

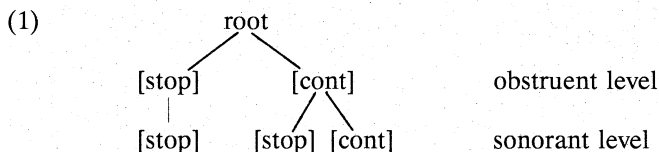
The manner node

Jeroen van de Weijer

0. Introduction

Much research in phonology in the last decade has centred around the organisation of distinctive features into feature geometries (Clements 1985, Sagey 1986, among many others).¹ However, the Manner features have by and large escaped a unified treatment: in recent proposals, features like [cont], [nasal] and [lateral] have been attached to a wide variety of nodes in the feature tree, which obscures rather than clarifies the way in which Manner characteristics are encoded in phonological segments.

In this paper I will attempt to show that the Manner characterisation of segments can be formally and insightfully represented. I assume a division between segments produced with a complete closure, which are represented with a [stop] feature, and segments produced without such a complete closure, represented as [cont]. When the oral airstream is interrupted, it can obviously no longer be modified. The only possibility is to add a second closure, necessarily at the velum, which results in a nasal segment. If, on the other hand, the airstream is not interrupted, further modification is possible. The model which expresses this is given in (1):



In such a model, Manner features such as [nasal] and [lateral] correspond to specific expansions of (1). Obstruents are represented as segments which only have features on the highest level, while sonorants require further expansion. This will be illustrated below.

The main purpose of this paper is to show that (1) embodies a calculus which generates a set of *complex segments*. Other aspects that will be touched

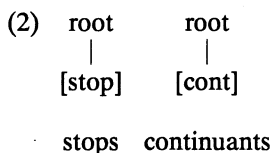
¹ I am very grateful to Colin Ewen, Carlos Gussenhoven, José Ignacio Hualde, Harry van der Hulst, Grazyna Rowicka and an anonymous *LIN* reviewer for their comments on earlier drafts. They are not responsible for the views expressed here. I would also like to thank the Netherlands Organisation for Scientific Research (NWO) for partly financing this research.

upon are *sonority* (the model in (1) permits us to define the sonority value of a segment derivatively, namely as a function of its internal structure), and the characterisation of *natural classes* of consonants.

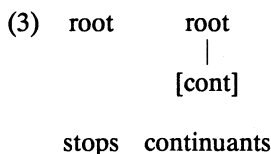
This paper is organised as follows: first, I will illustrate this model by way of the representations of non-complex consonants and comment briefly on the relation between the continuancy contrast on the obstruent level, which separates obstruent stops from fricatives, and that on the sonorant level, which, as we will see, separates laterals from rhotics (section 1). The main topic is the representation of complex segments (section 2). Finally, I briefly discuss Basque *Stop Deletion*, a rule in which Manner plays a crucial role (section 3).

1. Preliminaries: non-complex consonants

In this section I show how segments which do not involve internal branching of Manner features are represented. The discussion is limited to consonants. I assume that vowels (and glides) differ in a fundamental way from consonants: they lack Manner features altogether, and are distinct from consonants because of their Major Class specification (cf. van de Weijer 1991a). The most common and therefore arguably simplest types of consonants, obstruent stops and obstruent continuants, are represented as single expansions of the 'Manner tree':



The Manner contrast between stops and continuants might also be expressed otherwise. One other possibility is given in (3), where [stop] is underspecified:

