Short note

The deep grammar of haute cuisine*

OLIVER RAMBURGER

According to a classic argument in linguistics, such 'paraphrases' among the names of restaurant dishes as between (1) and (2):

(1) Spinach Holstein
(2) Eggs Florentine

must be due to their derivation from a common 'deep structure', corresponding to their 'content':

(3) Poached Eggs on Spinach.

Such an argument is based on the need to avoid redundancy in the interpretive 'semantic component' — in the case of restaurant dishes, the recipe upon which the actual production of the dish will depend. Moreover, the nomenclature typified by (1), (2), and (3) is 'productive', which is to say that there is a potentially infinite class of such expressions. For example, for any well-formed string *S* included in the class, the string (4), formed by concatenating the subexpression *on toast*, is also included in the class.

(4) *S* on toast.

Such a 'language' calls for analysis in the terms of Transformational Grammar, including a recursively productive base component of rules generating underlying structures, and a transformational component which relates them to surface forms.

The base component is a Context Free Phrase Structure Grammar of a familiar form, incorporating such rules as the following:

$$\text{Dish} \rightarrow \begin{cases} \text{Material} \\ \text{Material} \quad \text{Preparation} \end{cases}$$

$$\text{Preparation} \rightarrow \text{Relation} \quad \text{Dish}$$

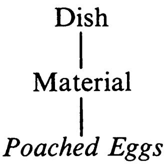
Linguistics 17 (1979), 169–172. © Mouton Publishers.

$$\text{Material} \quad \rightarrow \left\{\begin{array}{l} \textit{Spinach} \\ \textit{Poached Eggs} \\ \textit{Toast} \\ \text{etc} \ldots \end{array}\right.$$

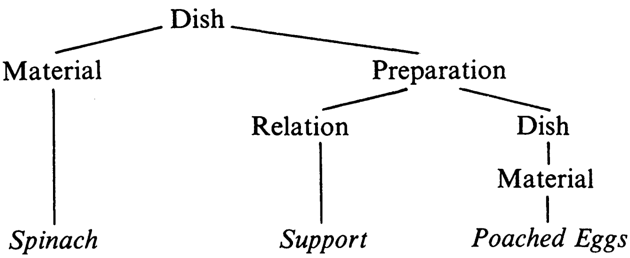
$$\text{Relation} \quad \rightarrow \left\{\begin{array}{l} \textit{Support} \\ \textit{Contain} \\ \textit{Accompany} \\ \text{etc} \ldots \end{array}\right.$$

The above rules generate such 'deep dishes' as the following:

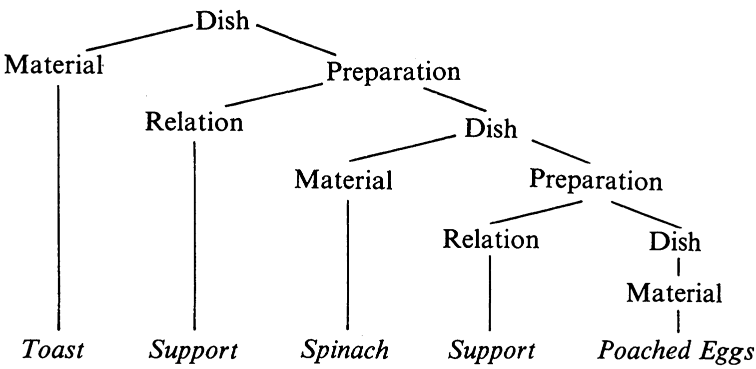
(5)



(6)



(7)



The transformational component includes such rules as the following:

PASSIVE
(Material (Relation dish)$_{\text{Preparation}}$)$_{\text{Dish}}$
→ (Dish (-*en* + Relation (*by* Material)$_{\text{Adv}}$)$_{\text{Preparation}}$)$_{\text{Dish}}$

