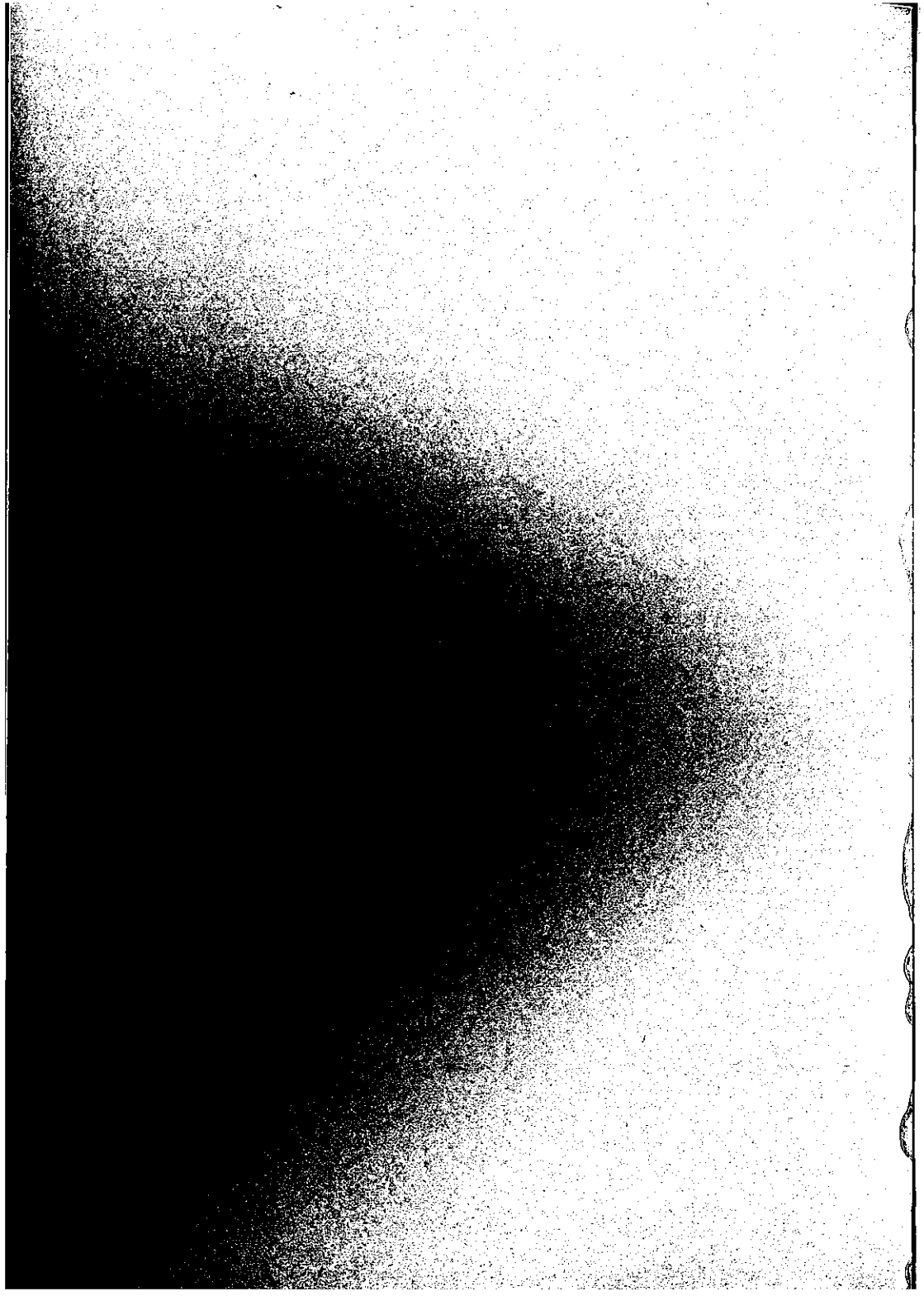

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Preface

This is the fourth volume of Wellington Working Papers in Linguistics reporting on work done by people associated with the Department of Linguistics at Victoria University. The theme for this volume is phonology and morphology.

The papers by Gavin Carr and Matthew Scott are revised versions of work they did in their honours year in 1991. Lisa Matthewson completed an MA in Linguistics at Victoria University in 1991 on non-concatenative morphology, but her paper in this volume represents more recent work in the field that she has been doing at the University of British Columbia. Laurie Bauer's review has formed the basis of seminars at the University of Leeds in 1989 and at Victoria University in 1991, but has never been published.

If there is a common theme to this collection of papers, beyond their very broad subject area, it is the excitement that being at the theoretical work-face brings. We see here people looking for 'better' descriptions of data than have hitherto been available; 'better' either in that they are more accurate, or in that they account for more data more neatly (the two are, of course, not mutually incompatible). Each of the students' contributions considers new data in the light of the latest theoretical perspectives; it is a tribute to the work of the three students that they are able to reach that point so early in their academic careers. It is part of the fascination of Linguistics that even after thousands of years of the study of language, such progress is still possible.

Review of John Kelly & John Local, *Doing Phonology*, Manchester & New York: Manchester University Press. 1989. Pp. viii + 286.

Laurie Bauer

Doing Phonology is the title of a new and potentially revolutionary phonology book by John Kelly and John Local from the University of York. It is intended as a book showing how Kelly and Local 'do' phonology and thus — by implication — how others might do it. This essentially personal view is one of the strengths of the book: it manages to avoid the usual phonological topics of rule ordering, feature systems, notational conventions for rule abbreviation, abstractness and so on, because they are irrelevant to Kelly and Local's view of phonology. But this emphasis on doing is the source of a number of the main disadvantages of the book, which I will look at first.

I understand that Kelly and Local provided camera-ready copy to the University of Manchester Press (which does little to explain the £25.00 price tag). Unfortunately, they were not able to set the complex phonetic notation that they require for their book. As a result, they wrote the phonetic strings out by hand (by two different hands, actually) and pasted the transcriptions into the appropriate places in the text. They try to make a virtue of this necessity, saying that this is the kind of material that the working phonologist has to come to terms with, but it is very messy, and at times virtually impossible to read. The book would be better, not worse, if the phonetics was also type-set (assuming that it was accurately done).

This is probably the only book in academic linguistics which has neither a bibliography nor an index. The lack of a bibliography is a cheat in some ways, since they do refer to other works in the text (e.g. p. 50), and they have simply not collected this material together. They appear to be trying to deny their academic forebears in a way which, ultimately, is not helpful. Perhaps they were embarrassed by how few people they'd cited, and realised that others had written on some of these areas, but that can only be speculation. The lack of the index is a nuisance for the phonologist or phonetician who, having read the book once, wishes to go back and find material on a particular topic. It cannot be found from the table of contents in a cluttered text.

It is not clear who this book is for, apart from Kelly and Local themselves ('On the whole it is written for ourselves, to put our work in perspective, take stock, and see where we have got to.' p. 1). It is not a textbook for undergraduates — not only because of the lack of academic

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impedimenta referred to above, but because it is densely written and really needs a tape to accompany it, and because it really presupposes greater phonetic sophistication than students in our department for example could ever hope to gain in the courses we offer. I shall illustrate this later. Neither is it aimed at mainstream phonologists, most of whom (I suspect) will ignore it as another piece of British crankiness, next to which Firthian phonology looks sound and clear. Perhaps only those unaligned phonologists who are already convinced of the importance of phonetics in phonological analysis will ever find here the kind of approach they are looking for. Yet at the same time, this may be the only extant textbook in Prosodic Phonology (in the Firthian sense): it certainly develops London School approaches and even overtly recognises its academic origins (p.4) in the work of Firth.

I suppose the main claim of the book is that phonology cannot be seen and dealt with simply as redundancy-free phonetics. Indeed, time and again Kelly & Local provide evidence which casts doubt on the notion of the phoneme as a viable phonological unit (and the morphophoneme, in whatever guise, is simply not in contention in this book). Rather, they would claim, phonological analysis is impossible without an extremely detailed auditory analysis of the phonetics of utterances. Only after very close observation and detailed recording, they would claim, does one have any chance of perceiving what is phonologically relevant. I want to take a few of their examples to illustrate this point, and I have chosen examples based on English, though they deal with languages such as Welsh, Malayalam, Polish, Igbo, Dutch and many less familiar languages as well.

The crucial feature that I come away from their book with is what they call **resonance**. Resonance is defined as 'those features of consonants which are the auditory concomitants of configurations of the oral cavity and/or movements of the tongue other than those which relate to the principal articulation' (pp.72-3). In other words, or in more traditional terminology, resonance refers to a characteristic secondary articulation, usually over a 'domain' in an utterance larger than the segment. However, the more traditional terms of palato-alveolarised, palatalised, velarised, uvularised etc. (see e.g. Laver 1980) do not divide up the domal secondary articulations finely enough for Kelly and Local, and they use palatalised, clear, half-clear, central, half-dark, dark and velarised, which they write as on p. 73.

		ə̇	ə	ə̄		
ç	ꞔ	C	C	C	ϵ	-ϵ

First of all, I want to take an example that Kelly & Local use to illustrate the kind of observation they feel is necessary in phonology. They do not comment on, but I shall, the kind of implications for phonology that this observation has. They speak of the way many speakers of English pronounce the sentence *This shop's a fish shop.* They point out that even when speakers have post-alveolar friction at the end of both *this* and *fish*, the lip-rounding (which in English is a typical concomitant of a post-alveolar fricative) begins later in *This shop* than it does in *fish shop*, and reaches its maximum degree much later in the sequence in *This shop* than it does in *fish shop*. Here, say Kelly & Local 'this difference reflects the difference in phonological status between the ('assimilatory') palatality at the end of *this* and the lexically relevant palatality at the end of the word *fish*' (p. 38). Notice the contrast here with the statement in Gimson (1962: 271) that '/s/ → /ʃ/ before /ʃ, j/, e.g. *this shop, this year*'. The Gimsonian type of statement is seen to be an over-simplification in the light of Kelly and Local's fairly simple observation, and possible a vital over-simplification. A fortiori, any phonological system which uses distinctive features can only reflect the kind of statement made by Gimson, since no phonological/phonetic features can take into account the kind of detail that Kelly and Local note. Furthermore, there are implications here for the whole issue of neutralisation. Typically, we might expect phonology books to tell us that the contrast between /s/ and /ʃ/ is neutralised before /ʃ/, but Kelly and Local make the point that 'underlying' /s/ and /ʃ/ can still be distinguished in this environment. This kind of observation seems to be be being made more and more often about instances of neutralisation (e.g. Dinnsen, 1985). In his review of *Doing Phonology* Lass (1990: 1066) says 'We should at least be forced to record the kind of detail K & L advocate before we ever claim neutralization or merger'. Given the claims about NZ English that I and others have propagated in the past (e.g. Bauer, 1986: 247), this is clearly an important point of principle in the overall context of NZE studies, too.

Now let's consider a simple case of merger, where resonance plays a part. Speaking of the English of East Anglia, Wells (1982: 338) states that 'Yod Dropping is certainly variable; but it is not at all unusual for there to be homophony in pairs such as *do-dew* /dʉː/'. Kelly and Local transcribe in some detail three potential minimal pairs as spoken by one native of East Anglia (p. 139).

do	dəʉ	*dew*	dəʉ̣
food	fəʉd	*feud*	fᵊʉd
boot	b̆əʉt	*Bute*	bᵊʉt

Notice first of all the vowels are variable but distinct in all cases. For this speaker at least, therefore, there is no homophony. But secondly, note that the term 'yod-dropping' is an inaccurate one for this speaker. What is involved is not so much dropping as redistribution, so that the palatality of the /j/ is spread over the whole of the syllable instead of being limited to the syllable onset. Note that it is the syllables which are distinct; the phonemic notion that a contrast can be isolated at a single point of contrast does not seem to apply in this particular instance. In Chomskyan terms, there is no condition of linearity in the representation. In autosegmental terms, the 'absolute slicing hypothesis' fails here. We can

see here how the underlying theoretical notion of Firthian prosodies (or even autosegmental tiers, if that isn't the same thing) is being applied in real language description.