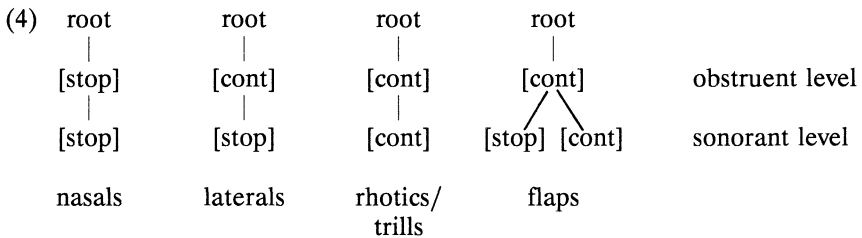


I assume that if the underlying contrast between stops and continuants should be represented in terms of absence versus presence of a Manner feature, this should be done as in (2), and not the other way around (with [cont] underspecified). Stops are clearly less marked consonants than continuants, which is

evident from facts about segmental inventories (the presence of fricatives implies the presence of stops) and child language (stops are learned first, and fricatives are replaced by stops context-freely). This might argue for treating [stop] as literally 'unmarked', that is, unspecified for Manner. However, as stops clearly also form a natural class, I assume that it is necessary to have some feature by way of which this class can be referred to. I therefore propose that the contrast is as in (2), and assume that [stop] is somehow 'marked' relative to [cont].

Sonorant segments, such as nasals, laterals and rhotics, are marked off as a class which is structurally different from obstruents: they need a further expansion under either [stop] or [cont]. Although this permits us to retain the *concept* of sonority, it makes the *feature* [son] redundant. This may be a good result, since spreading of this feature is seldom reported: under this proposal it does not exist. In this model the sonority value of a segment increases as its segmental structure becomes more elaborate (cf. Rice 1992 for a similar, and Dogil 1988 for the exactly opposite idea).

Representations of sonorants are given in (4):



In (4), nasals are represented as having two [stop] features, i.e. two complete closures, which is of course exactly right phonetically.

In this model laterals and rhotics both have a feature under [cont] on the obstruent level (henceforth the Manner features will bear a subscript 'obs' or 'son' to indicate which level is intended), and therefore form a natural class. The difference between them is one of continuancy. Following recent research (e.g. Halle and Clements 1983), I assume that laterals are [-cont] (or [stop]), while rhotics are [+cont] (or [cont]). Above I pointed out that the relation between [stop] and [cont] is such that stops are unmarked relative to continuants: the same goes for laterals versus rhotics, where the latter are more complex. For instance, Maddieson (1984:73) reports that laterals are more common cross-linguistically than rhotics.

An expansion not given in (4) is to leave [cont]_{obs} unspecified for either [stop] or [cont]. I assume that this representation is ill-formed, just as it was not allowed to leave the root node empty (cf. (3) above). The last expansion in (4) specifies [cont]_{obs} for both [stop] and [cont]. I would like to suggest that

this representation is adequate for flapped types of rhotic, which may contrast phonemically with trills, and for which a 'contour' representation has been suggested by Banner (1989), on the basis of phonetic considerations and the rule of 'flapping' in English. Hence, all possible expansions of (1) considered thus far receive natural interpretations.

Some discussion is in order with respect to the relation between the [stop] and [cont] features under the root node, and those under [cont]_{obs}. Although these are the same features, so that segments that have, for instance, a [stop] feature form a genuine natural class, under this model it is predicted that the continuancy specification of an obstruent cannot influence that of a liquid directly, such as by spreading, because there is no plane in which to spread the relevant features. That this may well be correct is suggested by the fact that in languages in which [l] and [r] are allophones of the same phoneme, the selection of the allophone never seems to be determined by the continuancy specification of neighbouring obstruents (cf. Maddieson 1984:83, Bhat 1978:71f and van de Weijer 1992 for case studies and further discussion).

A final point that should be made here is that this model predicts that nasals, which have a [stop] feature on the obstruent level, are able to cause hardening of fricatives into stops, which takes place in African languages like Kikuyu (Armstrong 1967). It is predicted that /l/ cannot have the same effect, which to the best of my knowledge is correct.

2. *Natural classes and complex consonants*

I will now turn to specific advantages claimed for the organisation I propose.

First, it is able to provide a non-arbitrary characterisation of the groups of segments which typically function together in phonological rules or constraints. Various natural classes can be distinguished. Obstruents and sonorants are structurally different. The left-hand branch of (1) groups together the nasal and oral stops (cf. Poser 1981 for cases which illustrate this natural class). The right-hand branch groups together the fricatives and liquids. The liquids themselves (which for example function as a class in syllabification and dissimilation) are defined as those segments that have a feature under [cont]_{obs}.