SUPPORTING EGG REPLACEMENT
(*support* ((*Poached Eggs*)$_{\text{Material}}$)$_{\text{Dish}}$)$_{\text{Preparation}}$
→ (*Holstein*)$_{\text{Preparation}}$

SPINACH-SUPPORT REPLACEMENT
(-*en* + *Support* (*by Spinach*)$_{\text{Adv}}$)$_{\text{Preparation}}$
→ (*Florentine*)$_{\text{Preparation}}$

ON SUBSTITUTION
(-*en* + *Support* (*by* Material)$_{\text{Adv}}$)$_{\text{Preparation}}$
→ (*on* Material)$_{\text{Preparation}}$

Such transformations as the above generate Surface Structures corresponding to (1), (2), and (3) from the deep structure (6). They also generate (8) and (9) from the deep structure (7), via one and two applications of PASSIVE, respectively.

(8) Spinach Holstein on Toast.
(9) Eggs Florentine on Toast.

Of course, the rules fail to generate the anomalous strings (10) and (11), as they must.

(10) *Holstein Florentine.
(11) *Holstein Spinach.

Recently, a 'revised extended' version of the standard theory has been advanced to take account of the fact that a restaurateur who wishes to call attention to, or 'bring into focus', his spinach, rather than his eggs, (perhaps on grounds of freshness), will utter (1), rather than (2). To bring such thematic aspects of meaning within the scope of the semantic component, the PASSIVE transformation is amended to introduce an extra 'trace' element, or 'soupçon', into the 'annotated surface structures' of passivised dishes. According to Soupçon Theory, the passive transformation operates as follows, where *s* is the trace or soupçon bound to the moved constituent, or 'ingredient':

PASSIVE
$(\text{Material } (\text{Relation Dish})_{\text{Preparation}})_{\text{Dish}}$
$\rightarrow (\text{Dish } (\textit{-en} + \text{Relation } \underline{s} \ (\textit{by} \text{ Material})_{\text{Adv}})_{\text{Prep}})_{\text{Dish}}$

(Such lexical insertion transformations as SPINACH-SUPPORT REPLACEMENT are amended accordingly.)

The grammar generates such anomalies as the following:

(12) ?Eggs Holstein (= Poached Eggs on Poached Eggs).
(13) ?Spinach Florentine (= Spinach on Spinach).

Such expressions owe their anomaly to the world knowledge of the users of this language, as does:

(14) ??Chocolate Florentine.

They are therefore not a proper concern of the theory. Similarly,

(15) ?Eggs Florentine Arnold Bennett a l'Armoricaine on Toast

owes its incomprehensibility to gastronomic 'performance constraints', and is also beyond the scope of a competence theory.

Received 2 October 1978
Revised version received
31 October 1978

Theoretical Gastronomy Research Unit
Department of Psychology
University of Warwick
Warwick
Great Britain

Note

* Acknowledgement to Peter Buneman, and the members of the Theoretical Gastronomy Unit, University of Edinburgh.

Short note

Lexical economy and phonological segmentation

A. M. DEVINE and LAURENCE STEPHENS

1. Criteria for phonological segmentation in autonomous and generative phonology have been largely isomorphic (insofar as such problems have received specific attention from the latter). One new and original approach, however, has been introduced by Harms (1966, 1968). A procedure identical to that suggested by Harms has been applied to Igbo phonology by Carrell (1970), and the proposal constitutes a major portion of Hyman's (1975) discussion of segmentation in his handbook. The purpose of this note is to discuss the theoretical implications of Harms's proposal; to this end we derive a simpler and more precise formulation of the criteria and identify the modifications required if the proposal is to achieve full generality. Particular attention is given to previously unrecognized language universal claims entailed by Harms's theory concerning the interrelations among segment inventory, distribution, and frequency.

