

# Evolution, Structuralism and Chomsky

## An Introduction to Issues involving Rules, Constraints and Universal Grammar in Modern Generative Phonology

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### **Preliminaries.**

Noam Chomsky is often referred to as the father of modern generative linguistics. His leadership and insights have informed virtually all forms of current linguistic inquiry, and though he has primarily been associated with the development of modern syntactic theory, his presence has certainly been felt in other linguistic sub-disciplines as well, perhaps most notably in the field of phonology. In this discussion, I consider the impact Chomsky has had on the development of modern linguistics in a general way, considering very basic issues that relate to the study of syntax, as well as that of phonology, in order that we may see in clearer light some points I wish to make about both the strengths and the shortcomings of current linguistic theory in general and modern generative phonology specifically. In other words, this paper has two main purposes: (1) to review some of the major contributions Chomsky has made to the study of linguistics in general, and to syntax, as well as to the study of phonology; and (2) to evaluate the current state of phonological theory, with some emphasis on my own contributions to the field over the last two decades,<sup>1</sup> ending with suggestions for possibly new directions for the future.

To begin the present discussion, however, I would like to expand the field of thought before narrowing it on a focus of linguistic research, and begin with a short discussion of the general constitution and aims of science and research. Let us then begin with some consideration of

what is that we call "facts".

Though not at all intuitive, "facts" are sometimes quite disconcerting to the scientist, where we would expect the opposite to be true. The reason for this is that a fact implies that something is true beyond reasonable doubt. The defining characteristic of a scientific fact, or statement, is that its accuracy can be tested by comparing it to observations in the natural world; in other words, a scientific statement must be *falsifiable*. In order to establish a fact, though, we have to pose a question, and propose a method of obtaining an answer. This leads to the formation of a hypothesis. When the hypothesis bears fruit and provides a useful generalization that could not otherwise be obtained, we can call this support for the hypothesis. We then test this hypothesis again in any and all conditions, and if we are met with consistent and continued success, we can then begin treating this as a theory that is capable of describing, if not explaining, all aspects of a given phenomenon. Many scientists, however, speak of facts when they mean theories, and theories when they mean hypotheses, though theories in truth are much more established than are hypotheses.

Evolution, for example, is not a hypothesis, a conjecture on how things might have developed, rather, it is a scientifically established theory that was developed methodologically over centuries of time involving rigorous scientific investigation that has observed the various facts of nature and has culminated in a principled explanation for the current state of the natural world. Such a theory of evolution accounts, by necessity, for both the convergence and the divergence found in the continual, if not sometimes chaotic, change of living organisms over time, beginning with the simplest single cell replicating life-forms, and continuing on through to the development of the complex modern human being.

Issues regarding evolution also are relevant to language; its acquisition, its structure and its development. In fact, the idea of evolution can be applied in at least two rather different views of

language. One is the evolution of the language faculty itself, to which many have offered suggestions, or hypotheses, as you will, as to how and why this came about (covering everything from cunning adaptation to coincidental but beneficial random "accidents" of nature), while the other notion concerns the evolution of theories about the language faculty itself—what it is, how it can be characterized, and what it tells us about the human brain, and mental processing. Regarding the evolution of the language faculty itself, much has been written on the topic, but I will summarize the issues by referring to Chomsky, 2005, where he states

at least two basic problems arise when we consider the origins of the faculty of language and its role in the sudden emergence of the human intellectual capacity: First, the core semantics of minimal meaning-bearing elements, including the simplest of them; and second, the principles that allow infinite combinations of symbols, hierarchically organized, which provide the means for language in its many aspects. Accordingly, the core theory of language—Universal Grammar (UG)—must provide, first, a structured inventory of possible lexical items [...] and second, means to construct from the lexical items the infinite variety of internal structures that comprise language. (pg 4)

Though I feel both aspects of evolution regarding language are relevant (one, involving the evolution of the human language faculty itself, and the other, involving the evolution of theories about what the language faculty is, and how best to describe it), I will concentrate here mainly on the latter issues, namely, those involving the evolution of hypotheses and theories regarding what language is, and how it is to be studied within a scientific framework. To do this, we will not return to the beginning of time, but rather, to a more recent stage in our evolutionary history, to a point in scientific discovery less than one hundred years ago, a period recognized for the birth of modern linguistic study, among many other achievements.

## **1. In the beginning—the American structuralists approach to the world: Making mountains out of molehills.**

Bloomfield, 1933, 1939, advocated a kind of "logical positivism" as Newmeyer, 1986 (Ch. 1), notes, involving the following assumptions:

- (1) Bloomfield's Logical Positivism
  - (i) All useful generalizations are inductive generalizations.
  - (ii) Meanings are to be eschewed [ignored] because they are occult entities—that is, because they are not directly empirically observable [in other words, "observability" was important].
  - (iii) Discovery procedures like those advocated in logical positivism should be developed for the proper conduct of linguistic inquiry.

These assumptions were then used to identify, prioritize and organize the various elements of linguistic structure, determining a model of both what to study, and in what order to study the identified elements.