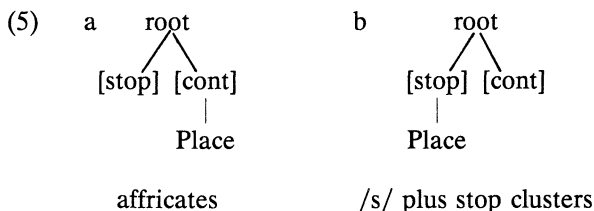
Also, it is expected that all segments that have [stop], that is, nasals, stops and laterals, can function as a natural class (cf. section 3 below). Finally, it is expected that the sonorant [stop] segments, nasals and laterals, function as a class in phonological rules. These predictions are correct, but an exemplification which would do justice to the diversity of the phenomena to be considered would exceed the scope of the present paper.

Second, the organisation in (1) embodies a calculus which generates a set of segments which have been described as 'complex' in the literature. An

algorithm of this sort is completely absent in current work in feature geometry, and I will therefore discuss this point in some detail. It will be seen that increasingly complex representations denote increasingly rare segments.

I will start by examining the representation of affricates, a class of segments non-controversially regarded as complex. It has been shown by Hualde (e.g. 1988) and Lombardi (1990) that affricates are best regarded as single segments combining the features [stop] and [cont]. Thus, these features are not two values of a single binary feature, but two independent unary features which appear on different autosegmental tiers in underlying representation (cf. section 3 below).

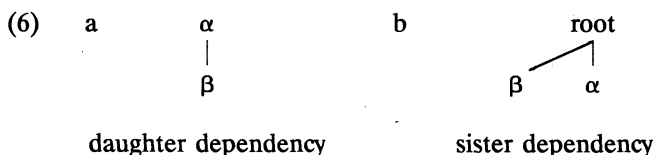
A separate question arises in such a representation of affricates, namely where Place is specified. The standard assumption would most likely be that there is a Place node, attached to the Root node, possibly via an intermediate Supralaryngeal node. A more restrictive hypothesis is possible, however. In van de Weijer (1990, 1991b) I proposed that individual Place features in the underlying representation of affricates are directly linked only to [cont]. This is intended to capture the generalisation that affricates and fricatives are typically found at the same places of articulation, either in particular language inventories, or cross-linguistically. The result is that affricates are represented as in (5a) (in (5) and below, 'Place' refers to any of the Place features, not to a node).



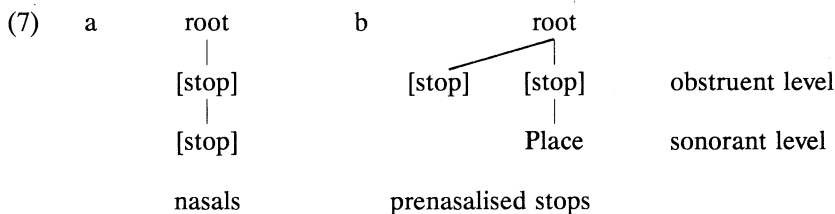
Place may in principle also be specified on the other Manner feature present, namely [stop], as in (5b). This denotes a single segment consisting of a continuant unmarked for Place, and a stop articulation that is marked for Place. This representation is a natural one for /s/ plus stop clusters, for which unit status has been claimed by a number of researchers (cf. Ewen 1982 and references cited there). Evidence consists of the widely postulated hypothesis that /s/ plus stop clusters syllabify as a single unit in English, that they only alliterate with themselves in verse, and that they are often more difficult to split up by epenthesis than regular clusters. It has also been noted that the /s/ part in such clusters is more liable to deletion than the stop part, for example in reduplication morphology (Broselow 1991). Parallels with the behaviour of affricates are discussed in van de Weijer (1991b).