Apart from the logically basic commutation test,[1] economy, and somewhat less centrally, frequency have always been fundamental criteria. Economy has been invoked explicitly in the form of feature counting on generative MSCs and P-rules, but was also implicit in the Trubetzkoyan requirements of phonotactic generality and symmetry in the inventory of segments. (Failure to realize this led Twaddell [1939] to a mistaken criticism of Trubetzkoy's analysis of NHD [pfr] and [štr].) Attention was, apparently, first called to the implications of frequency for segmental status by Martinet (1949).

The two factors of frequency and economy are combined in a novel way with far-reaching implications by Harms for his criterion of 'feature saving in the lexicon'. This represents a quite different conception of economy: whereas traditional feature counting in rules and conditions etc., was intended to reflect such things as simplicity, generality, and naturalness, feature counting in the lexicon is intended as a measure of the cost of storing unique items. Traditionally frequency too has been treated as an independent criterion, but in Harms's proposal it functions

Linguistics 17 (1979), 173–180. © Mouton Publishers.

as a co-efficient of weighting for segment features in the formula for lexical storage cost.

2. Briefly Harms's proposal is as follows. The lexical storage cost of a segment is defined as the product of the number of features required for minimal specification of a segment times its lexical frequency: thus if a segment requires *n* features and occurs in *p* morphemes, its storage cost is *np*. Obviously the cost of a sequence $[S_1S_2]$ depends on whether it is analyzed as a cluster or as a 'qualified' segment, but in addition the cost of the 'simple' segment $[S_1]$ depends on that analysis: if the sequence is taken as a single segment, a correlation is established requiring an additional feature in the matrices of both the 'simple' and the 'qualified' segments; on the other hand if the sequence is analyzed as a cluster, two matrices must be specified in all of its lexical occurrences. When the number of features for $[S_1]$ and $[S_1S_2]$ required on each analysis is weighted according to the respective lexical frequencies, the analysis which gives the overall lower storage cost is adopted. Letting *n* denote the number of features of the 'simple' segment S_1, *m* the number of features of the 'qualifying' segment S_2, and *f* the lexical frequency, and following Harms's assumption that only one additional feature is required for the qualified segment, we have:

	unit analysis	cluster analysis
$[S_1S_2]$	$f(S_1S_2) = (n + 1)$	$f(S_1S_2) = (n + m)$
$[S_1]$	$f(S_1) = (n + 1)$	$f(S_1) = n$
Cost	$(n + 1)(f(S_1) + f(S_1S_2))$	$n(f(S_1) + f(S_1S_2)) + mf(S_1S_2)$

For a cluster the sum on the left must be greater than that on the right; for a single segment vice versa.

Such is the formula as used by Harms, yet it is needlessly complex, since the relationship between the left hand and right hand sides (which of course is the crucial factor) will remain unchanged after some elementary algebraic simplification, namely cancelling *n* on both sides. The following rules result:

for all single segments: $f(S_1) < (m - 1)\, f(S_1S_2)$
for all clusters: $f(S_1) > (m - 1)\, f(S_1S_2)$

These simplified expressions make it easier to discern the often stringent and unexpected constraints that must apply to the phonological systems of all languages if Harms's formula is to be a valid test of segmentation.[2] These are:

3.1. The frequency of a simple phoneme must always be less than $(m = 1)$ times that of its complex correlate. In other words the number of features a secondary articulation would require determines the minimum frequency of a complex articulation in relation to its simple correlate.

3.2. All clusters (sequences) must always be less than $1/(m - 1)$ times as frequent as their first members (see 4.3 below). In other words the number of features required for the second segment of a cluster determines the maximum frequency of a cluster in relation to its first element.

3.3. Therefore no 'simple' phoneme may ever be more frequent in any sequence than it is elsewhere — indeed no phoneme can be more than $1/(m - 1)$ times as frequent in this environment as it is elsewhere.

3.4. Marked phonemes are almost always less frequent than their unmarked correlates. Since the 'qualified' segment in Harms's theory would be the marked one, it will regularly be more frequent than the corresponding simple segment; thus if the 'qualifying' articulation would need only two features $(m = 2)$, the sequence $[S_1S_2]$ will always be analyzed as a cluster. It follows from this, that in languages with only one semivowel phonetically palatalized consonants will always have cluster status.