Ludlow (forthcoming) observes that the American Structuralists identified four levels of linguistic structure: (1) phonemics (intuitively the study of sound patterns), (2) morphemics (the study of words, their prefixes and suffixes), (3) syntax (the study of sentence level structure), and (4) discourse (the study of cross sentential phenomena).

### (2) American Structuralist Four Levels of Linguistic Inquiry

- (1) Phonemics
- (2) Morphemics
- (3) Syntax
- (4) Discourse

The most primitive level of structure was determined to be the level of phonemics, presumably, as Ludlow observes, because it is "closer" to the data, upon which a theory of morphemics was built, out of which a theory of syntax was then constructed, etc.

### (3) Phoneme Driven Linguistic Structure

Phonemics>Morphemics>Syntax>Discourse

Ludlow notes, as did Newmeyer, that at the heart of the structuralist approach to language was a kind of "positivism" which recognized that the system was essentially guided by a principle of reductionism,


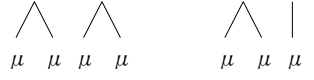
where every larger structure could be dismantled into a smaller structure (working backwards), ending up at the base level of phonemics (everything was ultimately reducible to the phonemic level of structure). This seemed intuitive, since it is this level that appeared most directly accessible, through sensory experience, to the real world.

Early phonologies, therefore, were systems composed of constituents, or primes (phonemes), which were sometimes altered by rules, *rules* of the form shown in (4).

- (4) A phonological rule  
 $A \rightarrow B/C\_D$

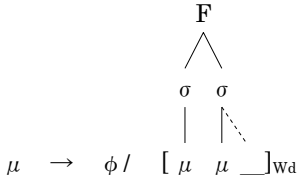
This required a theory which included a Structural Description, which defined the class of possible predicates, CAD, and it required a theory that included an inventory of Structural Changes, which defined the class of possible operations,  $A \rightarrow B$ , while providing no real explanation, ultimately resulting in fact in only a short-hand notational description of the change (see Skaer, 1994). The following data illustrates iambic shortening in Latin described by rule as I have just characterized (from Skaer, 1993). In Latin, the final heavy syllable of disyllabic words of the form *light* syllable (single mora) + *heavy* syllable (two mora), is lightened, or shortened (one mora is lost).

- (5) Iambic Shortening in Latin.

- a.  $[\sigma \quad \sigma]_{wa} \rightarrow [\sigma \quad \sigma]_{wa}$   
  
 $\mu \quad \mu \quad \mu \qquad \mu \quad \mu$   
 putaa  $\rightarrow$  puta 'believe', sg. imp  
 virii  $\rightarrow$  viri 'man', gen.sg., nom. pl.
- b.  $[\sigma \quad \sigma]_{wa} \rightarrow *[\sigma \quad \sigma]_{wa}$   
  
 $\mu \quad \mu \quad \mu \quad \mu \qquad \mu \quad \mu \quad \mu$   
 mandaa  $\rightarrow$  \*manda 'entrust', 2sg. imp.  
 laadoo  $\rightarrow$  \*laudo 'praise', 1sg. pres.

- c. 
$$\begin{array}{ccc} [\sigma & \sigma & \sigma]_{\text{wa}} \rightarrow *[\sigma & \sigma & \sigma]_{\text{wa}} \\ | & | & \wedge & | & | & | \\ \mu & \mu & \mu & \mu & \mu & \mu \end{array}$$
- simulaa → \*simula 'simulate', 2sg. imp.  
habitoo → \*habito 'inhabit', 1sg. pres.

(6) The rule-based "generalization" of Latin Iambic Shortening:



We don't know why heavy syllables are disfavored in one environment but not in another, and the result is similar to a description of the fact of moraic loss in certain environments, with very little useful insights, and no generalizations.

For another simple example, consider assimilation, where A precedes D, some or all of A's features assimilate to create D, which puts it into agreement with D, as in:

- (7) Assimilation
- a. Description: AD → DD
  - b. Rule: A → D / \_D

The "rule", (7b), does not say what tendency or principle is causing this change, it merely acknowledges that an element has one identity in one environment, and a different identity in another. We may call it "assimilation", but this is just a note-taking device. It doesn't tell us about whether this is *likely* to occur in other environments, whether it *can* occur in other environments, or even whether it *always* occurs in such environments, or its fragmentary environments. These and other problems led to the downfall of the early features and rules based approaches to phonological theory that characterized the structuralist approach to phonological research.

