

## Studies in Compensatory Lengthening: Introduction

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However difficult it may be to find relevant evidence for or against a proposed theory, there can be no doubt whatsoever about the empirical nature of the problem. We stress this fact because the problem has so often been misconstrued as one of 'taste' or 'elegance.' (Chomsky and Halle (1968:331))

Present-day phonology enjoys, and in some ways is burdened with, several formalisms generally referred to as "Non-linear" or "Non-segmental" phonology. Here we shall begin by reviewing some general principles of the autosegmental theory and of the theory of the syllable in order to set the stage for highlighting some of the issues dealt with by the phonological studies contained in this volume.

*The Sound Pattern of English*, the work that set the ground rules for generative phonological theory, had virtually no formalism to offer for the representation and manipulation of prosodic features such as pitch and length. Chomsky and Halle note:

"Our investigations of these features have not progressed to a point where a discussion in print would be useful" (1968:329).

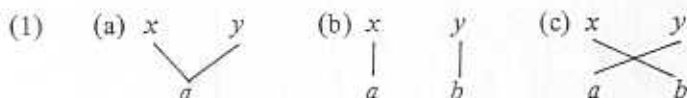
The exclusion of the proper representation of prosodic phenomena from linear phonology was particularly the result of one theoretical assumption in particular, identified by Poser as the "Bijectivity Constraint" (1982:122).<sup>1</sup> As stated by Poser, the bijectivity constraint insures that to every segment there corresponds exactly one feature specification, and conversely, that every feature specification corresponds to exactly one segment. Indeed, the application of this constraint prohibits the partial deletion of a segment or the insertion of an incomplete feature bundle, operations that would give rise to segments that fail to contain *exactly* one specification for every feature. Also, it disallows representations in which single feature representations are shared by two or more segments, or where a single segment is associated with two feature specifications, as in

the case of high and low tonal melodies corresponding to a single segment, or cases where a feature specification is not associated with any segment at all.

The autosegmental theory of Goldsmith (1976) is basically an enrichment of linear phonology, since it removes the bijectivity constraint. A further assumption of the autosegmental theory concerns the special status assigned to autosegments. While in linear phonology specified features are functionally non-distinct from one another, in the autosegmental theory they may be assigned different functional roles as autosegments by being represented at a separate tier. Finally, while in linear phonology derivations are exclusively based on rules, the autosegmental theory is enriched with the mechanism of association whereby autosegments link to segmental units provided they observe the minimal well-formedness condition of Goldsmith (1976), which stipulates that association lines may not cross. The most generally accepted version of the non-crossing constraint may be formulated as follows:

In a well-formed representation of associations, for any unit  $x$  and  $y$  of a designated level, if  $x$  precedes  $y$  then no unit associated with  $x$  can follow a unit associated with  $y$ .

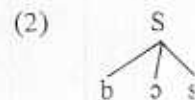
This formulation correctly allows (a) and (b) below while ruling out (c).



Summarizing we can say that autosegmental theory has the following characteristics.

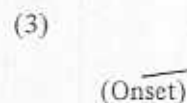
- (i) Rules and representations need not obey the bijectivity constraint.
- (ii) Special autosegmental status may be assigned to features.
- (iii) Autosegments associate with the units of the segmental core, observing certain universal and language-specific constraints.
- (iv) Additionally, all the basic principles of linear phonology that do not contradict (i)–(iii), above, are assumed.

An interesting extension of the autosegmental theory is observed in what may be called the "syllable theory" of which there are currently several versions. In Kahn (1976), the syllable is represented as a higher node which has as its direct constituents the units of the segmental core. As in the case of autosegmental associations, the relation of the segmental core to the syllable tier is not governed by the bijectivity principle, thus allowing the ambisyllabic representation of segments as members of two units of the syllable tier:



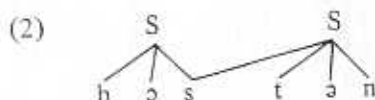
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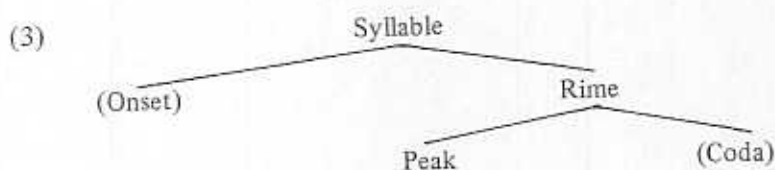
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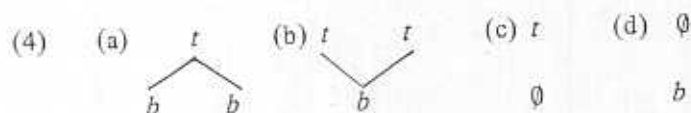


It should be emphasized that the analogy between the autosegmental associations and Kahnian representation of the syllable is only partial, since in (2) above the lines only indicate constituency relations, as opposed to autosegmental associations, which characterize a segment or a string of segments with a particular specification. Interestingly enough, syllable theory, like autosegmental theory, incorporates the well-formedness condition which excludes the crossing of association lines, while allowing ambisyllabic representations, which are generally disallowed in constituency relations.