3.5. When the 'qualifying' articulation is minimally expressed by a single feature, the sequence is always a cluster because $1 - 1 = 0$. This makes a universal claim about the relationship between features and segment inventory from which it would follow that the phoneme $/t^s/$ can never exist in languages with only one sibilant. This situation is in fact more common than might at first sight appear; for when redundancy-free feature specifications are used (see Carrell, 1970), a sequence such as [kp] would have to be assigned cluster status not only in languages in which *k* is not the first member of any other consonant cluster, but also in languages in which *k* clusters also with liquids, i.e. *p* is predictable from only one feature, whereas paradoxically *kl* and *kr* would have a greater chance *ceteris paribus* of being single phonemes (see 3.8).

3.6. In cases where $m > 1$ when the marked/unmarked frequency is reversed the sequence will always be a single phoneme.

3.7. Therefore Harms's criterion is interesting only when the 'qualifying' articulation requires three or more features (and the marked/unmarked frequency relation holds).

3.8. Harms's theory also implies a functional relationship between segment frequency ratios and the size of natural classes, since the number of features required to specify a segment increases monotonically with (the logarithm of) the number of segments in its class. Thus as the number of segments with comparable distribution that can be classed naturally with the 'qualifying' segment increases, the value of *m* increases and forces the minimum value of the frequency ratio for phoneme/cluster ($\geqslant$m − 1) to increase. Conversely, the ratio simple/'qualified' ($\leqslant$m − 1) must decrease the fewer the segments with comparable distribution that can be naturally classed with the 'qualifying' articulation. This is a suggestive universal about markedness which it would be interesting to check. However, in the very specific terms in which it is stated, it could lead to apparently undesirable implications. For instance if such features as [coronal] and [anterior] are used, it would follow that the phoneme/cluster ratios would have to exceed a greater value in languages in which *t* and *k* are the only stops occurring postconsonantally than in languages in which *p* and *k* or *p* and *t* are so characterized.

3.9. For Harms's criterion to be valid, drastic revisions will have to be effected in the phonological analyses of many languages, since it is common to obtain frequency ratios $f(S_1)/f(S_1S_2)$ of five and greater, not only in cases of nasalization, but also with palatalization, labialization, aspiration, affrication, and glottalization; see e.g. Greenberg (1966: 12–24) and Sigurd (1968). Consider, for example, Telefol, for which Healey (1964) reports a lexicon frequency of 12% for /k/ and only 1% for /k^w/. Thus the labial/velar would be analyzed as a cluster on Harms's criteria. However, such an analysis would contravene the otherwise exceptionless syllable structure constraint that only a single segment is permitted on syllable margins and the phonotactic rule that /w/ does not cluster with any consonant — rules which in traditional phonological theory support monosegmental analysis.

3.10. There are also some ambiguities in the procedure. Carrell explicitly states that feature saving effected through sequence redundancy rules (MSCs) is to be used in determining the value of *m*; Harms's practice is apparently limited to segment redundancy. If the former procedure is followed the chances of cluster analysis are greatly increased; on the other hand if fully specified matrices are used single segment analysis will be much more likely.

3.11. Harms applies his criterion to classes of segments, e.g. all non-palatalized consonants together versus all palatalized consonants together; Carrell, however, works segment by segment, e.g. [p] versus [pj], etc.

3.11.1. Application of the procedure to classes of segments is not consistent with the stated objective of maximal feature saving in the lexicon. For example in Latin when long vowels and short vowels are judged as classes, long vowels are analyzed as single segments; however, when treated pair by pair, it is more economical to analyze long *u* as [uu], but the remaining four long vowels as single segments (see Devine and Stephens, 1977). This shows that pair by pair application can produce analyses in conflict with system symmetry and naturalness.