Chomsky, 2005, remembered the later days of structuralism, saying that when he was studying back in the 1950s,

we assumed that the primitive step of analysis of linguistic experience would be feature-based phonetic analysis, along the lines of Roman Jakobson and his associates [...] We also tried to show that basic prosodic properties reflect syntactic structure that is determined by other principles [...] The primitive principles must also provide what George Miller called "chunking," identification of phonological words in the string of phonetic units.[...] It was assumed that the next step would be assignment of chunked items to syntactic categories, again by general principles of data analysis. (pg 6, 7)

## **2. Behaviorism dismissed in favor of Generativism: Chomsky and the birth of Modern Generative Linguistics.**

Chomsky abandoned virtually all of the building block structuralist views, including both the discovery procedures and the need for direct observation, early on (see, for example, Chomsky 1955/1975). Chomsky later reflects on this, by saying,

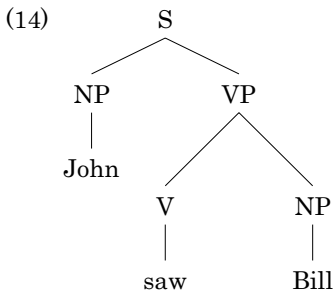
By 1953, I came to the same conclusion [as Morris Halle]: if the discovery procedures did not work, it was not because I had failed to formulate them correctly, but because the entire approach was wrong... [S]everal years of intense effort devoted to improving discovery procedures had come to naught, while work I had been doing during the same period on generative grammars and explanatory theory, in almost complete isolation, seemed to be consistently yielding interesting results. (1979: 131)

Ludlow notes that Chomsky dismissed the need for observability, which was particularly evident in Chomsky's early theories involving generative syntactic theory, which employed the unobserved (abstract) theory of *transformations*. For example, Chomsky, 1965, initially divided grammar into two levels of abstract representation: "deep structure" and "surface structure". Ludlow explains that surface structures represented licensed output structures (the sentence we produce and comprehend) while deep structure representations were generated by a

context free phase structure grammar — that is, by rules of the following form, where S stands for sentence, NP for noun phrase, VP for verb phrase, etc. (Ludlow, forthcoming: 2). The following examples are borrowed from Ludlow.

- (13)  $S \rightarrow NP VP$   
 $VP \rightarrow V NP$   
 $NP \rightarrow \text{John}$   
 $NP \rightarrow \text{Bill}$   
 $V \rightarrow \text{saw}$

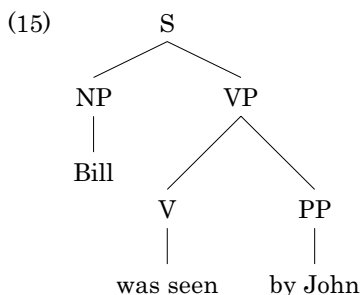
These rewriting rules then generated linguistic representations of the following form.



For Chomsky, the objects of analysis in linguistic theory were the abstract (unobserved) phrase markers (projections), and not the terminal strings of words (the observed markers)(Ludlow, forthcoming: 3). This of course is nearly opposite to the earlier structuralist view, where in fact the terminal strings were the required starting point of any kind of linguistic inquiry.

Transformational rules then operated on these deep structure representations to yield various surface structure representations. So, for example, the operation of passivization would take a deep structure representation like (14) and yield the surface structure representation (abstracting from detail) in (15).





In Chomsky's early work then, the two underlying representations, (14) and (15), are linked by way of a transformational rule, and are abstractly associated to the surface output string listed in (16).

(16) Bill was seen by John

As we can see, Chomsky took a very different approach to linguistic analysis than the preceding structuralists. He allowed for unobserved elements in the investigation, he virtually ignored the importance (or relevance) of the terminal output strings (observed data), and he instead relied on the (unobserved) intuitions and judgments of native speakers.

In essence, Chomsky seemed to have completely freed the study of linguistics from virtually any kind of constraints, at least in the development of theories of syntax. This unrestrained approach soon had an undesirable impact, however, where abstract grammars proliferated rapidly, with seemingly no overt controls. To combat this, according to Ludlow,

Chomsky [...] made a distinction between the descriptive adequacy and the explanatory adequacy of an empirical linguistic theory [...]; if a linguistic theory is to be explanatorily adequate it must not merely describe the facts, but must do so in a way that explains how humans are able to learn languages. (Ludlow, forthcoming: 4)

Ludlow further notes that Chomsky thereupon acknowledged the need for elegance through simplicity, showing concern for the rapidly increasing number of uncontrolled grammars appearing on the linguistic horizon for a variety of languages, and noted that while they

may be descriptively adequate, when taken in isolation, they almost by definition would fall short of explaining how they related to any other language, and even more crucially, failed to provide a reasonable explanation regarding how these languages were learned (in other words, each of these grammars arose as separate "theories" of structure, and were not unified in any specific way to show how they may all be in fact describing something that is fundamental to all languages, or that in some way all languages are fundamentally related, underlyingly).

Chomsky, 1964, 1965, first attempted to stem the tide of the proliferation of unrestricted grammars by introducing *conditions* on transformations, which could be seen as *constraints* on movement. Power was shifted from transformation to the phrase structure rules, and later, through Jackendoff's X-bar theory of grammar, 1981, these too were streamlined. Work in the early 1980s led to a further reduction of constraints, and a complete abandonment of transformations altogether, resulting in Chomsky's 1977, 1981, suggestion of a single rule, "move- $\alpha$ ", which, when taken alone, allowed for unrestricted movement of anything to anywhere.

(17) Chomsky's Universal Rule of Syntax

move- $\alpha$

Naturally, this too had to be constrained. However, it was clear that the rule was both elegant in its simplicity, and adequate in its explanatory power for a great number of formerly complex descriptions of linguistic phenomenon in a wide number of languages.