As a third example, I shall take the case of Manda, a five-year old Yorkshire child whose speech was recorded over several months by an undergraduate student (an amazing achievement for an undergraduate). To the casual observer, Manda seemed to be one of those children who cannot distinguish /r/ from /w/. A segment such as a rounded voiced bilabial approximant might occur in her speech corresponding to either adult /r/ or adult /w/. However, more detailed observation suggested two things. Firstly that the range of possible exponents of adult /r/ was different from the range of possible exponents of adult /w/, so that the phones realising adult /r/ and adult /w/ were overlapping sets. In Chomskyan terms, absolute invariance is not met in Manda's speech. Secondly, and more interesting, I think, is that the distinction between adult /r/ and adult /w/ was being maintained not only in the glide, but elsewhere in the syllable.

ring	ʋ̠ɯŋ̊ɟ	*wings*	ᵒw·ɪŋgʑ̊ᵊ
rich	ʋ̠ɪ̈ˀtɕ	*witch*	w·ɪ̠ˀtʃ
room	ʋ̠ᵊü:m	*whoosh*	w:ᶱʉ:ʃ

Again the absolute slicing hypothesis of phonemic and generative phonology is shown to be false, again linearity is breached, again we see contrasts being assigned to syllables (actually to longer structures, going even beyond the word, although that is not illustrated in the examples given here) rather than to segments. Kelly and Local conclude that most descriptions of child language are 'vitiated because they do nothing more than simply elevate an impoverished, broad transcription to phonological status' (p. 262). In the light of their own examination, one can only agree with them.

Doing Phonology challenges the phonologist by presenting analyses which clearly make sense in their own terms (and indeed make more sense than some of the alternatives that have previously been offered) and yet cannot be presented within the normal phonological frameworks. The phoneme has taken a lot of bashing since the early 1960s, but here it is bashed from a very different angle. Notions of neutralisation are questioned. The treatment of the so-called *do-dew* 'merger' in East Anglia clearly has sociolinguistic implications and implications in terms of how languages might 'change back' to an earlier form. Perhaps most controversially, there is a strong implication (if not more than that) that any worthwhile phonology is going to be done by practitioners whose phonetic skills are far greater than the ones we have been used to: indeed, they are going to have to be greater than those shown by many phoneticians. That is a sobering thought.

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On Heads in Morphology and Syntax

Gavin Carr

1. Introduction

Some of the most interesting recent work in morphology has been the extension of notions of headship into the morphological domain. Within words, the argument goes, there are elements which define and characterise the whole word in just the same way that heads do in compounds and in syntactic phrases. In a word like *happiness*, for example, since *happy* is an adjective, and *happiness* is a noun, and since in fact all *-ness* words are nouns, then we can argue that it makes sense to describe *-ness* too as a noun, and as the head of the word, so that the part of speech of *happiness* follows from the noun-ness of its head. Features like noun-ness percolate up from heads to higher levels within the word, just as features percolate up syntactic structures.

This is (at the most basic level) the notion of head put forward in Williams (1981), Lieber (1981), and Selkirk (1982). These papers differ on a number of the details — whether in general heads are the rightmost or the outermost affix; whether inflectional affixes can be heads; how percolation works; etc., but the basic idea is the same[1]. Heads are now most often taken to be the rightmost (derivational) affix on a word, the so-called Righthand Head Rule (RHR) of Williams (1981). Most authors would recognise that this is insufficient for large numbers of languages, and that even in languages for which it generally holds (like English) there are systematic exceptions (for example, the verbalising prefixes *en-* in *enthrone, entomb* and *de-* in *delouse, devalue*).

Just how well motivated these morphological heads are remains questionable. Zwicky (1985) points out that they are largely unprincipled, since they are motivated solely in terms of their category percolation effects, and these are simply stipulated. Similarly, Bauer (1990) demonstrates that a large number of other properties which syntactic

[1] This is clearly overly simplistic, but for our purposes it is probably sufficient. Williams (1981) in fact argues that inflectional affixes can be heads, which Lieber (1981) and Selkirk (1982) disagree with. This leads (most clearly in Di Sciullo and Williams (1987)) to a more relative notion of head, in which a word can have multiple heads, defined in terms of particular features. The more mainstream view, and that followed here, is that inflectional affixes cannot be heads, and that there is only one head of a word.

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heads have are inapplicable or yield unexpected designations of head when they are applied below the word level.

As far as I am aware these criticisms have gone largely unanswered. But in some ways the impact of these notions of headship has had more to with the kinds of implications they have for morphology than with the strength of their theoretical base. What is so attractive about morphological headedness is that it argues for the existence of principles applicable across both the morphological and the syntactic domains; it suggests that principles already motivated in the syntax can be meaningfully incorporated into a theory of word-formation. In other words, it raises questions about the place of morphology as a whole which may not be entirely compatible with the strongest versions of the Lexicalist Hypothesis[2].

It is in this context that some of the latest and most interesting work in this area is to be placed. Rochelle Lieber's latest work (1992) follows through on the kinds of questions that morphological heads raise for the Lexicalist Hypothesis. In her words, her work is an attempt to outline 'a theory of word-formation based on the premise that there is no separate component of morphology in the grammar' (1992: 1). Her main thesis is that all morphological processes can be made to follow from the principles of Government and Binding syntax, and that a separate morphological component is unnecessary.

As one would expect, morphological headedness occupies a central position within her theory. Lieber argues that morphological heads resemble syntactic ones because they are governed by a single set of headedness parameters. She predicts that heads at the phrasal level and heads at the sub-lexical level will always correspond.

This paper is essentially an examination of Lieber's theory of headedness, and an extension of her language analyses to some further language data. In section 2, Lieber's proposals are presented in some detail; sections 3 and 4 examine data from two non-Indo-European languages (Basque and Babungo) in the light of these proposals; and section 5 uses these and Lieber's own analyses to examine some of the issues raised by her proposals.

2. Lieber on Heads

As has been said, Lieber's thesis is that headedness is defineable in X-bar terms, and that in both the syntax and the morphology it is the result of a

[2] The Lexicalist Hypothesis states (in various forms) that syntactic rules and principles may not refer to (or modify) the internal morphological structure of words. This is normally taken to imply the disjunction of the sets of rules governing syntax and morphology, and hence their existence as separate components of the grammar.

single set of principles in the grammar. That is, languages choose particular settings for the positions of heads, and these settings give rise to word order in the syntax and in compounds, and to the order of bases and (derivational) affixes in word-formation.

Lieber (1992: 33) presents her theory of headedness in terms of a reformulation of X-bar theory to apply both above and below the word level. Foundational to her development of these ideas are two main papers — Stowell (1981), on X-bar theory; and Travis (1990), on headedness parameters.

Stowell (1981: 87) notes the following constraints as the foundations of X-bar theory:

(1) a. Every phrase is endocentric.
b. Specifiers appear at X" level; subcategorised complements appear within X'.
c. The head always appears adjacent to one of the boundaries of X'.
d. The head term is one bar-level lower than the immediately dominating phrasal node.
e. Only maximal projections may appear as non-head terms within a phrase.

Lieber (1992: 34) recasts (1a) and (1d) in terms of the familiar X-bar template:

(2) X^n -> ... X^{n-1} ...

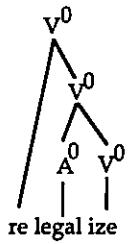
and then argues (1992: 37) for the following revisions to the template and to (1e) to allow the inclusion of lexical forms (that is, X^0) within the X-bar formalism:

(3) a. X^n -> ... $X^{\{n-1,n\}}$ ... ; recursion allowed at least for n=0[3]
b. Pre- or post-head modifiers may be X^{max} or X^0.

These two revised X-bar constraints allow complex words to have structures like (1992: 37):

[3] Note that (3) allows for the possibility of recursion at other levels (such as X'). Lieber prefers recursion at X^0 over the extension of levels to negative X^{-1}, X^{-2} etc., as Scalise (1984) and others have suggested (see 1992: 35-37). In actual fact (3) does not strictly exclude these negative levels (perhaps stipulate that n>=0).

(4)



Stowell's constraint (1c), which Travis calls the Head Initial/Final Parameter, is in many ways the most critical to Lieber's reformulation. It is in this context that Travis (1990) makes a crucial contribution to Lieber's thinking. Travis argues that Stowell's head initial/final parameter is too strong, in that there are languages which seem to have head-internal VPs. Travis suggests (1990: 265) that this constraint can be replaced by three parameters: direction of theta-marking; direction of case assignment; and a default headedness parameter. These can be defined in such a way, however, that only a single parameter needs to be set to describe all head position possibilities (1990: 275). She argues that languages like English simply set the headedness parameter. For English this is set to Initial, since all elements of the VP follow the verb. Chinese, on the other hand, has objects and argument PPs following the verb, but adjunct PPs to the left. In this case, Travis suggests that the direction of theta-marking parameter would be set to Right, and that this would imply a headedness parameter setting in the opposite direction (ie head Final otherwise). Kpelle is different again, having the object preceding the verb, but all PPs (argument and adjunct) following. Here Travis sets the direction of case assignment parameter to be Left (for the object), again implying a headedness setting in the opposite direction (ie default headedness Initial).

Lieber takes these arguments one step further. She distinguishes (following Stowell 1981[4]) between three classes of non-head element in X-bar theory — complements, specifiers, and modifiers. Using these classes, she goes significantly beyond Travis' position, arguing (1992: 35):

[4] Whether Stowell considers modifiers to be a class of the same order as complements and specifiers is unclear (cf his (1b) above). Modifiers are certainly less general, typically occurring only with Ns.

> Since it is possible for specifiers and modifiers to appear on one side of the head, and complements on the other (as in the case of English ...), or for specifiers to occur on one side of the head and both complements and modifiers on the other (as in the case of French ...), it appears that in fact we need three separate Head Initial/Final parameters, one concerning the position of complements, a second concerning the position of specifiers, and a third concerning the position of modifiers.

Lieber thus defines the following set of headedness parameters, which she terms Licensing Conditions (with her complement parameter (5a) defined exactly as in Travis (1990)):

(5) Licensing Conditions
- a. Heads are initial/final with respect to complements and adjuncts.
  - i. Theta-roles are assigned to the left/right.
  - ii. Case is assigned to the left/right.
- b. Heads are initial/final with respect to specifiers.
- c. Heads are initial/final with respect to modifiers.

(Lieber 1992: 35)

Clearly it is important exactly what Lieber means by these complement, specifier, and modifier terms. She defines them as follows[5]: complements are 'internal arguments obligatorily selected by a verb' (1992: 38); modifiers are entities 'that limit the reference of the modified item ... typically only Ns' (1992: 38); and specifiers, although somewhat problematic, probably include 'quantifiers, degree words, subjects, and perhaps modals' (1992: 39).

Further, these Licensing Conditions are applicable below the level of the word only if these classes are meaningful sublexically. Lieber argues (1992: 39) that sublexical complements clearly exist in compounds like *cat-lover* and *pasta-eating* (cf *lover of cats, eating of pasta*); that modifiers exist sublexically in compounds like *file cabinet* or *rowhouse*, where the first element delimits the reference of the second; and that sublexical specifiers could seem to exist filling some of the same semantic functions as phrase level specifiers (for example as morphemes of negation, as in *unhappy*, *impossible*, and *non-toxic*, or quantification, like *biweekly*, or

[5] It is significant that Lieber defines these terms functionally or semantically. Stowell (1981: 87) himself doubts that (1b) is a primitive of X-bar theory, since languages like Japanese and German apparently allow specifiers to occur at the X' level, *between* the head and its complements. Lieber (1992: 33-34) argues that the level at which these entities occur is subject to parametric variation, and then says 'We will therefore abandon [(1b)] as a part of X-bar theory'. Thus she seems to reject any structural definition of these terms on the basis that this structure *may* differ across languages.

semicoherent). But in general, the question of exact identification of such elements is left fairly open.