There have been two general lines of development built on the syllable theory of Kahn (1976). One of these proposes to assign an internal hierarchical structure to the syllable, along the lines argued for by Kuriłowicz (1948), Pike (1967), Halle and Vergnaud (1980), etc., whereby every syllable is composed of an (optional) onset and a rime, the latter containing a peak and a (optional) coda as in (3) below.



The other line of development takes its roots in the incorporation of timing units in the phonological representations. As suggested by Thráinsson (1978), McCarthy (1979), and others, segmental units are dominated by differentiated timing units, designated as C's and V's, which correspond roughly to consonantal and vocalic segments. This idea of a differentiated timing tier is further developed by Clements and Keyser (1981, 1983), who incorporated it into a theory of the syllable. The association relation between the units of the timing and segmental tiers may be said to be analogous to the relation between segmental units and autosegments in that neither relation is constrained by the bijectivity principle.<sup>2</sup> Therefore, the representations in (4) below, where *t*'s represent timing units and *b*'s stand for bundles of features, are well formed.



Typically, (4a) represents contour or complex segments, with a timing unit being associated with two bundles of features. The graph (4b) represents ordinarily a long segment, *i.e.* a single feature bundle occupying two slots on the timing tier. The situation with (4c) and (4d) is somewhat different. Although representations such as these are allowed both underlyingly and derivationally, it is usually assumed that there are post-derivational constraints that rule out both unfilled timing slots ("empty" C's or V's) and segmental units that are not assigned such slots ("un-timed" or "floating" features).

Although the emancipation of non-linear phonology from the bijectivity principle has made possible to conduct some quite interesting research, the present theory has yet seriously to address itself to the task of answering the following two-part question:

- (5) What are the formal and substantive universals of non-linear phonology regarding
- (i) the organization of different tiers, internally and with respect to one another,
- and regarding
- (ii) the rules, principles and parameters that relate different tiers to the segmental core, and possibly to one another.

It is in the context of these questions that the analyses presented in this volume gain in significance. Here, compensatory lengthening, or rather, compensatory effects in general is not simply a topic of interest in itself, but a context in which such questions as (5) may be addressed on empirical grounds. Although the articles in this volume do not support a consensus on the issue of formal and substantive universals of phonology, they provide substantially rich empirical material that may pave the way towards a better understanding of the theoretical issues at hand.

One of the unsolved issues of syllable phonology, for instance, is whether or not timing units are inherently differentiated as C's and V's. The issue, of course, is of an empirical nature. If it can be shown that there are independent phenomena crucially bearing on differentiated timing units, we will be led to believe that differentiated timing units are among the substantive universals of phonological theory. In the present volume, Clements, Kornfilt, Michelson, and Sezer argue in their respective articles that this is indeed the case. Their arguments are straightforward. Rules that normally require a consonant in their contexts treat unfilled timing units as consonantal. In such cases, the generality of the rule in question can be preserved if relevant timing units are assigned a C status.<sup>3</sup>

Another non-trivial issue in autosegmental phonology concerns the

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internal representation of tiers. Ongoing research in this topic supports the position that class tiers mediate between the timing tier and the individual features. In the present volume, Mascaró, and Walli-Sagey independently argue for intermediary tiers representing points of articulation, which may be referred to by rules. Mascaró recognizes intermediary tiers, such as the palatal, labial, and alveolar tiers. He predicts, depending on the point-of-articulation properties of underlying segments (and the extension of the assimilation rule), different compensatory effects for different dialects. Walli-Sagey further addresses the recalcitrant question of how many distinct tiers should be distinguished and how exactly they are related to one another. On the basis of a study of complex segments, she defends an organization of distinctive features within articulator tiers, these being themselves individually linked to timing units.

From the studies in this volume taken collectively it becomes rather evident that there is a set of phonological processes which may be generically characterized as "compensatory effects" of which compensatory lengthening is a special case. In non-linear phonology, the treatment of compensatory effects does not require special rule types. Independently motivated processes of deletion, dissociation, and reassociation sanctioned by the principles outlined above interact to directly account for such cases.