Work done by linguists on a variety of different languages determined that the "move- $\alpha$ " rule could be applied to a wide ranging number of structures, and required similar, but not identical constraints, suggesting that languages differed by how these constraints were employed, ordered, and prioritized, within a given language, thus leading towards the development of the "Principles and Parameters" framework of generative grammar. Ludlow suggests that the parameters approach represented a pre-wired box that had

numerous switches, which allowed, or disallowed, "current" to flow in one direction or another. Depending upon the language, some switches were activated, others not, and the order of activation itself was varied from language to language, though ultimately, the same basic pre-wired box was universally shared by users of all languages.

Above, we have noted that one of Chomsky's driving goals is to unearth the universal core of grammar, but in the literature of linguistics, just what exactly is a language universal, and what is a universal grammar (and whether these two concepts are indeed related) are often quite confusing questions at best, and frequently outright contradictory at worst. So, before proceeding, borrowing from Skaer, 2005, I will try to characterize what it is I understand these terms to mean.

In general terms, a linguistic universal is a descriptive statement about the property of language that holds true for all languages. One of the most commonly cited examples here is that 'all languages have both consonants and vowels'. Further, universals may be either *absolute*, where the statements apply to all languages, or *implicational*, which suggests that if one feature exists in a given language, then by implication, it suggests another related feature must also be present. For example, for absolute universals, we again can say that all languages have consonants. For implicational universals, if a language contains nasalized stops (such as /b̃/, /k̃/, /g̃/, etc.), we assume by implication that the language also contains nasals (such as /m/, /n/, /ɲ/, etc.). There are at least two other ways that we can view universals (based on Magnus, 2001), from a linguistic-functional perspective, which relate more to the idea of Chomsky's Universal Core, or basic Universal Grammar.

#### (18) Two Types of Universals

1. Some universals are innate (internalized general cognitive capabilities). They are part of any communication system that is used to convey information orally by human beings. These consist of most of the usual things that we think of when we

think of a language grammar from the linguist's point of view. These have to do with the form and nature of the message—essentially, the mathematics of its presentation (the rules (principles and parameters) of language).

2. Some universals are *imposed* (from external sources), and may differ somewhat from one cultural milieu to another. These may come in the form of physical limitations, such as the nature and state of the vocal apparatus, the maturity of the individual, externally imposed conditions (such as social criteria marking contrasts and declinations for things like color, time, and so forth). These have to do with real-world attributes of the message; the body that processes it, and the social milieu that engenders it—essentially, the biologies that are employed governing and constraining the presentation (the organic components of language transmission).

Innate universals express human capacities, while imposed universals are conditions of overt form, and they "arise as a result of function or language usage." (Magnus, 2001). Going back to phonology, then, we still have language universals such as "all languages have consonants and vowels", and "the syllable canon CV is favored." However, other linguistic tendencies, which correspond to issues such as ease of articulation, minimization of energy, and so forth, are better characterized as being related to imposed universals, limitations that result from the system in which they are produced. So, from a biological point of view, a string of consonants with no intermediary vowels will violate basic abilities for the human vocal apparatus to produce. In simple terms, not all notes can be played as easily in one order as in another—the more difficult ones to play (using the human vocal system), violate the restrictions controlled by imposed universals.

### **3. Generativism directed towards minimalism.**

Chomsky, 1995, 2000, has recently suggested an approach to syntactic research based on the notion of parameters (discussed above),

in what is now known as the "minimalist program". Ludlow maintains that the main idea behind the minimalist program has been the working hypothesis that

the language faculty is not the product of awkward and unpredictable evolutionary development (there is no redundancy, and the only resources at work are those that are driven by "conceptual necessity.") Chomsky, 1995, initially seemed to hold that in this respect the language faculty would be unlike other biological functions, but more recently Chomsky, 2001, seems to be drawn to D'Arcy Thompson's theory that the core of evolutionary theory consists of physical/mathematical/chemical principles that sharply constrain the possible range of organisms. In this case, the idea would be that those principles not only constrain low level biological processes but also that such factors might be involved with higher level functions as well — even including the human brain and its language faculty. (Ludlow, forthcoming: 5)

As suggested above, I myself have drifted in this same direction over the last three or four years, in my study of phonology, noting the real world physical constraints on speech production in discussions of casual speech processes, first language acquisition, and adult speech errors.