I will refer to the Manner feature that carries the distinctive Place specification as the *head*, and to the one unspecified for Place as the *non-head*. Thus, in affricates, [cont] is the head, and [stop] is the non-head. Phonetic interpretation is sensitive to headedness: the head is realised last. Moreover, from this we also derive the fact that in complex segments one and only one of the Manner branches must contain a Place feature: a segment with two Manner features both dominating their own Place feature(s) would be double-headed. In a non-complex segment the Manner feature must dominate Place: otherwise the segment would not have a head. Notice that the same does not apply to vowels and glides, which may therefore be left empty for Place.

The representations in (5) are the only two possible ones combining the features on the highest level in (1). Let us now examine the lefthand branch. The representation of simple nasals was given in (4). What is the representation of prenasalised stops? Phonologically, prenasalised stops seem to consist of the same material as nasal stops, namely the features [nasal] (which is expressed here as the [stop]_{son} feature), and [stop]. In particular, there is no evidence that such segments have or acquire the feature [-nasal]. To represent prenasalised stops I will adopt a proposal of van der Hulst (1991), who argues that dependent features may be dependent in two ways: they may either be strictly dominated by their head, or the head and the dependent may be sisters, with one of them as the head. These two types of dependency may be assigned different notations, as in (6) (where α is the head and β the dependent in both cases):



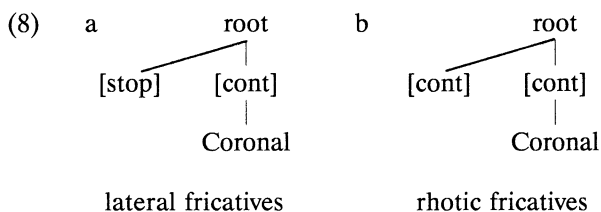
Following van der Hulst, I assume that daughter dependency expresses a close-knit phonological relationship between the features that enter into this relation, and that sister dependency expresses a looser relation. Sister dependency leads to a 'marked' segment type: in the model in (1) daughter dependency is the norm. Thus, the features [stop]_{obs} and [stop]_{son} in ordinary nasals are in a daughter-dependent relation (7a), while in prenasalised stops they are in a sister-dependent relation, as in (7b):



In (7b) the non-head Manner feature is again underspecified for Place. This is a desirable result, because the place of articulation of the nasal part of a prenasalised stop is predictable, and should therefore be left out of the underlying representation.

I should like to note that a segment cannot be prenasalised unless some Manner specification is present. Since vowels and glides are Mannerless segments, prenasalised vowels or glides cannot exist (cf. also Steriade 1991 for discussion). The representation of prenasalised stops in (7b) exhausts the range of possibilities of expansion within the lefthand branch of the Manner node, because by geometrical definition only $[\text{stop}]_{\text{obs}}$ can be head.

With respect to the $[\text{cont}]$ branch of the Manner node, the representation of simple laterals was given in (4) above, in which the head feature $[\text{cont}]_{\text{obs}}$ enters into a daughter-dependent relation with $[\text{stop}]$. These features can also enter into a sister-dependent relation. The result is given in (8a) (where it is assumed that all liquids are Coronal):

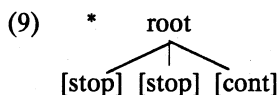


The representation in (8a) seems adequate for fricative laterals $/ɭ/$. In such segments, the part of the Manner specification that is head is the single Manner expansion of $[\text{cont}]$. Hence, the segment is expected to group with obstruent fricatives. Evidence that lateral fricatives are obstruents comes from languages like Ao (Gowda 1972), where $/ɭ/$ is classed with the obstruents in that it is able to occur in all positions in the morpheme (unlike $/l/$, which cannot appear finally). The rhotic counterparts of lateral fricatives are rhotic fricatives (8b). Such segments have also been reported, although relevant empirical material is scarce.

