}{s} \rightarrow s / \_\_ \left\{ \begin{matrix} u \\ o \\ a \end{matrix} \right\}$.

If naturalness is used as the criterion to evaluate these two solutions, 1 is chosen

to be a preferable solution since the rule is phonetically motivated--when /si/ becomes [s̬i], the alveolar /s/ assimilates to the frontness (or palatality) of /i/, which is a natural assimilation rule. On the other hand, the rule in 2 does not have any phonetic motivation and thus is an unnatural rule. Another role that naturalness plays in underlying structure is stated by Postal in his Naturalness Condition. To avoid the phonological representation from being too abstract, Postal puts the constraint on it that it should be specified in features that have intrinsic phonetic content.

To sum up, naturalness is most of the time necessarily a property of phonological constructs such as feature, segment, rule, rule ordering and underlying representation. That is, it serves as a criterion for an evaluation procedure to choose the best solution from a set of possible solutions.

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