Two further assumptions about Lieber's X-bar theory need to made explicit, since they become important to her analyses of particular data. Firstly, Lieber takes X-bar theory to fix not only the elements in a phrase, but also the ordering in which those elements occur[6]. There is no possibility of base-generated variation in word order. Thus any variations that do occur are the result of Move-Alpha operating between levels of D-structure and S-structure.

Secondly, Lieber takes category-neutrality, one of the central tenets of X-bar theory, to extend in particular (for our purposes) to this ordering, so that the ordering or headedness of any X-bar class must be constant across all categories. Complements (or any X-bar class) therefore appear in the same position over all possible X-bar categories[7].

In addition to her extended X-bar principles and the Licensing Conditions, Lieber (1992) assumes much of the morphological framework set out in Lieber (1981). She argues that affixes and free morphemes have lexical entries indicating their syntactic category, semantic and phonological representations, etc; and that affixes differ from free morphemes only in that they include a subcategorisation frame. Morphs are inserted into unlabelled trees on the basis of their subcategorisation frames, using Chomsky's (1981) Projection Principle.

For Lieber then, word structures are projected from the lexicon, and constrained by (extended) X-bar theory. X-bar theory and the Projection Principle generate base structures both above and below the level of the word. Lieber's Licensing Conditions constrain headedness at both levels, so that 'the position of the head of a word is *inextricably* linked to the position of the head of a phrase, and vice versa' (Lieber 1992: 40, my emphasis). We now examine these claims in the light of data from Basque and Babungo.

3. Basque Phrase and Word Structure

I have chosen to examine Basque for a number of reasons. Firstly, Lieber's analyses involved three Indo-European languages (English, French, and Dutch), and the Philippine language Tagalog. Since Lieber's headedness

[6] This is important because some X-bar systems do not hold to this assumption, allowing phrases to be base-generated without ordering constraints.

[7] This is a significant point, and constitutes a strong theoretical claim. Some authors, including Travis (1990), explicitly allow (at least some) headedness parameters to vary cross-categorially. A well-known case is German, which has head-final VPs and head-initial PPs (both with complements, in Lieber's terms).

parameters are envisioned to be settings of Universal Grammar, it is important to pursue analyses from a wide variety of language families. Basque is thus interesting as a non-Indo-European language, and a language isolate.

Secondly, Lieber's choice of Tagalog is based on the fact that word-formation is predominantly left-headed, and thus a challenge to most other theories of morphological headedness; and that the setting of the Licensing Conditions from the syntax is reasonably straightforward. Basque is in many ways the precise opposite, being a language whose derivational morphology is exclusively right-headed, making it an excellent exponent of Williams's Righthand Head Rule, and thus an interesting test case for Lieber's theory. And in being so strongly morphologically right-headed, Basque seems to be typical of other SOV languages (eg Japanese, Turkish).

My data for Basque is from Saltarelli (1988) and Ortiz de Urbina (1989).

Following Lieber, I will first consider phrase structure in Basque, in order to determine her Licensing Conditions for the language, and then consider how well these settings are reflected at the level of word structure[8].

For complements, we find the situation is relatively clear — complements generally precede their heads (complements are italicised[9]):

(6) a. VP
ikasle·ek *harri·ak* bota zituzten
student·pE[10] stone·pA throw aux
The students threw stones
ni·k *polizi·ei* *harri·ak* bota nizkien
I·E police·pD stone·pA throw aux
I threw stones at the police

[8] Given the clarity of headedness at the morphological level, it is perhaps arguable that it is better to set the Licensing Conditions on the basis of word structure, and then evaluate this analysis at the phrase structure level. I have decided against this approach because of the imprecision in determining su ch items as complements, specifiers, modifiers and predicates at the sublexical level. That is, we are extending a series of syntactic notions into the morphology, and I therefore think it preferable to begin with the syntax. In the course of this analysis, however, it might be useful to keep in mind that the morphology is overwhelmingly rightheaded.

[9] Lieber's use of 'complement' seems somewhat at odds with her definition — 'internal arguments obligatorily selected by a verb' (1992: 38). In practice, she seems to be classifying as complements any obligatory (theta-marked?) constituent.

[10] The following number and case marker descriptors are used: pE is plural ergative, sE is singular ergative, and E is indefinite ergative, etc. For case, E is ergative, A absolutive, D dative, gen genitive, abl ablative, inst instrumental, loc locative, etc.

b. NP
zerri·aren hilketa
pig·gen killing
the killing of the pig
berri·en zapalketa
people·gen oppression
the oppression of the people

c. PP
etxe·tik at
house·abl outside
outside the house
mendi·an zehar
mountain·loc across
across the mountain

d. PP
diru·aren·gatik
money·gen·motivative
because of the money
behi·aren·gan
cow·gen·loc(animate)
within the cow

Postpositions may be either free as in (6c) or bound (as in (6d)). Saltarelli (1988: 72) and Ortiz de Urbina (1989: 74) argue that the oblique case markers are also postpositions (the ablative, *-an* locative and genitives in (6c) and (6d)), so that PPs take either NP or PP complements. In all cases though, the complement precedes the head.

Adjective phrases are less straightforward, Ortiz de Urbina (1989: 76) noting that complements can occur either before or after the head, with no difference at all in meaning:

(7) AP a. *etxe·rako* egokia
house·purposive appropriate
appropriate for the house
b. egokia *etxe·rako*

Now as we have mentioned, in Lieber's X-bar theory both of these configurations cannot occur at D-structure — complements of APs either precede their heads, or they follow them, but they cannot do both. One of these S-structures must therefore occur via movement. And of course our category-neutral X-bar theory must have the complement position constant across all categories, so that in this case (given the data in (6)), AP complements must precede their heads. Therefore (7a) is basic, and (7b) derived by movement.

The obvious question that now arises is whether this prediction finds any support from the data. In fact, we find that there is evidence for exactly this position, in that certain kinds of AP cannot appear in the head-initial (7b) configuration. One example is APs with participial heads:

(8) AP
hauts·ez bete·a
dust·inst filled·A / ?? bete·a hauts·ez
full of dust
elurr·ez estali·a
snow·inst covered·A / ?? estali·a elurr·ez
covered with snow

Hence, the first of Lieber's Licensing Conditions can reasonably be set as follows:

(9) Heads are *final* with respect to complements.

For modifiers (cf Lieber 1992: 50-54), we have a situation in Basque similar to that in English — bare adjectives appear on one side of the head, while genitives and relative clauses appear on the other. For example (modifiers italicised):

(10) NP
a. etxe *zuri·ak*
house white·pA
the white houses
b. etxe *zahar haudi·ak*
house old big·pA
the big old houses
c. *gizon·aren* begi·a
man·gen eye·sA
the man's eye
d. *Jon Wayne·ren* pelikula·k
John Wayne·gen film·pA
John Wayne's films
e. *etxe·ko* andre·a
house·rel woman·A
housewife
f. *mendi·ko* *baserri·ko* gizon *zaharr·ak*
mountain·rel farm·rel man old·pA
the old man from the farm in the mountains
g. *hi·k* *erosi·ko* mando·a
you·E buy·rel mule·sA
the mule you bought
h. *hi·k* *erosi hu·en* mando·a
you·E buy aux·comp mule·sA
the mule you bought
i. ilegorri·a d·en neska
red-haired·sA is·comp girl(A)
a girl with red hair
j. *aldapa·n dago·en* *ha·ren* etxe *zuri* hori
hill·loc aux·comp he·gen house white that(sA)
that white house of his which is on the hill

(10a) and (10b) show bare adjectives following the head, while (10c)-(10j) illustrate the genitive case *-(ar)en* and the relatives *-ko* and *-en*, all of which precede the head (Ortiz de Urbina 1989: 68-74).

As with adjectival complements, if we take these adjectives and relative clauses to be members of one class — modifiers of NP — then we must determine that only one of these positions is basic, and that the other derived. Lieber (1992: 53) does exactly this for English, arguing that there the adjectives are basic, with the relatives being moved to a post-head position by a rule of Heavy-NP shift.

Here again we must ask whether these theory-specific hypotheses can be substantiated to any degree from our data. Interestingly, there again seems to be some support for a movement analysis. We are faced with similar alternatives as for English — either the relatives are moved before the head (from a post-head position), or the adjective is moved after the head (from a pre-head position). For Basque, though, the evidence points in the opposite direction to Lieber's analysis of English, in that here it is the adjective that seems to move, rather than the relatives.

The main evidence in this regard is the position of adjectival intensifiers, which occur *before* the head noun, separated from the adjective they modify (Ortiz de Urbina 1989: 77, intensifiers italicised):

(11) NP
a. *hain* zerru ederr·a
so sky beautiful·sA
such a beautiful sky
b. *oso* zkale zabal·a
very street wide·sA
the very wide street

Intensifiers never appear after the noun, except as adjuncts *outside* the NP (as shown by the case markings). This kind of adjunction also occurs for some relative clauses (adjunct underlined):

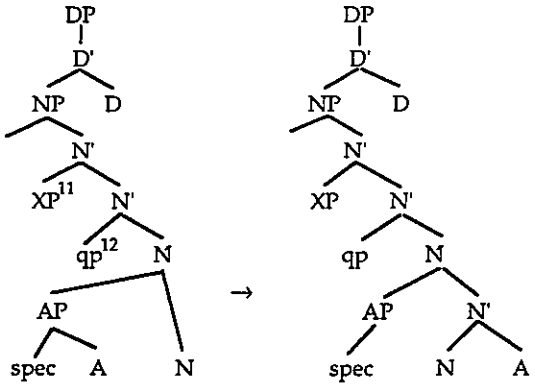
(12) NP
a. helburu praktiko·a *oso*
goal practical·A very
a very practical goal
(Ortiz de Urbina 1989: 77)
b. heldu·ko da egun bat *hone·taz ere*
arrive·fut aux day one(A) this·on too
argi·a *egin·go* *d·en·a*
light·A make·fut aux·comp·A
A day will come when light will be shed on this too
(Ortiz de Urbina 1989: 69)

Since these intensifiers would normally be taken to be specifiers of the AP, they are presumably generated together at D-structure. To argue for a post-head modifier position, then, we must have two movement operations, since the intensifier and the relatives move to different pre-

head positions (intensifiers appear after quantifiers, relatives before). More convincing, to my mind, is the case for generating modifiers before the head, perhaps as in (13a) below. Such an analysis requires only a single movement operation, head-movement of A adjoining to the N, as in (13b).

(13)

a. D-structure b. S-structure



Additionally, such an analysis is able to capture the unitary nature of the examples in (12), which would simply involve apposition of a pre-head N' element outside the NP.

If something like this can be motivated, we can set the third of Lieber's Licensing Conditions as follows:

(14) Heads are *final* with respect to modifiers.

We turn now to Basque specifiers. Recall that Lieber (1992: 39) postulates subjects, quantifiers, degree words (intensifiers), and perhaps modals, as specifiers.

With respect to subjects, Basque is generally taken to be SOV, giving IP a structure like that of (16) below, where the [spec,IP] subject precedes its head:

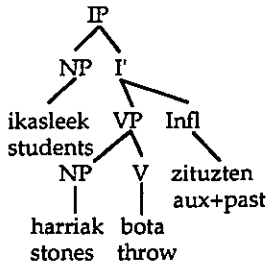
(15)	IP	*ikasle·ek*	harri·ak	bota	zituzten
		student·pE	stone·pA	throw	aux+past

[11] Genitive/Relative clause position

[12] Quantifier phrase

The students threw stones

(16)



(cf Ortiz de Urbina 1989: 59)[13].