In (8a) both liquid types are represented with a Coronal node. It has been noted that segments like these are typically formed at a Coronal place

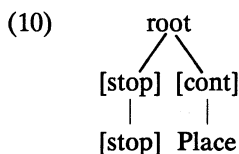
of articulation. This has been formalised by attaching the feature [lateral] to the Coronal node in the feature geometry (Levin 1988). Notice that this would be quite contradictory to the idea adopted here that Manner features dominate Place features, and not vice versa. Moreover, Shaw (1991) has shown that attaching [lateral] under Coronal makes a wrong prediction about coronal harmony systems: when in such systems Coronal spreads, [lateral] does not necessarily spread along. She therefore proposes to deal with this cross-linguistic regularity by way of a redundancy rule which makes all segments that are [lateral] also Coronal. This proposal is adopted here.

The representations in (8) exhaust the range of possibilities of complex segments under either the [stop] branch or the [cont] branch alone. It is possible, however, to combine both branches, as in affricates and /s/ plus stop clusters, and expand one of these branches. In that case there is a sisterhood relation between the features [stop] and [cont], as a result of the geometry itself. This makes it impossible for a segment to consist of [stop]_{obs}, [cont]_{obs} as well as [stop]_{son}, all as sisters. This would result in the ill-formed representation in (9):



The fact that Manner configurations like that in (9) are ill-formed is due to the fact that dependency is a relation between *two*, not three, entities: [stop]_{obs} in (9) would have to be sister to [stop]_{son} and to [cont]_{obs}.

The result is that complex segments with both [stop] and [cont] that expand one of these branches can only have a daughter-dependent feature. Adding a sonorant [stop] feature to [stop]_{obs} results in (10):

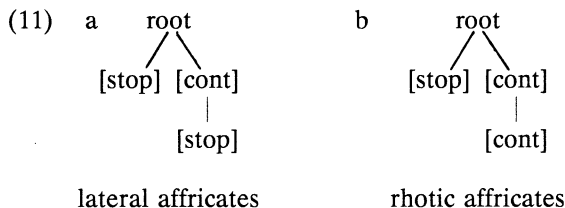


prenasalised affricates/
prenasalised fricatives

The only reasonable interpretation here is that of prenasalised affricates or fricatives. No contrast can be expressed between the two categories. This may in fact be a good result, because, as Steriade (1991) points out, (a) there are no languages which contrast the two, (b) there are languages in which the two occur in free variation, and (c) there are languages in which prenasalisation

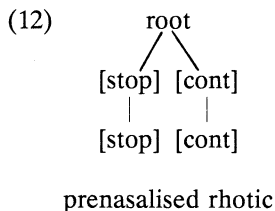
of a fricative yields a prenasalised affricate. The hypothesis in (10) that the two have the same phonological representation may therefore not be unwelcome.

Now consider possible segment types with both [stop] and [cont], and further structure on the [cont] branch, given in (11):



In (11a) the representation is of lateral affricates /t±/, which occur in native American languages such as Navaho and Tlingit, as well as others (Maddieson 1984). Again, the [cont]_{obs} may also dominate [cont] instead of [stop]. The resulting segment is a rhotic affricate (11b). Phonological evidence about such segments is scarce, as was the case for rhotic fricatives. However, in the Chilean language Araucanian, described by Echeverría and Contreras (1965), a rhotic retroflex affricate occurs, which alternates with a single retroflex stop. The language allows no clusters except for ordinary affricates and these rhotic affricates, which is reason to regard both as single segments (cf. also Key 1978:284). Similar evidence can be obtained from Melanesian languages, discussion of which would go beyond the scope of this paper.

The final kinds of complex segments generated by the theory are those which expand both branches fully, as for example in (12):



In this model prenasalised liquids are the only kinds of prenasalised sonorants permitted. In Fiji, described by Maddieson (1989), the prenasalised post-alveolar stop is sometimes realised as a prenasalised trill, so *a priori* we should not rule out this kind of segment (for the Fiji phoneme, cf. also Hockett 1955:124 and Schütz 1963). A prenasalised rhotic is also reported for Malagasy (Herbert 1986). As they are the most elaborate of the complex segments generated here, with expansion on both Manner sides, we expect

them to be the rarest. Note furthermore that (12) may also represent a prenasalised rhotic affricate, just like (10) could stand for a prenasalised fricative or affricate. A prenasalised rhotic affricate occurs in Logo (Goyvaerts 1983), where it is explicitly claimed to be a single segment on the basis of syllabic structure.