On the other hand, it is as yet far from clear how compensatory effects are to be restricted, or, to phrase it differently, how universal and language-specific stipulations interact in determining the exact nature of compensatory effects. Thus for example, compensatory lengthening is bidirectional in Kinyarwanda (Walli-Sagey), and in LuGanda (Clements), but it is directional and syllable based in Turkish (Kornfilt and Sezer). Mascaró shows that diphthongization as a compensation for the loss of a timing unit happens only if the result is a well-formed diphthong. Kay and Lowenstamm argue that compensatory lengthening of a vowel is possible only when gemination of the consonant adjacent to the lost segment is not allowed in a language. According to Bichakjian, languages normally evolve towards earlier acquired features. Therefore, distinctive vowel quantity can be introduced into a phonological system only when it replaces a feature that children acquire even later. With this evolutionary principle Bichakjian explains why compensatory lengthening produced long vowels in Latin, but failed after all to introduce quantity in Old and Early Modern French. Rialland presents evidence showing that in Modern French the compensatory lengthening of a consonant through the deletion of schwa is crucially dependent on a sonority hierarchy. Further empirical research will hopefully contribute to a better understanding of the principles and parameters that determine the limits of compensatory effects both universally and specifically.

Also, the autosegmental representation of length should lead so naturally to compensatory changes, that the non-occurrence of this type of phenomena in historical phonology would be an embarrassment to the autosegmental theory. An examination of the historical origin of the compensatory-lengthening cases discussed in this volume and elsewhere<sup>4</sup> seem to reveal that vowel lengthening is most easily obtained if the segment which is lost is a sonorant (although other cases are not infrequently attested). This observation however, if it turns out to be valid at all, is not necessarily explained by considering it a property, or better a tendency, that is specific to compensatory lengthening. Especially in the descriptive framework of autosegmental phonology, within which assimilation is treated as a combined process of feature spreading and deletion, just like compensatory lengthening, one might expect that the relative ease with which sonorous segments give rise to long vowels is just one manifestation of a general property of assimilation: the smaller the contrast between adjacent segments, the greater the likelihood of complete assimilation. Similarly, one might expect that compensatory lengthening occurs more readily in accented than unaccented syllables. This follows from the fact that compensatory lengthening preserves the integrity of the timing tier and consequently also the weight of the rime. Since the preferred locus of the accent seems to be a heavy syllable<sup>5</sup> it is only natural to expect languages to keep their accented syllables heavy (cf. Pope 1952:206). Also, since the weight of the rime plays a much more prominent role in the phonology of the world's languages than the weight of syllable onsets (see especially Hyman, 1985), it is to be expected that the loss of a coda segment more frequently triggers compensatory lengthening than the loss of an onset segment. Therefore, what at first sight seem to be factors favoring or disfavoring the production of compensatory lengthening processes might on closer examination turn out to represent mere manifestations of more general constraints or principles. Nonlinear phonology, because it represents a rather different descriptive model as compared to the standard linear one, could prove to be a fruitful heuristic framework within which these and similar questions can be more profitably explored. One hypothesis about the origin of compensatory lengthening which has been put to proof in this volume is the one defended by de Chene and Anderson (1979). According to these authors compensatory lengthening is always the telescoping of a historical sequence of events involving the transformation of a coda consonant into a glide and the subsequent monophthongization of the derived diphthong. This hypothesis, which is given only passing treatment in most of the studies contained in this volume, is more directly dealt with by Poser, who carefully examines Japanese data bearing on this issue. The picture which very clearly emerges is that this hypothesis cannot be maintained.

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Finally, we would like to highlight some of the formal principles advocated and motivated in the studies of this volume. As stated above, the papers in this volume do not represent a consensus on the issue of phonological representations. Most of the authors have couched their analyses in the descriptive framework set out by Clements and Keyser (1983). As we saw, in this model the prosodic (syllabic) information is encoded in the skeleton and the syllable tier, which connects to the functionally differentiated skeletal positions by way of a "flat" structure. Universal principles and language specific properties determine the possible links between the syllable and CV tiers as well as those between the CV tier and (subparts of) the segmental tier. To the extent that the number of tiers increases, the amount of possible geometries increases. Constraints are needed to rule out configurations which lack empirical or theoretical justification. As for various well-formedness conditions on the representations within syllable theory, Wetzels proposes a Nuclear Fusion Principle, which excludes adjacent identical tautosyllabic (auto-) segments, and a Nuclear Fission Principle which excludes ambisyllabic long vowels. Another interesting suggestion is the general output condition used by Clements, Wetzels, etc. according to which single segmental units may not occupy more than two timing slots.

Clements and Sezer suggest independently that the formal universals of phonology be constrained so as to exclude what is known as the transformational rule format. As a first step, Clements formulates the following constraint:

- (6) The structural change of a phonological rule may not contain two occurrences of the same integer

Constraint (6) severely limits the power of transformational rules by disallowing the statement of copying transformations. As such, it is hopefully the beginning of a line of research which will ultimately lead to the complete elimination of the transformational format, which is, on the one hand, an extremely powerful device that predicts unattested dependent changes, and on the other hand a totally inadequate device for capturing the derivational mechanisms behind compensatory effects.