In APs, the majority of intensifiers precede their heads[14], although Ortiz de Urbina (1989: 77) does note a few exceptions (intensifiers underlined):

(17)	AP	a.	zakurr·a *oso* beltz·a da dog·sA very black·sA aux The dog is very black
		b.	zakurr·a beltz *samar·*a da dog·sA black rather·sA aux The dog is rather black

Saltarelli (1988: 71) does not mention these exceptions, so presumably they are fairly rare.

As was true for modifiers, the situation is least clear with respect to NPs. In general, enumerators and indefinites precede the head (18a-c), while most quantifiers follow (18d-f, specifiers italicised):

(18)	NP	a.	*bi* etxe·ak two house·pA two houses

[13] Alternatively, IP might have a flatter structure in which the NPs, V and Infl are all sisters (eg Ortiz de Urbina 1989: 86). In either case, subject as [spec,IP] will precede its head.

[14] Abney (1987) holds that some intensifiers (or degree words) are heads of degree phrases (DegP), taking obligitary AP complements, while others may still be specifiers of AP. For Basque, analysing intensifiers as DegP presents serious complications, in that we then allow a phrasal level in which complements follow the head, while for all others they *precede* the head. For Basque, then, I am assuming the more traditional position, that intensifiers are specifiers of AP.

b. *sei* liburu·ak
six book·pA
six books

c. *zenbait* albistari
certain few newspapers(A)
some (certain) newspapers

d. txori *gutxi*
bird few(A)
a few birds

e. armiarma·sare *asko*
spider·web many(A)
many spiderwebs

f. etxe zuri *guzti*·ak
house white all·pA
all the white houses

Additionally, two types of cooccurrence restrictions exist — firstly, a phrase cannot have both indefinites and quantifiers (as in (19)); secondly, a phrase cannot have both quantifiers and determiners[15] (as in (20)), although it may have both indefinites and determiners (Salterelli 1988: 81):

(19) NP a. **sei* gizon *guzti*·ak
six man all·pA
all six men

b. **zenbait* gizon *asko*
certain man many(A)
some many men

(20) NP a. *etxe *gutxi·ak*
house few·pA
the few houses

b. *etxe *asko hori·ek*
house many that·pA
those many houses

Any number of analyses exist for this data. If we follow Lieber and assume that these indefinites, enumerators and quantifiers are all specifiers, then again we must determine only one position to be basic. If this specifier position could only be singly filled, as is typical of specs, the cooccurrence restriction in (19) would automatically follow. And presumably, invoking category-neutrality, we would want to argue that it is the quantifiers that undergo movement, making specifiers head final.

Alternatively, we could argue that not all these elements are specifiers. One possibility is that enumerators and indefinites are specifiers, but that quantifiers are in fact determiners, and presumably

[15] Saltarelli (1988: 81) notes one exception: *guzti* 'all' is (marginally) acceptable with a determiner, as in (18f).

then heads of DP. This allows us to explain the cooccurrence restriction in (20), and maintain a head-final specifier position for all categories.

Another possibility might be to argue that the enumerators and indefinites, since they precede the head as we have argued that modifiers do, are themselves modifiers, and it is only the quantifiers that are specs. The difficulty here is that we then have NP specs after their head, while [spec,IP] and [spec,AP] seem to precede their head. This is thus difficult if we are maintaing category-neutrality.

For the purposes of setting the Licensing Conditions, I will assume that one of the first two possibilities is defensible, so that quantifiers are either moved out of spec position or are in fact determiners. In both cases, we can maintain an initial specifier position, giving Licensing Conditions for Basque as follows:

(21) Licensing Conditions: Basque

a. Heads are *final* with respect to complements.

b. Heads are *final* with respect to specifiers.

c. Heads are *final* with respect to modifiers.

From here we turn to an examination of Basque's 'very productive' derivational morphology (Saltarelli 1988: 256). Just as Lieber would predict from the Licensing Conditions, all category-changing derivational morphology is right-headed. The following examples from Saltarelli (1988: 256-61) are illustrative:

(22) a. -tu $]_{N,A,Adv}—]_V$

$lagun_N$	'friend'	lagundu	'to help'
$luze_A$	'large'	luzutu	'to lengthen'
$berandu_{Adv}$	'late'	berandutu	'to delay'

b. -etsi $]_A—]_V$

on	'good'	onetsi	'to accept'
gaitz	'bad'	gaitzetsi	'to reject'

c. -tasun $]_A—]_N$

ezti	'sweet'	eztitasun	'sweetness'
eder	'beautiful'	edertasun	'beauty'

d. -(k)eria $]_A—]_N$

alfer	'lazy'	alferkeria	'laziness'
gaizto	'bad'	gaiztokeria	'badness'

e.	-tsu	$]_N$—$]_A$			
	mendi	'mountain'	menditsu	'mountainous'	
	euri	'rain'	euritsu	'rainy'	
f.	-koi	$]_N$—$]_A$			
	eliza	'church'	elizakoi	'devout'	
	herri	'people'	herrikoi	'popular'	
g.	-ka	$]_{N(,V)}$—$]_{Adv}$			
	$harri_N$	'stone'	harrika	'by stoning'	
	$ukabil_N$	'fist'	ukabilka	'by striking'	
	jo_V	'to hit'	joka	'by hitting'	
h.	-ki	$]_A$—$]_{Adv}$			
	eder	'beautiful'	ederki	'well, beautifully'	
	eme	'soft'	emeki	'softly'	

In addition to these, there are a number of derivational suffixes which are not category-changing, forming nouns from nouns, but which still seem to act as heads to their words. Examples include the following (all are $]_N$–$]_N$), from Saltarelli (1988: 256-257):

(23)	a.	-ari	'occupation'		
		pelota	'ball'	pelotari	'ball-player'
		bulego	'office'	bulegari	'office-worker'
		ehiza	'hunt'	ehizatari	'hunter'
	b.	-tagi	'place'		
		oilo	'hen'	oilotegi	'henhouse'
		okin	'baker'	okintegi	'bakery'
	c.	-gai	'one aspiring towards'		
		senar	'husband'	senargai	'fiancé'
		apaiz	'priest'	apaizgai	'seminary student'
	d.	-tza	'abundance'		
		diru	'money'	dirutza	'lots of money'
		jende	'person'	jendetza	'multitude,crowd'
	e.	-kada	'measure of'		
		aho	'mouth'	ahokada	'mouthful'
		plater	'plate'	platerkada	'plateful'
		esku	'hand'	eskukada	'handful'

These suffixes attach only to nouns, and regularly form nouns, which often differ from their bases in terms of features like animacy, abstractness

etc. This would be sufficient evidence for Lieber to grant them the status of heads. Saltarelli lists a further six such suffixes.

I have deliberately separated out from the examples above suffixes which take verbal bases. Lieber (1992: 48-49) appears uncertain on the status of this kind of word formation in terms of her Licensing Conditions. With regard to Tagalog, where a number of such examples contradict her predictions, she suggests that the ordering of heads with respect to verbal bases is not necessarily constrained by the Licensing Conditions, since verbs do not normally act as either complements, modifiers, or specifiers, but as predicates. Of Saltarelli's (1988: 258-60) list of derivational suffixes taking verbal bases, the following are representative:

(24)	a.	-te (-tze)	$]_V$—$]_N$		
		etor	'come'	etortze	'arrival'
		ikas	'learn'	ikaste	'learning'
	b.	-dura	$]_V$—$]_N$		
		abia.tu	'hurry'	abiadura	'speed'
		kutsa.tu	'contaminate'	kutsadura	'contamination
	c.	-pan, -man	$]_V$—$]_N$		
		irakatsi	'teach'	irakaspan	'education'
		labur.tu	'abbreviate'	laburpan	'summary'
	d.	-tzaile (-le)	$]_V$—$]_N$		
		hil	'die'	hiltzaile	'killer'
		ikusi	'see'	ikusle	'viewer'
	e.	-tza	$]_V$—$]_N$		
		jaio	'be born'	jaiotza	'birth'
		ezkon.du	'marry'	ezkontza	'wedding'
		egon	'to be'	egoitza	'residence'
	f.	-erazi	$]_V$—$]_V$		
		etorri	'come'	etorrerazi	'make come'
		sar.tu	'enter'	sarreraze	'make enter'
	g.	-kar	$]_V$—$]_A$		
		iraun	'last'	iraunkar	'permanent'
		eman	'give'	emankor	'productive'
	h.	-garri	$]_V$—$]_A$		
		farre	'laugh'	farregarri	'laughable'
		negar	'cry'	negargarri	'lamentable'
		jan	'eat'	jangarri	'edible'

It is immediately clear that deverbal forms exhibit the same right-headedness as the rest of Basque derivational morphology. Lieber's tentative exclusion of such forms from being covered by the Licensing Conditions would seem to be, at least for Basque, unnecessary.

A similar situation occurs in compounding, which is also relatively productive, at least for nouns and adjectives (Salterelli 1988: 262):

(25) Dvandva compounds

a. $[N\text{-}N]_N$ compounds

zeru·lurr·ak	
heaven·earth·pA	'heaven and earth'
aiton·amona·k	
grandfather·grandmother·pA	'grandparents'

b. $[A\text{-}A]_A$ compounds

zuri·garri	
red·white	'red and white'

(26) a. $[N\text{-}N]_N$ root compounds

arta·soro·a	
corn·field·sA	'corn-field'
haizkora·kirten·a	
axe·head·sA	'axe-head'

b. $[N\text{-}N]_N$ synthetic compounds

albistari·saltzaile·a	(from *saldu* 'sell')
newspaper·seller·sA	'newspaper seller'
buru·hauste·a	(from *haus* 'break')
head·breaker·sA	'puzzle'
anka·sartze·a	
foot·put in·sA	'mistake'

c. $[V\text{-}N]_N$ compounds

idaz·makina	
writing·machine(A)	'typewriter'
lo·gela	
sleeping·room(A)	'bedroom'

d. $[N\text{-}A]_A$ compounds

asku·zabal	
hand·wide	'generous'
buru·gogor	
head·hard	'stubborn'

Thus in terms of category (26c-d) and semantic head (26a-d), Basque endocentric compounds are consistently right-headed.

For Basque, then,we find the following situation. At the syntactic level, phrases seem to be right-headed with respect to complements, specifiers, and modifiers, giving the Licensing Conditions in (21). At the morphological level, all derivational morphology, and all endocentric compounding is also right-headed.

This clearly supports Lieber's contention that headedness is linked across the syntactic and the morphological domains, that morphological headedness and syntactic headedness are instantiations of a common set of principles. There is however, little here to support the specifics of Lieber's proposals, simply because everything is so overwhelmingly head-final. Establishing the correctness of the parameters really requires contrast between individual parameter settings at the synactic level to be able to be demonstrated to also occur at the morphological level.

4. Babungo Phrase and Word Structure

I turn now to an examination of Babungo, a Grassfields Bantu language spoken in the North West Province of Cameroon. Babungo is interesting as another non-Indo-European language; it evidences category-changing prefixes in the derivational morphology, which indicates at least some (morphological) left-headedness; and it is an SVO language, in contrast to Lieber's left-headed example, the VOS Tagalog.

My data for Babungo is from Schaub (1985).

Headedness with complements is relatively clear — heads are initial in both VP and PP, as follows (complements italicised):

(27) VP a. nishu wi twaŋ *yikiŋ yi*
mother her roast-pf crab that
her mother roasted that crab

b. mə kɔ *fa ti lambi*
I give-pf thing to Lambi
I gave something to Lambi

PP c. yiba *ŋii*
behind house
behind the house

d. nə *ŋwiŋ wi*
with child her
with her child

e. fi fuu *ti*
from on tree
from on the tree

Some prepositions like *fi* in (27e) take PPs rather than NPs; but for all PPs, the complement follows the head. Schaub (1985: 66) states that APs do not take arguments; and although he reports (1985: 243-245) that large numbers of nouns are deverbal, he does not cite any examples of NPs having complements. The first of Lieber's Licensing Conditions is therefore:

(28) Heads are *initial* with respect to complements.