This exhausts the combinatorial possibilities present in the model in (1). For other types of complex segments, such as clicks and postnasalised stops, other resources must be found. This might involve allowing for the possibility that a single timing position can dominate two root nodes (cf. van der Hulst and van de Weijer in progress).

3. Basque stop deletion revisited

In Basque, an obstruent stop is deleted before other obstruent stops, nasals, and laterals in certain morphologically defined environments (Hualde 1988, Lombardi 1990, and others). Examples are given in (13):

- | | | | |
|------|---|------------------------------------|------------------------|
| (13) | a | bat paratu → baparatu | ‘put one’ |
| | | guk piztu → gupiztu | ‘we light’ |
| | | bat naka → banaka | ‘one by one’ |
| | | arront lapurre → arronlapure | ‘a total thief’ |
| | | ez dut Lupe ikusi → ez dulupeikusi | ‘I have not seen Lupe’ |
| | b | hitz tegi → hiztegi | ‘dictionary’ |
| | | hitz keta → hizketa | ‘conversation’ |

Notice in (13b) that the [stop] part of an affricate is also deleted, which is evidence for the representation of affricates with [stop] and [cont] features on different tiers. Although this seems a peculiar rule, it may not be unprecedented: a similar rule occurs in the native American language Luiseño (compare, for instance, Munro and Benson 1973:17, Davis 1976:199).

The Manner proposal developed here also bears on the representation of the trigger segments: we are able to define this class as a natural one, because all these segments have the feature [stop] in their representation. Exactly the same set of segments triggers ‘aspiration’ of /t/ in the Brazilian language Wayana (Jackson 1972). Finally, the Manner-Place dependency bears on the output of the Basque process: because [stop] dominates Place directly in the target segments, obstruent stops, the whole segment is deleted when [stop] is deleted.

4. Conclusion

The geometry of Manner features presented here is able to express the Manner properties of segments adequately by taking into account the airstream characteristics of segments as well as phonological considerations. It affords a non-arbitrary characterisation of natural classes like stops, continuants, etc., and divides obstruents from sonorants into two structurally different natural classes. Also inherent to the geometry is a calculus which generates a set of complex consonants and complex segment types like /s/ plus stop clusters. In this respect the proposal advanced here is a step on the way towards an integrated theory of segmental structure.

References

- Armstrong, L.E. (1967) *The Phonetic and Tonal Structure of Kikuyu*, Cambridge University Press, Cambridge.
- Banner (Inouye), S. (1989) 'The Flap as a Contour Segment', *UCLA Working Papers in Phonetics* 72, 39-81.
- Bhat, D.N.S. (1978) 'A General Study of Palatalization', in J.H. Greenberg, ed., *Universals of Human Language*, Stanford University Press, Stanford, California.
- Broselow, E. (1991) 'The Structure of Fricative-Stop Onsets', paper presented at the Conference on Phonological Feature Organization, LSA Summer School, Santa Cruz, California.
- Clements, G.N. (1985) 'The Geometry of Phonological Features', *Phonology Yearbook* 2, 225-52.
- Davis, J.F. (1976) 'Some Notes on Luiseño Phonology', *International Journal of American Linguistics* 42, 192-216.
- Dogil, G. (1988) 'Phonological Configurations: Natural Classes, Sonority and Syllabicity', in H.G. van der Hulst and N.S.H. Smith, eds., *Features, Segmental Structure and Harmony Processes I*, Foris, Dordrecht.
- Echeverría, M.S. and H. Contreras (1965) 'Segmental Phonemes of Araucanian', *International Journal of American Linguistics* 31, 132-35.
- Ewen, C.J. (1982) 'The Internal Structure of Complex Segments', in H.G. van der Hulst and N.S.H. Smith, eds., *The Structure of Phonological Representations II*, Foris, Dordrecht.
- Goyvaerts, D.L. (1983) 'Some Aspects of Logo Phonology and Morphology', in M.L. Bender, ed., *Nilo-Saharan Language Studies*, African Studies Center, Michigan State University.
- Gowda, K.S.G. (1972) *Ao-Naga Phonetic Reader*, Central Institute of Indian Languages, Mysore.
- Halle, M. and G.N. Clements (1983) *Problem Book in Phonology*, MIT Press, Cambridge, Massachusetts.
- Herbert, R.K. (1986) *Language Universals, Markedness Theory, and Natural Phonetic Processes*, Mouton de Gruyter, Berlin.
- Hockett, C.F. (1955) *A Manual of Phonology*, Indiana University Press, Bloomington.
- Hualde, J.I. (1988) 'Affricates are not Contour Segments', *West Coast Conference for Formal Linguistics* 7, 143-57.
- Hulst, H.G. van der (1991) 'The Molecular Structure of Phonological Segments', Ms, University of Leiden.