It might be useful here to make a small detour to elaborate slightly on D'Arcy Thompson's unique view of the world in general, and of evolution in particular. Thompson was emphatic that his ideas on evolution were just that: ideas—and not meant to represent the richness of a theory such as espoused by Darwin, but at the same time, perhaps warranted further investigation. With that in mind, according to Wilding et al, 2005, Thompson was a minimalist at heart, believing that all life, or organic forms, conformed to physical and natural laws, and these laws both determined and constrained the static and dynamic functioning of the organism. He felt common principles of form and function transcended all organic forms, though shied away from suggesting any underlying philosophical import of these

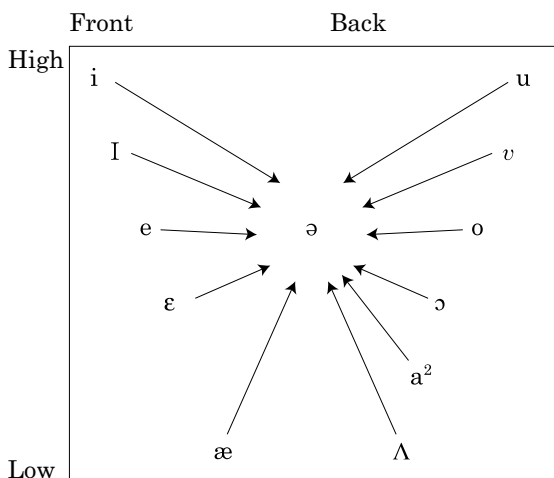
observations. "Thompson observed that there [are] only a few generic shapes which nature keeps using, and that these shapes are greatly modified by slight variations in their physical and chemical environment during growth and development" (Wilding et al, 2005, 3). Thompson also noted that forces of tension, compression and shift occurred in all living structure and influenced growth, function and form (cf. Wilding, et al, 2005), observing that living organisms treated *strain* (the result of stress) as an inducement for change, growth, and, adaptation—where the growth was of course constrained by the natural physical limitations of the host organism. The notion of the body's "architectural constraints" also is noted by Chomsky, 2005, where he says

the rules constraining embryonic development, almost entirely unknown, interact with other constraints imposed by the general body plan, mechanical properties of building materials, and other factors in restricting possible changes of structures and functions in evolutionary development, provide architectural constraints that limit adaptive scope and channel evolutionary patterns. (pg 5)

At this juncture, I would like to consider some issues in phonology that relate to the question of architectural constraints, explanatory theory and cognitive planning. Recently, work by Kirchner, Skaer, Goldstein and others have shown that much of what we produce in the form of actual speech is not only a result of phonological planning, but is in no small way constrained by the physical architecture that produces it. The architecture itself will in fact set up at least qualified predictions as to what sounds might be favored universally, and why, as well as what kinds of sequences may predominate, again, from the perspective of the constraints imposed evolutionarily on the vocal apparatus itself, the mechanical complexity and sophistication of the speech apparatus, and so forth. In this respect, related issues such as force, displacement, energy and so forth play a role in the natural productions that follow from the speech apparatus. Notice, however, that most of these constraints are physical, and as such, have no place

in the traditional abstract architecture of cognitive planning, or phonology. This fact has become recognized as something of a limitation in some areas of phonological inquiry, and has to some suggested the inherent limitations of an approach to language production study that by definition must circumvent real-world occurrences and structures, while at the same time attempt to provide a true and accurate characterization of how and why we speak the way we do. To illustrate this point from a phonological perspective, is it a coincidence of phonology (planning), or biological impositions, in common casual speech reductions, as discussed in Skaer, 2001, that all vowels reduce to schwa in unstressed and de-stressed environments, as depicted in (3)?

(19) Vowel Neutralization Illustration



As I argued in 2001, the explanations for (19) are more physiological than phonological. Issues related to these, that place understanding phonology closer to biological and other physical science issues are factors such as displacement, articulatory effort and articulatory cost (see Kirchner, 1998, and Skaer, 2001, 2004). The notion, articulatory cost (COST), for example, provides an explanation as to why certain phonemes are likely to appear before others in the emerging child's

phonology, and is comprised of both planning (phonological) aspects, as well as production (physical, biological and neurological) aspects.

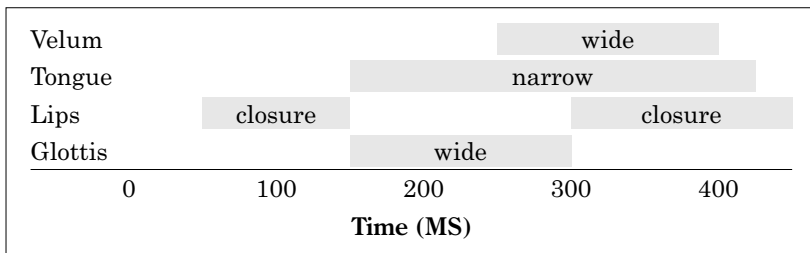
(20) Articulatory Cost – COST (ranked low to high)

low vowel (1) > mid vowel (2) > high vowels (3) > stops (4) > fricatives (5) > nasals (6) glides (7) > liquids (8): where low COST is favored over high.

This in turn leads to questions concerning the formation and delivery of the sound "chunks" themselves. From the days of structuralism on, phonemes have been the lowest denominators of the prosodic hierarchy, made up of matrices of binarily represented features. However, as I pointed out in Skaer, 2003, our speech of course is not a series of discrete units, but rather a smoothly flowing stream of sound, which as linguists, we have seen fit to slice up into easily identifiable discrete "frozen" units of representation. By doing so, however, I suggested that we overlook key features that are involved with the downstreaming aspect of human speech, where physical properties of inertia, displacement, energy and so forth all come into play to produce a given speech sequence. As I showed in several ways, the things that we represent by discrete units are in fact interconnected with other parts of the prosodic unit, and have beginnings and endings that fall outside of our normal methods of representations. See, for example, the gestural score of an utterance of the word "palm" (from Skaer, 2003).