For modifiers, the situation is also clear. In general, modifiers follow their heads, as below (modifiers italicised):

(29) NP a. ŋga *kwalə*
antelope big
the big antelope

b. wuu *bwə*
person bad
the bad person

c. fɔ *ki*
medicine his

d. fənti *fia*
stick our

e. ŋkaw *wuumba ŋwaa*
chair friend my
my friend's chair

f. weenshu *wi wəzwi*
sibling his woman
his sister

g. wə *ntiə yuu ŋwə show ŋgu yə*
person that who he steal-pf chicken your
the person that has stolen your chicken

h. ŋkaw *ŋkiə faŋ lambi kɔ*
chair that which Lambi gave-pf
the chair which Lambi gave

The examples above illustrate adjectives (29a,b); possessives (29c,d); NP modifiers (29e,f); and relative clauses (29g,h). In all cases modifiers follow their heads. The sole exception to this is the case of emphatic possessives as in (30b):

(30) NP a. təsaw *tə*
pipes your

b. *ntii* təsaw
your-emph pipes

In this case it seems relatively unproblematic to suggest that some kind of movement rule moves emphasised modifiers before the head. The second of Lieber's Licensing Conditions is therefore:

(31) Heads are *initial* with respect to modifiers.

Again we find that specifiers are more of a problem. As has been mentioned, Babungo is an SVO language like English, so that subjects precede their heads (assuming INFL to be adjacent to the verb):

(32) IP a. *nishu wi* twaŋ yikiŋ yi
mother her roast-pf crab that
her mother roasted that crab

b. *lambi* zwi zɔ nyə
Lambi kill-pf snake this
Lambi has killed this snake

Similarly, intensifiers occur before their heads across all categories:

(33) NP a. *ŋkee* ŋkaw kaŋ
very chair my
my very own chair

b. *tuu* wə mu
not even person one
not even one person

AP c. *ŋkee* we
very strong

d. *she* vətaa
only well
all/entirely well

PP e. *ŋkee* taa ŋka
very in forest
right into the forest

f. *she* ti ndula
only to Ndula

AdvP g. *ŋkee* jee
very well

h. *she* mbisi ŋkuusə
only tomorrow Ngkuuse
only on Ngkuuse (day of the week)

Other supposed specifiers occur after their heads. In particular, quantifiers occur after the head noun (as in (34) below), as do demonstratives ((35) below):

(34) NP a. ŋkaw *kemu*
chair one

b. ghɔŋ *tee*
eggs five

c. vəŋkaw *vəyaŋ*
chairs many

d. vəŋkaw *vənshə*
chairs all

(35) NP a. zɔ *ŋyə*
snake this

b. vətɔ *və*
things these

c. tɨ *ki*
tree that

d. *yiŋkii* tɨ
that-emph tree
that particular tree

There are again a number of possible analyses for this data. The most likely is that specifiers occur in pre-head position, for a number of reasons. Firstly, it seems a priori preferable to accept evidence from a number of classes over the evidence of a single class, and especially NP. The corollary to this is that it is easier to motivate a movement analysis for quantifiers in NP than to motivate a movement analysis for subjects and for intensifiers over several classes. Secondly, I am inclined to treat the position of subject of IP as a reasonable indicator of specifier position, since recent analyses of subject movement indicate that even when some kind of movement occurs it is normally into a specifier position (eg Koopman and Sportiche 1990).

If this is correct, an obvious possibility is that the quantifiers and demonstratives are in fact modifiers. This is supported by the fact that demonstratives undergo the same kind of movement when emphasised, as in (35d), as we have already seen for possessives (see (30) above). Alternatively, it could be argued that quantifiers and demonstratives are specs, but undergo movement to their post-head position[16].

If either of these are correct, then heads are final with respect to specifiers, and the Licensing Conditions will be set as follows:

(36) Licensing Conditions: Babungo

a. Heads are *initial* with respect to complements.

b. Heads are *initial* with respect to modifiers.

c. Heads are *final* with respect to specifiers.

[16] Presumably emphasis would allow demonstratives not to undergo movement. Possessives could probably be taken to be specifiers as well, like English genitives.

The set of Licensing Conditions obtained here for Babungo is in many ways more interesting than those for Basque in (21), in that Lieber's theory now predicts that the morphology may exhibit both left- and right-headedness, and further, that right-headed morphology will involve sub-lexical specifiers, as opposed to modifiers and complements. It is therefore a good test case for Lieber's proposals.

Nominalisation is the most productive type of derivational morphology. A number of nouns in Babungo are homophonous with the verb from which they are derived, or differ only in tone. Schaub (1985: 244) analyses such nouns as being formed by a derivational prefix bearing only tone features, in which case the tones on the nouns follow from regular Babungo tone rules. The following are examples:

(37)

verb		tone on derivational prefix	noun	
bə́ŋ	'to dance'	H	bə́ŋ	'dance'
séj	'to gain'	L	sěj	'gain'
bǐ	'to load'	H	bī	'load'
sǐi	'to peel (cocoyams)'	H	sǐī	'soft shell of cocoyam'
fǎ	'to work'	L	fa	'work'

There are also examples where the noun bears a noun class (ie declensional) prefix, in which case the tonal behaviour indicates that the derivational prefix is present between the noun class prefix and the verb. For example:

(38)

kú	'to die'	H	jī.kú	'death'
tŏ	'to walk'	H	jī.tô	'walk'

It is obviously not clear that these examples should be handled within the kind of concatenative framework that we have been using here. But it seems reasonable that such prefixes (bearing tonal information but not segmental) could be analysed as heads and bear features like [+N] category membership in much the same way as more conventional affixes.

Other nominalisations are more typical. Schaub records two other kinds of derivational prefixes. The prefix *mə̀-* can nominalise any verb at

all, and carries a kind of participial meaning. The following are illustrative:

(39) mə- $_{N}[\_\__{V}[$

tej	'to begin'	mətej	'beginning'
lej	'to be light'	məlej	'light'
mɔŋ	'to test'	məmɔŋ	'testing'
bwaŋ	'to thank'	məbwaŋ	'thanking'

Another frequent nominalisation device is prenasalisation. Nouns are frequently formed from verbs by the prefixation of a nasal homorganic with the initial obstruent of the word, and bearing a low tone. Schaub (1985: 244) represents this as *N-*. For example:

(40) N- $_{N}[\_\__{V}[$

bɔŋ	'to create'	mbɔŋ	'creator'
shu	'to pound'	nshu	'mortar'
bwej	'to sleep'	mbwej	'sleep'
bwe	'to split'	mbwe	'chisel'
fi	'to measure'	mfi	'measurement'

These nominalisations are thus all arguably left-headed, regularly deriving nouns from verbs. This left-headedness fits in well with the Licensing Conditions if we take these bases to be acting as modifiers, which seems reasonable[17].

The only other concatenative derivational affixes Schaub (1985: 245) reports are those forming verbs from verbs[18]. The suffix *-nə* decreases the valency of (certain) transitive verbs, promoting the direct object into

[17] Note that if we accept Lieber's suggestion that the Licensing Conditions may not hold for forms taking verbal bases, then Babungo is a language about whose derivational morphology the Licensing Conditions can predict nothing, since all forms are deverbal. As with Basque, I am assuming that Lieber's tentative exclusion of these forms is unnecessary.

[18] Schaub (1985: 245-246) cites two further derivational processes, both of which are non-concatenative. Adjectives are formed from verbs by deletion of the initial prefix from the progressive verb. And some adverbs are formed from verbs by reduplication, usually of the entire form.

subject position. The suffix *-sə* increases the valency of verbs and is causative. Examples include the following:

(41) -nə $]_{V}\_\_]_{V}$

a. mə ŋa shuufwə
I open-pf door
I opened the door

b. shuufwə ŋa·*nə*
door open-pf-dec
the door opened

c. mə kwa mbiŋ
I set-off-pf trap
I set off the trap

d. mbiŋ kwa·*nə*
trap set-off-pf-dec
the trap went off

(42) -sə $]_{V}\_\_]_{V}$

a. wee nyɔŋ yiməŋ
child suck-pf breast
the child sucked the breast

b. wəzwi nyɔŋ·*sə* wee
woman suck-pf-caus child
the woman suckled the child

c. muu ndɔŋ
water be-hot-pf
the water was hot

d. mə ndɔŋ·*sə* muu
I be-hot-pf-caus water
I heated the water

It is not clear whether these suffixes should be considered heads of their words or not. Their valency effects are not of the kind that would suggest them to be simple theta-assigners taking complements. If they are in fact right-headed, then the base must be acting as a specifier, but this does not seem to me to be particularly obvious. I would probably argue that these suffixes are not in fact acting as heads, since they do not seem to effect their base in any way except for the valency effects. Lieber (1992: 86) argues that argument structures are not percolated like syntactic features are, so that these alone do not necessarily imply headship. That is, Lieber is arguing that changing the number of arguments of a verb is not necessarily category-changing. If this is the case, then it is the base that is the head, and the suffix is presumably some kind of modifier.

Within compounding, the only productive processes produce nouns (Schaub 1985: 247), and are composed of nouns and nouns or nouns and verbs. The following types occur:

(43) Exocentric

$[V\text{-}N]_N$

a. me-vəlu
   swallow-eggs
   egg-eating snake
b. lee-fu
   dawn-outside
   daybreak

(44) Endocentric

$[N\text{-}N]_N$ left-headed, very common

a. bi-ndaw
   goat-horn
   goat
b. nyaa-vəŋa
   animal-scales
   pangoline
c. baba-ŋkɔŋ-me ($[N\text{-}N\text{-}N]_N$)
   hawk-shaved one-neck
   vulture

$[N\text{-}N]_N$ right-headed, relatively rare

d. nshwi-fa
   mother-thing
   very big thing
e. wee-ti
   child-tree
   small tree
f. wee-ghɔ
   child-hand
   finger

For compounding then, the clearly preferred pattern for endocentric compounds is the left-headed one. In terms of our Licensing Conditions, this clearly implies that the non-head element is a sublexical modifier (since no theta-assignment is involved), exactly as would be expected.

The only productive right-headed compounds are those formed with the diminutive *wee*, which can attach to almost any noun, forming a noun. Exactly how to treat these compounds is problematic. Given that diminutives generally seem to be transparent affixes for headship purposes (Scalise 1987), and are thus already handled somewhat specially, perhaps it is possible to interpret *wee* here as a specifier, or even to argue that it is not covered by the Licensing Conditions at all.

For Babungo then, the (concatenative) derivational morphology and compounding is wholly prefixing or left-headed, except for two verbalising suffixes and one kind of right-headed compounding. As I

have suggested, this left-headedness is entirely consistent with the Licensing Conditions if we take the base to be acting as a modifier, as seems reasonable. The right-headed morphology that would seem to be a possibility from the setting of the Licensing Conditions is represented only by the *wee* diminutive compounds, if at all. Of the three kinds of sublexical entities Lieber postulates, only sublexical modifiers seem to be clearly evidenced for Babungo.

5. Discussion

5.1 Methodological Issues

There have been two obvious difficulties encountered in these analyses. The first has been the difficulty of determining one position to be basic where elements apparently of a single X-bar class occur on both sides of the head. Thus we have seen that Basque (like English) has bare adjectives on one side of the noun, and genitives and relative clauses on the other. With specifiers, Basque has subjects, intensifiers, enumerators and indefinites before the head, and quantifiers and demonstratives after. Similarly, Babungo has subjects and intensifiers before the head, and quantifiers, enumerators and demonstratives after.