- Hulst, H.G. van der and J.M. van de Weijer (1992) 'Two-Root Complex Segments', in progress, University of Leiden.
- Jackson, W.S. (1972) 'A Wayana Grammar', in J.E. Grimes, ed., *Languages of the Guianas*, Summer Institute of Linguistics, Norman, Oklahoma.
- Key, M.R. (1978) 'Araucanian Genetic Relationships', *International Journal of American Linguistics* 44, 280-93.
- Levin, J. (1988) 'A Place for Lateral in the Feature Geometry', Ms, University of Texas at Austin.
- Lombardi, L. (1990) 'The Nonlinear Organization of the Affricate', *Natural Language and Linguistic Theory* 8, 375-425.
- Maddieson, I. (1984) *Patterns of Sounds*, Cambridge University Press, Cambridge.
- Maddieson, I. (1989) 'Prenasalized Stops and Speech Timing', *Journal of the International Phonetics Association* 19, 57-66.
- Munro, P. and P.J. Benson (1973) 'Reduplication and Rule Ordering in Luiseño', *International Journal of American Linguistics* 39, 15-21.
- Poser, W.J. (1981) 'Nasal Stops and Nasal Fricatives', Ms, MIT, Cambridge, Massachusetts.
- Rice, K.D. (1992) 'On Deriving Sonority: A Structural Account of Sonority Relationships', *Phonology* 9, 61-99.
- Sagey, E.C. (1986) *The Representation of Features and Relations in Non-Linear Phonology*, Doctoral dissertation, MIT, Cambridge, Massachusetts.
- Schütz, A.J. (1963) 'A Phonemic Typology of Fijian Dialects', *Oceanic Linguistics* 2, 62-79.
- Shaw, P.A. (1991) 'Consonant Harmony Systems: The Special Status of Coronal Harmony', in C. Paradis and J.-F. Prunet, eds., *The Special Status of Coronals: Internal and External Evidence*, Phonetics and Phonology, Vol. II, Academic Press, San Diego.
- Steriade, D. (1991) 'Closure, Release and Nasality', paper presented at the Conference on Phonological Feature Organization, LSA Summer School, Santa Cruz, California, to appear.
- Weijer, J.M. van de (1990) 'Basque Affricates and the Manner-Place Dependency', Ms, University of Leiden, to appear in *Lingua*.
- Weijer, J.M. van de (1991a) 'Towards a Theory of Phonological Complexity', in F. Drijkoningen and A. van Kemenade, eds., *Linguistics in The Netherlands 1991*, John Benjamins, Amsterdam.
- Weijer, J.M. van de (1991b) 'The Manner-Place Dependency in Complex Segments', Ms, University of Leiden (paper presented at the Phonology Workshop of the LSA Summer School, Santa Cruz, California), submitted for publication.
- Weijer, J.M. van de (1992) 'Continuancy in Obstruents and in Liquids', Ms, University of Leiden.