In the approach defended by Lowenstamm and Kaye, the prosodic information is encoded in a richer geometry of the syllable tree. In their model, the skeleton, which is composed of undifferentiated timing units, has a derivative status: timing units generally constitute the terminal elements of the syllable tree. Existing discrepancies (timing units may be missing) are allowed only within the limits of a universal principle which restricts the occurrence of null elements to non-branching prosodic categories. The geometry of the tree, combined with the location of the null

elements, permits the derivation of prosodic labels, which in turn determine the way in which null elements must be filled by elements of the segmental tier. As the reader will notice the predictions made by this theory are very strong, and easily testable.

It would certainly be worthwhile for future work in phonology to put the constraints and principles proposed in this volume to rigorous empirical tests, which will hopefully lead to a significantly constrained theory that will begin to make interesting claims on possible phonological properties and processes of human languages.

## NOTES

1. For various characterizations of the general representational constraints of prosodic phenomena in non-linear phonology see Goldsmith (1976), Clements (1981), and van der Hulst and Smith (1982).
2. There are, on the other hand, as it will be argued by various contributions to the present volume, general and specific constraints on the association between segmental and timing units.
3. Other proposals defend undifferentiated timing units, like Levin (1985), Kaye, and Lowenstamm (this volume), or an undifferentiated weight tier, as Hyman (1985).
4. See, for example, de Chene and Anderson (1979).
5. Compare also Murray and Vennemann "The preferred stressed syllable (in Germanic) has exactly two morae" (1983:526).

## REFERENCES

- de Chene, Brent and Stephen Anderson. 1979. "Compensatory Lengthening". *Language* 55.
- Chomsky, Noam and Morris Halle. 1968 *The Sound Pattern of English*. New York: Harper and Row.
- Clements, George. 1981. "Akan Vowel Harmony: a Nonlinear Analysis". *Harvard Studies in Phonology*, vol. 2. IULC, Bloomington.
- Clements, George and Samuel Keyser. 1981. "A Three-Tiered Theory of the Syllable". Occasional Paper #19. Center for Cognitive Science, MIT.
- . 1983. *CV Phonology. A Generative Theory of the Syllable*. Cambridge: MIT Press.
- Goldsmith, John. 1976. *Autosegmental Phonology*. Doctoral Dissertation, MIT (distributed by IULC, Bloomington).
- Halle, Morris and Jean-Roger Vergnaud. 1980. "Three Dimensional Phonology". *Journal of Linguistic Research* 1. 83-105.
- Hulst van der, Harry and Norval Smith, (eds.). 1982. *The Structure of Phonological Representations*. (Part I). Dordrecht: Foris Publications.
- Hyman, Larry. 1985. *A Theory of Phonological Weight*. Dordrecht: Foris Publications.
- Kahn, Daniel. 1976. *Syllable-based Generalizations in English*. Doctoral Dissertation, MIT (distributed by IULC, Bloomington).
- Kurđowicz, Jerzy. 1948. "Contribution à la théorie de la syllabe". *Biuletin Polskiego Towarzystwa Języko-Znawczego* 8. 80-113.

*Studies in Compe*

- Levin, Juliette. 1985
- McCarthy, John. 1981  
Doctoral Dissertation
- Murray, Robert and  
in Germanic Phonology
- Pike, Kenneth. 1967  
*Human Behavior*.
- Pope, Mildred. 1951  
Press.
- Poser, William. 1981
- Van der Hulst, F.  
*Phonological Representations*
- Thráinsson, H. 1978  
*Journal of Linguistics* 1. 2

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- Levin, Juliette. 1985. *A Metrical Theory of Syllabicity*. Doctoral Dissertation, MIT.
- McCarthy, John. 1979. *Formal Problems in Semitic Phonology and Morphology*. Doctoral Dissertation, MIT (distributed by IULC, Bloomington).
- Murray, Robert and Theo Vennemann. 1983. "Sound Change and Syllable Structure in Germanic Phonology". *Language* 59. 514-528.
- Pike, Kenneth. 1967. *Language in Relation to a Unified Theory of the Structure of Human Behavior*, 2nd ed. The Hague: Mouton.
- Pope, Mildred. 1952. *From Latin to Modern French*. Manchester: The University Press.
- Poser, William. 1982. "Phonological Representation and Action-At-A-Distance". Van der Hulst, Harry and Norval Smith, (eds.). 1982. *The Structure of Phonological Representations* (Part II). Dordrecht: Foris Publications.
- Thráinsson, H. 1978. "On the Phonology of Icelandic Preaspiration", *Nordic Journal of Linguistics* 1. 3-54.

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