The difficulty here is that Lieber's theoretical assumptions often force one to posit an underlying unity of form and the existence of movement processes in the face of what can seem to be prima facie evidence to the contrary. And if we posit a movement analysis, the lack of positive evidence makes it difficult to determine which of the positions is basic, and which derived. This kind of difficulty is illustrated in Lieber's analysis of English modifiers (1992: 50-54). Lieber ends up with precisely the opposite movement analysis that Jackendoff (1977) and Stowell (1981) adopted for these modifiers, primarily on the basis that movement of a heavy constituent is already necessary for Heavy NP shift in English[19]. A movement analysis is not so much suggested by the evidence as necessitated by the assumptions that word-order is category-neutral, that elements of a single X-bar class can occur on only one side of a head, and that adjectives and relative clauses are both elements of the same class (in this case, modifiers).

In fact, the designation of X-bar class membership is the second major difficulty in these analyses. As we have seen, Lieber's discussion of these classes ignores their most traditional definition in terms of structure, and instead uses them on the basis of particular function or semantic content. In particular, specifiers are exemplified rather than defined —

[19] Interestingly, Basque modifiers, as seen in section 3, on the basis of the position of the modifier's intensifier, seem to undergo precisely the opposite kind of movement to that which Lieber suggests for English.

rather than being singly-filled non-heads 'occurring at the X" level' (Stowell 1981: 87), they simply include (1992: 39) 'quantifiers, degree words, subjects, and perhaps modals'. This further implies that quantification, for example, is the property that defines whether something is a specifier. Therefore quantifiers will *always* be in specifier positions across languages. And while this may be true in many Indo-European languages, I would argue that it is largely indefensible as a universal, and in the case of Babungo in particular.

As Bauer (personal communication) points out, the reason for Lieber's definition in these terms is presumably the difficulty of extending the traditional structural definitions of these classes to the morphological level, since we are never dealing with an X^{max} in morphology. But Lieber never makes this clear, assuming basically without argument that such items can be reasonably defined semantically.

5.2 *On Travis*

The assumption that X-bar classes can occur on only one side of their head is also an interesting one, and worthy of further attention. In fact, it is precisely this assumption that Travis (1990) challenges for VP elements, arguing that for languages like Chinese and Kpelle complements do in fact appear on both sides of their head. What she manages to demonstrate, however, is that the ordering of these elements is still principled. In effect, she shows that complements can be divided into subclasses, depending on whether they are theta-marked or not, or case-marked or not. Heads can appear initially or finally for complements as a whole (as English); or in one position for theta-marked complements and the other for unmarked ones (as Chinese); or in one position for case-marked complements, and the other for case unmarked ones (as Kpelle). Travis thus argues that some languages make principled distinctions between kinds of complements, and that these distinctions can be relevant in terms of head position.

In this light, it is worth pointing out that the kind of data Travis examined with complements is at least superficially similar to the kind of data that has been encountered for modifiers and specifiers. It is at least provocative to suggest that it might be possible to motivate distinctions between different kinds of modifiers and specifiers which are relevant to head position, just as Travis does for complements. For instance, one might argue that languages like English and Basque distinguish between heavy modifiers and non-heavy modifiers, and specify a headedness parameter for this subclass. Thus English would be head initial for heavy modifiers, and head final otherwise. The obvious difficulty with this analysis is that Travis's subclasses are based on theta-marking and case-marking, which are independently motivated elsewhere in the grammar, while the mechanism to distinguish between subclasses of modifiers and specifiers is more problematic. Further, this kind of analysis would clearly complicate the application of these parameters to the morphology.

5.3 *On Word-Formation*

Another of the issues related to Lieber's theory of headedness is the place of word-formation in the grammar. It is not particularly clear where word-formation takes place in Lieber's theory. She defines the lexicon (1992: 26) as being 'the list of idiosyncratic items ... that form the atomic particles of language'. She goes on to introduce her theory of headedness in terms of showing 'how the grammar puts together these atomic particles into productively derived complex words'. This would appear to imply that these productively derived complex words, being formed from atomic particles in the lexicon, are not themselves listed in the lexicon at all, but are base-generated each time they are used from roots and affixes in just the same way that sentences are from words, using the same headedness and percolation principles[20]. That is, it is not clear how the lexicon can be the list of atomic particles and idiosyncratic items if the outputs of productive rules are listed there. Additionally, if word-formation does not happen outside the lexicon, then Lieber is arguably still left with a separate morphological component, albeit one operating on the same principles as the syntax.

Such a position underlines the centrality of headedness to Lieber's theory. Not only do the same headedness principles apply at the phrase structure level and at the word structure level, but they apply at the *same time*. Headedness and percolation are not principles that apply only when a complex word is first formed and entered into the lexicon, but apply every time the word is used. Word-formation is simply a substage in ordinary syntactic phrase-formation.

This further implies that there is no notion of an 'actual' or 'existing' word[21]. One can distinguish between words that are lexicalised or idiosyncratic (ie not productively derived in the syntax) and words that are not, but there is no distinction available between words that are productively derived and actually occur, and words that are possible but do not exist. There is no way of capturing an intuitive difference between words and sentences, that it makes sense to talk about actual or existing words, but not about actual or existing sentences.

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20 This is supported by the fact that Lieber (1992: 111-115) sees derivational and inflectional word-formation as basically identical, both being the result of these headedness and percolation principles. The only distinction she makes is that derivational affixes can act as heads, while inflectional affixes cannot.

21 Lieber herself makes use of exactly this notion, however, in her comments on productivity. She says (1992: 3) that the notion of a word existing is only meaningful with reference to their occurrence in the mental lexicon of a speaker. It is not clear how this is to be reconciled with her later remarks on the lexicon, as above.

5.4 *On Complements*

With regard to the specifics of Lieber's proposals, I think that her discussion of complements and category-changing prefixes is one of the most attractive aspects of her theory. The Licensing Conditions that Lieber derives for English, in (45), provide an ideal test case for her complement parameter, because the Licensing Conditions would predict that any left-headed derivation can only involve sub-lexical complements.

(45) Licensing Conditions: English

a. Heads are *initial* with respect to complements.

b. Heads are *final* with respect to specifiers.

c. Heads are *final* with respect to modifiers.

(Lieber 1992: 54)

In fact, of course, the only left-headed derivation in English are the verbalising prefixes, which have been treated as arbitrary exceptions in virtually all previous accounts of English headedness. What Lieber attempts to do is to argue that there is a distinction between the two kinds of verbalising affixes that exist for English, and that this difference is exactly what one would expect from her Licensing Conditions. The crucial types of affix are those in (46):

(46) a. de- $[_V$—$[_N$ *debug, dethrone, defuzz*
en- $[_V$—$[_N$ *encase, enrage, enthrone*[22]

(Lieber 1992: 57)

b. -ify $]_{(N,A)}$—$]_V$ *purify, solidify, glorify*
-ize $]_{(N,A)}$—$]_V$ *standardize, unionize*

(Lieber 1992: 55)

Lieber's account of these affixes argues that the prefixes in (46a) take a sub-lexical complement. The right-hand element of these words therefore receives a theta-role. Thus, she analyses *de-* as assigning a theme theta-role to its base, so that *to defuzz X* is to 'remove *fuzz* from X'. Similarly, she argues that *en-* assigns a locative theta-role to its stem: thus *to enthrone X* is to 'put X *on a throne*'; and *to encase X* is to 'put X *in a case*'. The crucial distinction she makes is between these prefixes and the verbalising suffixes in (46b), which she argues do not take complements. Rather, the base acts as some kind of modifier to the predicate itself. Thus *to standardize X* means 'to make X *standard*', and *to purify X* means 'to make X *pure*' (or '*make pure* X'). Unlike the prefixes, Lieber argues that there do not seem obvious theta-roles that can be assigned to *pure* and *standard*. Where *de-* means something like 'remove' and *en-* means something like 'put', the *-ify* and *-ize* suffixes mean something like 'make', and arguably carry a lesser amount of semantic content.

[22] Lieber (1992: 208) suggests that *en-* is probably no longer productive, and that as such these forms would be lexicalised and not base-generated as we discuss them here. Similar comments might apply to other category-changing prefixes like those in *unhorse, ablaze,* and *bewitch,* cited by Bauer (1990).

These distinctions are clearly rather subtle, but seem to me to be relatively convincing. To my mind there does seem to be a distinction in the degree of semantic closeness between the stems and their affixes in (46a) and (46b). On the whole, verbalising prefixes seem to be rather like 3-place predicates (*remove, put*), where one internal argument is assigned within the word; while verbalising suffixes behave more like 2-place predicates (*make*), and assign their internal argument outside the word[23].

In as far as Lieber's position here is defensible, then, we find that sublexical complements do seem to exist, and to exist for English exactly and only where Lieber's Licensing Conditions would predict them to. This is clearly a significant achievement, and provides strong support for the existence of a complement headedness parameter. Lieber's account of English category-changing prefixes seems to me to be easily the most elegant account of these affixes in the literature.

5.5 *On Modifiers and Specifiers*

Just as English was an excellent test case for Lieber's complement parameter, so the Licensing Conditions for Babungo, repeated here in (47), would seem to provide an excellent test case for modifiers and specifiers, especially given that we might now seem to have a reasonable idea of what a sub-lexical complement looks like.

(47) Licensing Conditions: Babungo

a. Heads are *initial* with respect to complements.

b. Heads are *initial* with respect to modifiers.

c. Heads are *final* with respect to specifiers.

Thus would expect all left-headed derivational morphology (including compounding) not involving verbal heads and theta-assignment to be examples of sub-lexical modifiers. Similarly, we would expect all right-headed morphology to involve some kind of sub-lexical specification.

[23] More questionable cases exist, such as *glorify,* which seems to mean 'give X *glory*', in which *glory* is arguably a theme and thus a complement. On the other hand, *enslave* means 'to make X *a slave*', and is exactly the kind of example in which *slave* should be treated as a specifier or modifier. Lieber might perhaps argue that such anomalies are lexicalised, and do not reflect the productive semantics of their affixes.

As we have seen, endocentric compounding in Babungo is almost entirely left-headed, as is the vast majority of derivational morphology, involving various nominalising prefixes on verbs. Thus for Babungo we find that the morphology apparently involves heads taking sub-lexical modifiers, with no sub-lexical specifiers evidenced at all (with the possible exception of the *wee* diminutive compounds).

What is extremely interesting, however, is that Lieber's analysis of French yields exactly the same Licensing Conditions as Babungo (1992: 64-65). Thus it would seem that French and Babungo are typologically similar for (syntactic) headedness, and that we might therefore expect their headedness at the morphological level to reflect this.

As for Babungo, French root compounding is left-headed, and is taken (1992: 65) to involve sub-lexical modifiers. French also evidences (1992: 68) two verbalising prefixes, *en-* and *de-*, which seem to involve sub-lexical complements, directly analagous to the English ones discussed above. Although Babungo does not evidence this kind of affix, they clearly fit in well with the Licensing Conditions in (47).

What is surprising, though, is that in French the overwhelming majority of cat egory-changing derivation is right-headed, not left-headed as in Babungo. For example, French has:

(48)	-eté	]$_A$_]$_N$	joyeuseté	'joyousness'
	-eur	]$_V$_]$_N$	voyeur	'voyeur'
	-ais	]$_N$_]$_A$	japonais	'japanese'
	-eux	]$_N$_]$_A$	vaporeux	'vaporous'

(Lieber 1992: 67)

In fact, French evidences *no* left-headed derivational morphology, except for its verbalising prefixes, and thus evidences no sub-lexical modifiers, except for within compounds. On the other hand, Babungo, as we have seen, evidences *only* left-headed derivation, and exhibits no sub-lexical specifiers, except perhaps for within compounds.

This seems to me to be a dramatic problem for Lieber's theory. On what basis are we able to argue that nominalising affixes in French are specifiers, but in Babungo must be modifiers? In spite of identical settings of the Licensing Conditions, we are faced with completely discordant headedness in the morphology[24].

[24] It seems to me that Lieber's only chance to reconcile these examples would be to argue that heads are in fact *initial* for specifiers in Babungo, and therefore that the nominalising prefixes in Babungo are sublexical specifiers, just as they apparently are in French. This fits quite well, except that it requires a movement analysis for subjects and intensifiers (across all categories) that seems totally unsupported by the evidence.