3.12. There are two further difficulties. The criterion is dependent on the feature system employed. this is not a criticism but the difficulty should be kept in mind. For example if Jakobsonian features are used English [gr] satisfies rule 3.2 above for cluster status, but if the features [syllabic] and [sonorant] are used it violates rule 3.2 — f(g)/f(gr = 2.86 (word frequency [Roberts, 1965]; note that if usage frequency is substituted, [gr] satisfies the cluster condition in any feature system — f(g)/f(gr) = 8.16).

3.13. The criterion can conflict with traditional frequency criteria. For example, not only is English [t ʃ] a cluster (with a ratio of 12.12 [Roberts, 1965]), but so is [ʃ], i.e., [sj] (with a ratio of 4.7). In support of this analysis presumably some might invoke a rule such as SPE Palatalization IV 121. Therefore in place of the single segment /č/ we would have to posit the triphonemic cluster /tsj/. But /tsj/ is 19.42 times as frequent as /nkl/, the next most frequent triphonemic cluster, 9.71 times as frequent as /hw/, the most frequent biphonemic cluster, and 1.72 times as frequent as the single segment /θ/ (word frequency [Roberts, 1965]). Traditionally this would have been taken as evidence of the segmental status of [t ʃ].

4.1. Harms's formula for calculating the lexical storage cost of the two analyses is potentially incomplete. In practice a sequence $[S_1S_2]$ would never be considered for cluster status if it did not satisfy the requirements of the traditional commutation test. This means that either the segment $[S_2]$ must exist in some environment other than S_1_____, or if it does not that $[S_2]$ can be analyzed as a contextual variant of such a segment (e.g. $[S_3]$ occurs in $X \neq S_1$ and there is a process $S_3 \rightarrow S_2/S_1$_____). Nevertheless, it is not unreasonable to expect the procedure to be adequate for and produce correct results with non-problematic segmentation decisions if it is to be a reliable guide in problematic instances. Let us consider a language not satisfying the above requirements for cluster analysis of, say, [tʃ]; it has [t], [ts] and [tʃ], but no [ʃ]. Although not common, this type of language is well attested in the literature: see, for example the Uto-Aztecan Cora (McMahon, 1967), the Dravidian Kolami (Emeneau, 1955), and the Macro-Panoan Mateco (Tovar, 1958). Cluster analysis would entail one more feature for *s* than a unit analysis would. Harms's formula must be modified to account for the fact that cluster analysis affects the feature specification of three segments but unit analysis only two: the additional cost of *s* must be added to the right-hand side (which represents the cost on cluster analysis of the above inequalities. In general when the cluster solution would create a new contrast with a third segment the inequalities will be of the form:

$$\text{for all clusters: } f(S_1) > (m - 1)\,f(S_1S_2) + f(S_3)$$

and vice versa for single segments. If this modification is not made, Harms's formula will not be in accord with traditional considerations; if it is we see that cluster analysis becomes extremely unlikely as it should be.

4.2. Depending on the feature system employed of course, the segmentation decision may have an effect on *m*, the number of features needed to specify the 'qualifying' segment. It is possible that when *m* features are required for S_2 on cluster analysis, $m + 1$ may be required on a single segment analysis of $[S_1S_2]$. In this case the increase in cost of the segment $[S_2]$ in its occurrences elsewhere must be added onto the left-hand side of the inequalities (representing the cost of single segment analysis) giving:

$$\text{cluster: } f(S_1) + f(S_2) > (m - 1)\,f(S_1S_2)$$

and vice versa for single segment analysis. The likelihood of cluster status is greatly increased; indeed in such cases the sequence will only exceptionally turn out to be a single segment.

The complete formulation of Harms's criterion will therefore take the following form:

$$\text{for all clusters: } f(S_1) + X > (m - 1)\,f(S_1S_2) + Y$$

where X represents the possible additional cost of other segments on the single segment analysis, and Y the additional cost of other segments on the cluster analysis; both of these new terms will, of course, frequently be zero, but nevertheless they must be determined for each application of the test.