(21) Gestural Score for the Utterance "palm"

Input String: /pam/





This illustration clearly shows that there is significant overlapping of gestures in the production of the monosyllabic English word "palm". In my 2003 discussion, I go on to note that one gesture triggers others in coordinated and predictable ways. We can as a result bring some understanding beyond what the *planning* (phonological) perspective allows us to the idea of how features spread, and why, such as in spreading, or assimilation of the nasal feature onto a vowel which is followed by a nasal consonant.

Considering once again Chomsky's present undertakings, the minimalist program, Chomsky suggests that there are two levels of linguistic representation, characterized by Ludlow as the following: The minimalist program includes

PF (phonetic form) and LF (logical form), and a well-formed sentence (or linguistic structure) must be an ordered pair  $\langle \pi, \lambda \rangle$  of these representations. PF is taken to be the level of representation that is the input to the performance system (e.g. speech generation) and LF is, in Chomsky's terminology, the input to the conceptual/intentional system. Since language is, if nothing else, involved with the pairing of sounds and meanings, these two levels of representation are conceptually necessary. A minimal theory would posit no other levels of representation. (Ludlow, forthcoming: 5)

Most recently, Chomsky, 2005, has suggested an even more minimal perspective, reducing "move- $\alpha$ " to the single concept, "Merge". He characterizes this in the following way:

An elementary fact about the language faculty is that it is a system of discrete infinity. Any such system is based on a primitive operation that takes  $n$  objects already constructed, and constructs from them a new object: in the simplest case, the set of these  $n$  objects. Call that operation Merge. Either Merge or some equivalent is a minimal requirement. With Merge available, we instantly have an unbounded system of hierarchically structured expressions. [...] there are two subcases of the operation of Merge.

Given A, we can merge B to it from outside A or from within A; these are external and internal Merge, the latter the operation called "Move," which therefore also "comes free," yielding the familiar displacement property of language. (Chomsky 2005: 11, 12)

(22) Chomsky's Universal Rule of Grammar

MERGE

Chomsky, 2000, earlier notes that the concerns of the minimalist program are to keep the number of principles constrained, not just to satisfy economy constraints, but to better facilitate the embedding of linguistics into theories of language acquisition, cognitive psychology, and perhaps most importantly, general biology.

I must admit that while I found little in the "move  $\alpha$ " approach to language grammar that lent itself to the field of phonology (other than the fact that a Universal Core Grammar need not be flushed out in discrete detail, but thought of more as *propensity* towards change, which in turn, had to be constrained, or restricted, as needed, by both general and specific language constraints), I am struck by the immediate applications of MERGE for phonological applications. In fact it reminded me specifically of ideas that I considered in describing assimilation processes, ideas that revolved around the key parameters of "attraction", "repulsion" and "trigger" mechanisms (see Skaer 1999). For example, given a prosodic domain, segments dominate syllables, and when in conflict, the requirement on a part (the segment) preempts the requirement on the whole (the syllable)—this, I believe, is very similar to Chomsky MERGE from within, given the restrictions the metaphor obviously places on itself by relocating it within a phonological perspective. For phonology, this can be rewritten as a kind of "force of attraction", for operations such as assimilation.

(23) Prosodic Domain:

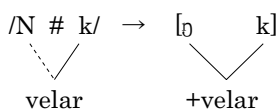
The force of attraction is stronger in a smaller domain than in a larger domain.

This force can also be seen as a force resistant to change. An

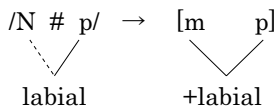
assimilatory situation is one where two adjacent segments have conflicting specifications, and the specification of one unit overrides that of the other. Thus, the features of left- and right-edge segments of base or root morphemes have dominance over the weaker affix morpheme unit, thus requiring the relevant edge segment of the affix morpheme to undergo some sort of assimilation. For Optimality Theory (OT), this is characterized by right and left alignments, which trigger regressive and progressive assimilations.

(24) Regressive Assimilation Examples

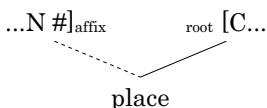
a. incorrect



b. improbable



(25) English Nasal Place Assimilation



This allows for the complete underspecification of nasals in English, leaving place unspecified, which is completely natural, since place determination is entirely dependent upon place features of the segment at the left edge of the root. In other words, the smaller unit in the given prosodic domain, the prefix, has attracted the feature of the less dominant, larger unit in the domain.