In sum then, we find that French and Babungo appear to be two languages having identical Licensing Conditions, but demonstrating diametrically opposed derivational morphologies. As such, they pose a major problem for her headedness parameters.

6. Conclusions

What Lieber has essentially attempted to do is to establish a framework within Universal Grammar that allows us to describe a principled basis for the kinds of typological headedness universals that hold between syntax and morphology. It is an attempt firstly to demonstrate that between these domains there exist important regularities in terms of the ordering of elements with respect to heads; and secondly to provide a number of parameters along which these regularities can be captured.

It is with respect to the first of these that Lieber has most clearly succeeded. At a general level, she has been able to demonstrate that headedness in the syntax and headedness in the morphology interrelate — that the left-headedness of Tagalog morphology is to be expected given the left-headedness of its syntax, etc. But at the more specific level of her parameters, it is only her discussion and characterisation of complements that manages to be relatively convincing. The problems outlined above with regard to the contradictory behaviour of French and Babungo seem to demonstrate fundamental weaknesses in the relationship between syntactic and morphological specifiers and modifiers.

Further, the application of functionally- or semantically-defined X-bar classes to the sublexical level seem at best problematic. No explanatory power is gained if the headedness of words can be made to work by simply assigning a sublexical element to an appropriate X-bar class. If however clear parallels can be demonstrated between elements at the phrasal and word levels (as Lieber has done for complements), and such relationships permit headedness generalisations to be captured, then we have clearly gained. But other than for complements, I am unconvinced that Lieber has achieved this.

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Prosodic Morphology in Alabama Negation*

Lisa Matthewson

1. Introduction

This paper provides an analysis of negative formation in the Muskogean language Alabama. The analysis draws heavily on the study of Alabama negation provided by Montler and Hardy (1991), but, unlike Montler and Hardy's analysis, works within the model of Prosodic Morphology (McCarthy and Prince 1986, 1990). The current analysis is shown to be empirically superior to Montler and Hardy's (1991) treatment, and is argued to result in a more insightful treatment of the data.

The paper is structured as follows. The remainder of this section contains a brief introduction to the theory of Prosodic Morphology, followed by some background information about prosodic structure in Alabama. In section 2 the negative formation data for Alabama is presented, and Montler and Hardy's treatment of the data is summarized. It is shown that Montler and Hardy's analysis fails on some points of prediction and generality. In addition, their analysis is not formalized within any constrained theory of morphology or phonology, meaning that many implausible systems are not ruled out.

Sections 3 and 4 present the analysis proposed here of the Alabama negation data. This involves prosodic circumscription of the base by extraprosodicity, suffixation of a mora template with floating melodic material, and a heavy syllable output template. The complex system of negative formation in Alabama follows from basic mechanisms provided by the theory, and the diversity of the various patterns of negation is shown to be reducible to independent factors.

Points of theoretical interest include the fact that in Alabama negation, satisfaction of the output template occurs after reconstitution of extraprosodic material, rather than before, as in McCarthy and Prince's analysis of the Arabic broken plural. In addition, the possible need for a distinction between 'phonological' and 'morphological' extraprosodicity is pointed out.

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1.1. Prosodic Morphology

Prosodic Morphology has its roots in McCarthy's (1979a, 1981) use of morphological CV-templates. McCarthy showed that morphemes in Semitic languages can consist merely of an invariant shape, defined in terms of C and V slots, to which melodic material is mapped. CV-templates can also be used to characterize the shape of affixes. For example, Agta reduplication is argued by Marantz (1982:439) to result from affixation of a CVC template, to which melodic material from a copy of the base is mapped.

McCarthy and Prince (1986, 1990) argue that morphological templates are defined not in terms of segments, such as C and V slots, but instead are defined prosodically. Templates make use of 'the authentic units of prosody: mora (μ), syllable (σ), foot (F), prosodic word (W), and so on' (McCarthy and Prince 1990:209).[1] The Agta reduplication template, for example, can be reanalysed as a heavy syllable. The use of prosodic templates avoids the redundant restatement of language-particular syllable wellformedness conditions in the shape of templates, and constrains possible templates in a way C and V slots do not, requiring them to consist of prosodic constituents.

As well as defining the shape of affixes (as in reduplication) and of lexical items (as in the Arabic *binyanim),* templates can also define domains to which morphological operations apply. An example of this 'prosodic circumscription' is Samoan plural reduplication. Here, a prosodic template circumscribes 'the rightmost, main-stressed foot of the word'. The reduplicative affix is prefixed to this base; the result is apparent infixation in words longer than one foot (McCarthy and Prince 1990: 230-31).

Affixation may also apply to the residue of extraprosodicity; in this case a prosodic constituent is made extraprosodic for the purposes of the morphological operation. An example is Tagalog actor focus infixation; an initial consonant is made extrametrical, and the morpheme *-um-* is prefixed to the residue (McCarthy and Prince 1990:227). After affixation, reconcatenation occurs:

1.	stem	*tawag*	'call'
	extraprosodicity	*<t>awag*	
	residue	*awag*	

[1] A light syllable contains one mora and a heavy syllable contains two (or more) moras. Vowels are always moraic; whether coda consonants are moraic or not is a language-particular matter. Thus, a syllable of the form CVC is light (monomoraic) in some languages, heavy (bimoraic) in others (see McCarthy 1979b: 445). I assume that coda consonants are moraic in Alabama, following Lombardi and McCarthy (1991).

affixation	*um-awag*
reconstitution	*tumawag*

I show below that Alabama negation is a templatic process. Prosodic circumscription by extraprosodicity, combined with a heavy syllable template, give the correct results for the data.

1.2. Background Prosodic Information[2]

The possible syllable types of Alabama are 'light syllables CV and V; heavy syllables CVC, CVV, VC, and VV; and extra-heavy syllables CVVC and VVC' (Montler and Hardy 1991: 7). Sequences of three light or three heavy syllables are dispreferred, and sequences of three extra-heavy syllables are disallowed (Montler and Hardy 1991: 8). Almost all verbs, including all derived verbs (and hence all negative verbs), end in the sequence heavy syllable - light syllable. This heavy-light final sequence is termed the Alabama Verb Frame (Montler and Hardy 1991: 9). The minimal word consists of two syllables (Montler and Hardy 1991: 11).

Words in isolation never end in consonants; in sentences, the syntactic suffixes /k/, /t/, /n/, and /s/ may appear at the end of words (Lupardus 1982: 56). According to Hardy and Montler (1988a: 380), onsetless syllables occur only word-initially; on the other hand, Lupardus (1982: 56) claims that syllable division occurs between unlike vowels, and lists in her glossary nine words containing sequences of unlike vowels which are not in initial position.

I do not have evidence of the foot structure of Alabama. The analysis of the negative presented in this paper does not depend on any particular claim about foot structure.

Alabama has a system of pronominal agreement on verbs. The negative forms discussed here are unmarked for agreement (or marked for 3rd person, since 3rd person agreement consists of a zero morph (Montler and Hardy 1991: 17)). Montler and Hardy assume that 'the agreement formatives are added to the negative stems' (1991: 17).

2. Negation in Alabama: Montler and Hardy (1991)

2.1. Negation Data

Standard (as opposed to periphrastic; see Montler and Hardy 1991: 6-7) negation in Alabama is performed by affixation. There is considerable complexity in the behaviour of the negative affix. Not only does it attach

[2] Montler and Hardy's data for Alabama come largely from their own field work, as do Lupardus's.

at several different points within the word form, appearing as a prefix, an infix or a suffix, but the affix itself takes several different forms, namely /ki/, /ik/ or /kii/.

Negative formation also involves in all cases the suffixation of /o/, which causes the final vowel of the base to be deleted. If tautosyllabic sequences of unlike vowels are disallowed (see section 1.2.), the deletion could be regarded as occurring automatically, due to the constraint against final heavy syllables. If such vowel sequences are not independently ruled out, the /o/ must be regarded as being inserted in a 'feature-changing' manner (as opposed to a 'feature-filling') manner; this means that /o/ automatically 'overrides' any previous vowel (cf. McCarthy and Prince 1990: 245).

High pitch accent (represented by the symbol ´) is also inserted in all negatives on the penultimate syllable of the derived form (the position of the accent within heavy syllables not being contrastive (Lombardi and McCarthy 1991: 57)). I do not discuss the significance or the mechanics of the high pitch accent placement here.[3]

There are six types of standard negative affixation. Examples of each of the six types are given below, followed in each case by a characterization of the relevant portion of affirmative and negative forms in terms of C and V slots. All data is taken from Montler and Hardy (1991: 4-6).

Type 1 (Prefixation)

affirm.	**neg.**	**gloss**
(i)sa	íkso	'be located'
(i)la	íklo	'come'
(i)bi	íkbo	'kill'

(i) CV → íkCo

(Montler and Hardy (1991: 11-12) and Lupardus (1982: 58) argue that the initial /i/ in these affirmative forms is prothetic, appearing only to maintain the minimum word size).

[3] Lombardi and McCarthy (1991: 57-59) argue that in the Choctaw *y*-grade and the Alabama imperfective, a high pitch accent is lexically linked to the mora affixed by the relevant rule. This is probably not the case in the Alabama negative, as can be seen below; in Type 6 negation, the accent occurs on base material, not on the affix which is added.

Type 2 (Infixation)

hoopa	hokíipo	'sick'
pakaama	pakakíimo	'tame'
ooti	okíito	'kindle'

VVCV → VkíiCo

Type 3 (Infixation)

talwa	takílwo	'sing'
bassi	bakísso	'poor'
nocihla	nocikíhlo	'sleepy'

VCCV → VkíCCo

Type 4.a (Infixation)

liska	lisíkko	'beat'
libatka	libatíkko	'cooked'
baski	basíkko	'long'

VCkV → VCíkko

Type 4.b. (Infixation)

afaaka	afaíkko	'laugh'
botooka	botoíkko	'ground'
naaliika	naaliíkko	'talk'

VVkV → Víkko

Type 5 (Suffixation)

isi	ísko	'take'
hocifa	hocífko	'name'
kano	kánko	'good'

VCV → VCko

Type 6 (Suffixation)

bit-li	bítko	'hit'
hap-li-ci	hapkíico	'bathe someone'
alkomoo-li	alkomóóko	'hug'

VC → VCko[4]

VV → VVko

Montler and Hardy (1991: 12-17) argue that the suffix *-li* in Type 6 is not present at the stage of derivation when the negative is added, and appears in the affirmative only to fulfill the Verb Frame. Their evidence for this claim includes: (a) the lack of semantic coherence of the suffix; (b) its unique phonological characteristics (it is missing in some phonological environments, unlike other suffixes, and the /l/ it contains is 'the only /l/ in the language to undergo a very marked assimilation rule' (Montler and Hardy 1991: 13)); and (c) the fact that, unlike other apparently parallel suffixes, *-li* is difficult to reconstruct as an auxiliary in Proto-Muskogean.

2.2. Montler and Hardy's (1991) Analysis

Montler and Hardy (1991: 9) propose the following Negative Placement rule (where {/k/, /i/} indicates 'a contiguous pair of segments unspecified as to linear order'):

[4] The output *hapkíico* does not conform to this pattern; this is a result of the presence of an additional suffix *-ci*, and is shown below to be entirely predictable from the analysis proposed.

2. (a) If the onset of the final syllable is /k/, then place {/k/, /i/} before it.

   (b) If the stem already conforms to the Alabama Verb Frame, insert {/k/, /i/} into the rime of the penultimate syllable.

   (c) Elsewhere, place {/k/, /i/} so as to conform to the Alabama Verb Frame.

Parts (b) and (c) of the rule are paraphrased as follows: 'if the stem ends in a one-mora foot, prefix two moras; if it ends in a two-mora foot, suffix one mora; if it ends in a three-mora foot, prefix to the third mora from the end' (Montler and Hardy 1991: 9-10).