4.3. Although Harms has only applied his criterion in cases where the 'qualifying' segment is the second in the sequence, there is no reason why it cannot be applied in cases where the 'qualifying' segment precedes the simple segment, e.g. prenasalization. Obviously then the test has to be run in reverse.

5. Harms has made two innovations in the assessment of frequency and distribution for decisions on segmentation. First he assumes that for frequency values the relevant comparison is that of the candidate sequence with what would be its unmarked correlate on the single segment analysis, rather than with single segments in general. Second he uses not the frequency values themselves, but the frequency values adjusted by a factor ultimately determined by inventory and distribution.

Harms proposed test turns out in fact to presuppose a claim about the universal properties of distribution and phoneme frequency and the way in which they interact (see 3.3 and 3.8 above), namely that at least for minimum and maximum limiting values the frequency ratios of unmarked and marked vary according to the inventory and distribution of segments in a language. We are not in a position to evaluate this claim, but in practice we have seen that it leads to certain undesirable results. This inclines us to think that the proposed segmentation test is unacceptable, at least in its present form, which is unrealistically prejudiced in favour of cluster status.

Received 15 September 1978
Revised version received 21 November 1978

Department of Classics
Stanford University
Stanford, CA 94305
U.S.A.

Notes

1. The criterion of commutation is not 'arbitrary' (Hyman, 1975: 97), if the logic of the procedure and its limitations are properly understood. Devine (1971) goes some way towards explaining this.
2. Hyman (1975) rightly points out that Harms's criterion involves very strong claims beyond simple feature counting, but he concentrates particularly on the implications for language acquisition and suggests as possible complicating factors frequency in usage as opposed to frequency in the lexicon and the related centrality/marginality of the lexical items containing the 'qualified' segment. These points are certainly well taken, and the limitation to lexical frequency to the total exclusion of usage frequency is always problematic. Such reservations, however, are perhaps more relevant to the larger issue of the adequacy of the generative model and indeed of many others as well. In any case there are many more immediate claims and implications involved in Harms's proposal, and the linguist need not suspend his judgment until means are found to render the broader issues less speculative.

References

Carrell, P. L. (1970). *A Transformational Grammar of Igbo.* (West African Language Monographs 8.) Cambridge: Cambridge University Press.
Chomsky, Noam and Halle, Morris (1968). *The Sound Pattern of English.* New York: Harper and Row.
Devine, A. M. (1971). Phoneme or cluster. *Phonetica* 24, 65–85.
Devine, A. M. and Stephens, Laurence (1977). *Two Studies in Latin Phonology* (Studia Linguistica et Philological 3). Saratoga: AnMa Libri.
Emeneau, M. B. (1955). *Kolami, A Dravidan Language.* Berkeley: University of California Press.
Greenberg, J. H. (1966). *Language Universals.* The Hague: Mouton.
Harms, R. (1966). The measurement of phonological economy. *Language* 42, 602–11.
—(1968). *Introduction to Phonological Theory.* Englewood Cliffs: Prentice Hall.
Healey, A. (1964). Telefol phonology. *Pacific Linguistics* B, 3.
Hyman, L. M. (1975). *Phonology: Theory and Analysis.* New York: Holt, Rinehart and Winston.
Martinet, A. (1949). Occlusives and affricates with reference to some problems of romance phonology. *Word* 5, 116–22.
McMahon, A. (1967). Phonemes and phonemic units of Cora. *International Journal of American Linguistics* 33, 128–34.
Roberts, A. H. (1965). *A Statistical Linguistic Analysis of American English.* The Hague: Mouton.
Sigurd, B. (1968). Rank-frequency distribution for phonemes. *Phonetica* 18, 1–15.
Twaddell, W. F. (1939). Review of Grundzüge der Phonologie. *International Journal of American Linguistics* 1, 62.
Tovar, A. (1958).Notas de campo sobre el idioma mataca. *Revista de Instituto de Antropología* 9, 7–18.