Once again returning to our thread of discussion concerning Chomsky and evolution, Chomsky denies the claim that language (as studied by the linguist) is a social object, and adopts the perspective that it is a natural object. But what kind of natural object? Since children acquire their linguistic competence without serious formal training and indeed with impoverished or at least inconsistent data,

Chomsky hypothesizes that there must be an innate language acquisition device which accounts for this competence, a question I considered in Skaer, 2005. According to Chomsky, the task of the linguist is to learn the initial state of this device, and to determine the possible parametric variations of the device that are brought about by exposure to linguistic data. This is another allusion to the pre-wired box available to the child at birth, which the child learns parametric "switch" settings for as he or she goes about the task of learning his or her first language. Chomsky, 2005, indirectly sheds more light on this pre-wired box. He notes that we have "instincts to learn" and that we can

think of these mechanisms as organs within the brain, achieving states in which they perform specific kinds of computation [...] they change states under the triggering and shaping effect of external factors, more or less reflexively, and in accordance with internal design. (pg 5)

This thesis has led to controversy—indeed, it has come to be at the center of recent innateness debates. The debates have turned on whether language acquisition requires a dedicated language faculty or whether "general intelligence" is enough to account for our linguistic competence. As Ludlow notes, Chomsky (with the pre-wired box in mind) considers the "general intelligence" thesis hopelessly vague, and argues that generalized inductive learning mechanisms make the wrong predictions about which hypotheses children would select in a number of cases. Consider the following two examples from Chomsky, 1975.

(26) The man is tall.

(27) Is the man tall?

Chomsky observes that confronted with evidence of question formation like that in (26)-(27) and given a choice between hypothesis (H1) and (H2), the generalized inductive learning mechanism will select (H1) (i.e., the child will favor H1).

(H1) Move the first 'is' to the front of the sentence

(H2) Move the first 'is' following the first NP to the front of the sentence

Of course, based on (26) and (27) it is impossible to determine which hypothesis is favored. However, given (28), Chomsky states that children will select (H2), since in forming a question from (28) they never make the error of producing (29), but always opt for (30).

(28) The man who is here is tall.

(29) \*Is the man who here is tall?

(30) Is the man who is here tall?

Chomsky notes that this is true despite the fact that the only data they have been confronted with previous to encountering (28) is simple data like (26)-(27). Chomsky's conclusion is that whatever accounts for children's acquisition of language it cannot be generalized inductive learning mechanisms, but rather must be a system with structure-dependent principles/rules. In effect, one has to think of the language faculty as being a domain-specific acquisition module.

But, wait a minute, did we just not witness a rather crucial argument, indeed, a critical fact of language learnability upon which Chomsky has at least in part based his minimalist theory, on real world datum (an actual child's production, as opposed to his usual abstract verification through native speaker intuitions)? Or, more simply, has he not inserted direct observation to substantiate his hypothetical claim?

As stated, clearly the crucial evidence Chomsky cites in the last example concerning learnability theory, is by definition idiosyncratic, and is in fact of the form that must have been directly observed—something that he apparently rejected in his dismissal of structuralism. This brings us to a point that many Chomsky advocates misunderstand; where while Chomsky does indeed advocate reliance on speaker-intuition based judgments to determine grammatical structure, he does allow, rather crucially, for validation of such structures, in terms of learnability, through direct observation of learner's data, which of course by general definition are actual speech

samples obtained from actual speakers. So, we see both observation of the ideal speaker, through abstraction of speaker intuitions, but also direct observation of children's speech to confirm the ramifications of at least some of these intuitions.

#### **4. Syntax and Phonology different branches of the same tree?**

So what does Chomsky have to do with phonology? Both everything and nothing, I suggest. Clearly, the study of phonology predates Chomsky by hundreds if not thousands of years. Just as clearly, going back to the recent past, to Bloomfield's time nearly a century ago, we saw some of the pioneers in the field of phonology at work, including, in the 1920's and 1930's in particular, Trubetzkoy and Jakobson. Their early investigations into the structure and order of the phonological system was grounded at least in form by the structuralist movement, and rarely crept above the first (phonemic) level of linguistic observation. Following these linguists, decades of research were conducted in similar fashion, beginning with the prime constituents, the phonemes, and devising elaborate rule-based schema to produce representations of observed phenomena. Essentially, the structure of phonemes first, morphemics second and on up, as characterized in (3) above, was maintained until such a view of linguistics was dismissed by the coming of Chomsky, and his across the board dismissal of the structuralist movement. However, in some aspects phonology was not as quick a convert to the modern generative movement as syntax, in no small part due to Chomsky's own tamperings in the field.

From the advent of Chomsky, there were, however, clearly new dimensions introduced into the field of phonology. Introduced by Chomsky, the notions deep and surface structure survive in one form or another to this day, in the form of the dichotomy between phonemes and allophones, morphemes and allomorphs, for just two of many examples. The ideas of competence (linguistic knowledge) and performance (linguistic output) also carry over to the present day. And

indeed, the abstract idealized structure of phonology has reigned supreme over data-based phonetic (structuralist) approaches to cognitive planning of speech.

Even so, in phonology, the idea of a system essentially built up, from its prime constituent parts into a rich prosodic structure, was maintained well past the time transformations had replaced rules in syntax. In reality, a concept similar to, but not yet the same as, transformations, drove phonology, sharing the same basic concept of a one-to-many principle, where the base structure consisted of a limited number of constituent primes, and through a system of rules (in phonology) or (transformations) in syntax, we were able to generate a potentially infinite number of surface outputs. As we noted, however, in the field of syntax, Chomsky recognized early on that such a system created an unrestrained proliferation of transformations, in a sense overwhelming the simplicity of the system, and thus calling for imposed restraints, in the form of constraints on transformations, later reducing transformations to a single movement, which was later constrained as necessary to fit language specific parameters.

However, such realigning of the newly empowered (deregulated?) field of phonology was not as quickly forthcoming as it was in syntax. In fact, Chomsky himself, along with his cohort Morris Halle, teamed up to produce one of the most significant, if not misguided, works on English phonology to date, The Sound Pattern of English, in 1968. Many see this work (and I still can't understand the singularity of the word "Pattern" in the title), as an effective tombstone to structuralism though not recognized by others as such until in some cases decades later, demonstrating by its limitations, and its obtuse characterizations of the English stress system in particular, that once and for all structuralism was indeed dead—though of course this was not the intended impact.

Following the rule-based approach to characterizing phonology, we gradually saw the emergence of constraints to restrict various operations that seemed to generally apply in a variety of similar

situations. This allowed greater cross-linguistic explanatory power, greater generalizations in the direction of universal grammar, and shared tendencies across languages and across language groups. It also allowed for more elegant descriptions of language specific phenomena, such as the characterizations of the past tense and plural forms of English, as discussed in Skaer, 1995, 1999. The advent of constraints allowed for the minimization, and later elimination, of ordering of rules, though even in the present day version of constraint-based Optimality Theory, there is still a need for the ordering of constraints, if not rules, in bleeding and feeding relationships, which suggests that some of the old building layers of structuralism must be preserved, at least in some form.

It was really not until the late 1980's that phonology formally began working itself away from the rule-based grammars, with works that preceded the first stages of the development of OT theory, such as by Itoh, 1986, Goldsmith, McCarthy and others. In 1991, I made my own contributions to this development, offering a discussion of the prosodic structure of the mora *and* the syllable in Japanese within a constraint-based theory of grammar. This I later summarized in my article on word games in Japanese (Skaer, 1994).

From the early if not mid 1990s on, most, if not all, work in modern generative phonology was cognizant of OT, and constraint theory, if not wholly consumed by it. Many of the residual effects of the Chomskyan revolution, however, were (and in many cases still are) steadfastly maintained. Distinctions were blindly maintained between phonetics (the study of speech *execution*) and phonology (the study of speech *planning*) as characterized in Skaer, 2002, 2003. Behind this maintenance of distinctions was the axiom Chomsky adhered to from early on; namely, that our investigations into language, as linguists, should not focus specifically on observed data, but on the form of language that represents the idealized output, which in syntax is judged intuitively as acceptable or not. Phonologists have maintained this idealized conception, but I think that this perhaps may not be the



best way to handle the subject, at least with our present knowledge of the system.

It is at this juncture that I suggest that phonology and syntax may no longer necessarily be two branches of the same tree of generative linguistics. Clearly, as I have demonstrated in my most recent papers on casual speech, child language acquisition, Universal Grammar and Language Universals, there is both a benefit and need to bridge the gap between intention and product, between knowledge and performance, and between abstraction and realization—ideas contrary to Chomsky's generative view of the world.

## **5. Conclusion. Modern Phonological theory: (time for a) return to structural/behaviorism?**

As I have noted above, even Chomsky does not deny the importance of real world data, and though he suggests that he will not let such data control his theory of language production, but only allow it to act as a kind of confirmation of its efficacy, I would counter that by doing so, he is in fact allowing actual datum to play an active role in the formation of his theories. And I suggest that nothing less should be expected in the study of phonology, and that in fact, due to the nature that phonology does seem to me more grounded in the natural world of observable occurrences, it may make even more sense to give allowances for, and even provide for, the interaction and integration of some aspects of the physical engineering of the output, while studying the cognitive engineering that goes into producing such output. While I am not suggesting a new theory of language development or production nor am I suggesting a reversion to structuralism, I am suggesting that perhaps it is time that we pause to consider whether we are availing ourselves of all the possible tools, and employing all the possible strategies, that we need to elegantly and accurately characterize the way we speak, the way we learned to speak, and the way we think. Clearly, our thinking about the world has certainly evolved since we first adopted the tools still presently in use in the

study of phonological phenomena.

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1 This paper was originally written to serve as an introduction to a collected volume of ten articles by the author on the subject of phonology, published over the last decade. It was further developed to serve as the opening lecture, presented in April 2005, for the Hiroshima Linguistics Forum 2005-2006 series of lectures. I thank all participants in the Forum audience for their valuable and instructive feedback. I also wish to thank two anonymous reviewers for their useful suggestions on stylistic improvements. Of course I take full responsibility for any errors that remain in this text.

2 Please note the symbols /a/ and /ɑ/ are used in free variation in the International Phonetic Alphabet, contrary to the suggestion of one anonymous reviewer: they both refer to the same sound in English, the vowel which you would commonly hear in the word "cot." Since /ɑ/ is accessible on any keyboard, I prefer it to the other.