Given the apparent complexity of the negative affixation data and the complex rules which could be formulated to produce the position and shape of the affix, it is extremely desirable to attempt to reduce the behaviour of the negative affix to independent considerations (such as accommodation to the Verb Frame), as Montler and Hardy have done. Their analysis does not, however, produce the correct output in all instances.

The Negative Placement rule is not completely precise and therefore overgenerates. The paraphrase of the rule is in fact more specific than the rule itself. For example, part (b) of the rule characterizes the site of affixation for a stem which already conforms to the Verb Frame as 'into the rime' of the penultimate syllable. 'Into the rime' is ambiguous; the affix could insert according to these instructions at the beginning of the rime, in between the two moras of the rime, or after the rime. The paraphrase of this part of the rule makes explicit the site of affixation, but gives incorrect results; input stems ending in a 'three-mora foot' do not prefix {/k/, /i/} to the third mora from the end. Prefixation to the third mora from the end in the Type 2 stems (ending in VVCV) would give the incorrect derivations in (3):

3. hoopa → **hikóopo* (correct output *hokíipo*)
   ooti → **ikóoto* (correct output *okíito*)

Another example of the impreciseness of the Negative Placement rule is that while part (c) states that the input must be altered so that the output conforms to the Alabama Verb Frame, in some cases there is more than one way to do this (contrary to what the paraphrase of the rule implies). For example, if the stem of the input ends in a 'two-mora foot' of the form CVCV (Type 5), suffixation of one mora (giving CVCki) is not the only way to produce an output which conforms to the Alabama Verb Frame; /ik/ could be infixed (note that an output ending in CVikCV is not ruled out, as shown by the forms in Type 4.b.).

Finally, the shape of the affix itself is not precisely determined by the rule or the paraphrase. In Type 2 affixation, there is no explanation of

the fact that the affix takes the form /kii/, rather than /ik/ (which would produce a legitimate form according to the Verb Frame; cf. Type 4.b.). Conversely, given that it is legitimate for the affix to have the form /kii/, there is no reason why Types 4.a and 4.b (part (a) of Montler and Hardy's rule) must affix /ik/ rather than /kii/. The application of part (a) of the rule could equally well produce the derivations shown in (4):

4.	*liska*	→	**liskíiko*	(correct output *lisíkko*)	Type 4.a
	afaaka	→	**afaakíiko*	(correct output *afaíkko*)	Type 4.b

It can therefore be seen that while the aim of Montler and Hardy's anaysis (to explain the position and shape of the affix by means of general rules interacting with independent constraints) is a desirable one, the actual Negative Placement rule needed would be more specific (and therefore less attractively general) than the one they give.

A second reason why I consider Montler and Hardy's analysis to be inadequate is that it is not formalized in any constrained theory of morphology or phonology. While their statement of the rule aims at simplicity and generality, it is not constrained in any formal way, and there is therefore no reason why the rule should have the form it does rather than any other form. For example, there are no constraints on statements such as 'insert {/k/, /i/} into the rime of the penultimate syllable', meaning that insertion could with equal formal simplicity occur at any point in the word. For this reason I attempt in the remainder of this paper to analyse the Alabama negation data within the theory of Prosodic Morphology, as developed by McCarthy and Prince (1986, 1990).

3. A Prosodic Morphology Analysis: Preliminaries

The suffixation of /o/ is relatively straightforward and can be dispensed with here. /o/ is a floating element which attaches right-to-left in a feature-changing manner, after the application of {/k/, /i/} affixation. The behaviour of {/k/, /i/} is the interesting aspect of the data, and for the remainder of the paper I ignore the alternation of final vowels with /o/.

An analysis of Alabama negation in a Prosodic Morphology framework requires answers to the following questions:

A. Is there a template for the affix {/k/, /i/}, and if so, what is it?

B. Is there a template for the output of affixation, and if so, what is it?

C. Why is the affix attached in different parts of the word, occuring as a prefix, an infix or a suffix, and under what conditions does each occur?

D. Is there a rule of metathesis, or does the order of the elements /k/ and /i/ follow from independent considerations such as syllable structure, template satisfaction, and/or phonotactics?

E. If there are templates for the affix and/or the output of affixation, how does association to the templates proceed?

F. How is the base for the affixation characterized?

The remainder of section 3 deals with the first two of these questions, and additionally outlines a preliminary assumption of the analysis, namely the extraprosodicity of final syllables in negation.

3.1. Affix template

Alabama negative formation seems to involve affixation of a mora. Affixation always raises the mora count of the base by at least one. In Types 2-6, one mora is added, and in Type 1, two are added (the additional mora in Type 1 can be explained by independent means, detailed below in section 4.1).[5] I therefore propose that a template consisting of a single mora is involved. That the template is not a light syllable, but simply one mora, is shown by Type 5, repeated here:

5.	isi	ísko	'take'
	hocifa	hocífko	'name'
	kano	kánko	'good'

The negative forms in this type contain in each case one mora more than the affirmative forms, but the number of syllables remains the same.[6]

Lombardi and McCarthy (1991: 49; 54) propose an affix consisting of a mora template for medial gemination in Alabama and Choctaw. Medial gemination differs from negation, however, in that the affix in medial gemination does not have melodic content; its effect is therefore simply to induce spreading. An example from Alabama is given in (6). An iambic base is first positively prosodically circumscribed; the first mora of the resulting string is made extraprosodic, and a mora template is prefixed to the residue of this operation. Leftward spread fills the template, and reconstitution takes place:

6.	stem	*balaaka*	'lie down'
	iambic base	*balaa*	
	extraprosodicity	*<ba>laa*	

---

[5] Thanks to Patricia Shaw (personal communication) for bringing these facts to my attention.

[6] Montler and Hardy's (1990: 265) approach to affirmative affixation in Alabama resembles an appeal to an affixal template. Their rule of affixation states that the affix should be added where it will add at least one mora.

residue	*laa*
prefixation	μ + *laa*
spread	*llaa*
reconstitution	*ballaaka*

The negative affix in Alabama obviously contains not only a template, but also floating melodic material (namely {/k/, /i/}). That the {/k/, /i/} is floating at the stage of affixation is shown by the fact that while the mora count of the base raises by one, the melodic elements themselves end up attached in widely varying positions within the syllable, and with varying weights. The elements {/k/, /i/} can appear as a light syllable (e.g. Type 5), a heavy syllable (Type 1), a rime (Type 4.a.), part of a rime (Type 4.b.), or an onset plus a mora (Type 3). In Types 1, 2, 4.a and 4.b, the elements {/k/, /i/} end up occupying two moras, while in Types 3, 5 and 6 they occupy one mora.

It is not completely desirable to postulate floating {/k/, /i/}, as floating material should ideally make up a prosodic constituent. McCarthy and Prince (1990:245), however, do allow floating /gi/ (which does not make up a prosodic constitutent, but provides the initial CV of a syllable) in Kolami echo word formation.

3.2. Preliminary assumption: extraprosodicity

There is reason to believe that the final syllable in the base and output forms is extraprosodic. Lombardi and McCarthy (1991) argue for Choctaw that final syllables are extraprosodic, a proposal which they claim is 'not implausible' in the light of a constraint against word-final long vowels (Lombardi and McCarthy 1991: 47). A similar constraint exists in Alabama (see section 1.2. above); in fact, final syllables in Alabama are even more restricted than in Choctaw. While Choctaw words may end in a consonant, Alabama words do not (except when the syntactic suffixes are added in sentences). It is therefore plausible that final syllables in Alabama are extraprosodic in the phonology.

This assumption is not a necessary prerequisite, however, to the claim that final syllables are extraprosodic for the purpose of negative formation. An operation of extraprosodicity is legitimate as part of a morphological process, regardless of whether extraprosodicity exists in the phonology; Lombardi and McCarthy (1991: 69, fn 9) note that 'prosodic circumscription is part of a morphological operation, not a process that assigns phonological structure.' I assume that the stem for negation undergoes the operation of extraprosodicity schematized in (7). A function Φ parses out a light syllable at the right edge of the domain; this syllable is made extraprosodic:

7. $\Phi(\sigma\mu, \text{Right})$

Lombardi and McCarthy (1991:55) also utilise final syllable extraprosodicity for Alabama medial gemination.

3.3. Output template

The regularity of the output shape in negation (the sequence heavy syllable - light syllable) could be the result of mapping to a template. It could alternatively be the result of a lengthening rule which actively enforces the Verb Frame (similar or identical to the lengthening rule discussed by Lombardi and McCarthy (1991: 44-46) and Ulrich (1986: 53ff) for Choctaw). In this case an output template which enforces the Verb Frame would be redundant.

There is a difference between Choctaw and Alabama with respect to the status of the preferred heavy-light word ending. While the lengthening rule in Choctaw applies to all words, and is tied in with the construction of iambic feet, in Alabama the shape restriction applies only to verbs, and strictly refers only to the penultimate syllable (given that final syllables are always light by a separate constraint). So for example Hardy and Montler (1988a: 385) mention that '(CV)CVCV is a very common root shape for nouns, but is very rare (<1%) for verbs.'[7] Even for verbs, only the outputs of derivations conform to the Verb Frame:

> there is a general constraint on the derivation of verbs in Alabama to the effect that the output of any lexical rule applying to verbs must be a form ending in a heavy-light syllable sequence ... Derived verbs must end in a two-syllable, three-mora foot (Montler and Hardy 1991: 9).

This enforcement of the Verb Frame in derivation but lack of enforcement in underived words makes it likely that we are dealing with an output template on rules, rather than a separate rule which enforces the Verb Frame.

Under the assumption of extraprosodicity of the final syllable in Alabama, the template for the output of negation can be characterized as in (8):

8. $\sigma\mu\mu]$word

The template in (8) means that a word-final syllable is heavy. The output template cannot be larger than one syllable because in Types 1, 5 and 6 the

---

[7] Ulrich (1986: 54) notes that the lengthening rule does not actually apply 'across the board' in Choctaw. He proposes that lengthening applies at level one of the phonology, but not at level two.

output form (disregarding the extraprosodic final syllable) may consist only of one heavy syllable.

The template given in (8) only defines the shape of *part* of the output form (the right edge, disregarding extraprosodic material). A template defining part of the output form is used in the Arabic broken plural (McCarthy and Prince 1990) and the Choctaw *y*-grade (Lombardi and McCarthy 1991). In both these cases a prosodically circumscribed subpart of the base maps to the template, and the residue of prosodic circumscription does not; for example, in the Choctaw *y*-grade the base is prosodically circumscribed as an iamb, which maps to a canonical iambic template.

It appears to be impossible in the case of Alabama negation prosodically to circumscribe a part of the base which maps to the heavy syllable template. In Types 1 and 2, no base material maps to the template at all (the affix itself filling the template). In Types 3, 4.a. and 4.b., the affix plus following or preceding segments from the base map to the template, and in Types 5 and 6, it is purely base material which maps to the template (except in the form *hapkíico*, where the affix satisfies the template). It therefore appears that there is no operation of positive prosodic circumscription defining a certain portion of the base which maps to the output template. The only generalization which can apparently be made is that the penultimate syllable of the output is always heavy.

For these reasons I conclude that the template must be a bimoraic syllable which appears at the right edge of the output form (disregarding the final extrametrical syllable). After the template is filled, remaining melodic elements are free to construct prosodic structure according to normal prosodization rules (reprosodization is necessary, as the syllable structure of the base is not necessarily preserved; this is noted where relevant below).

4. The Analysis

The analysis of negative formation that I propose involves an initial operation of extraprosodicity which removes a final light syllable from the base. Affixation, which is shown below to be suffixation in all cases, then applies; the output conforms to a template imposing a heavy syllable at the right edge. With bases ending in a sequence of two light syllables, extraprosodicity of the final syllable does *not* apply; these are also the only bases where the penultimate syllable is not heavy. A constraint is therefore proposed, stating that after the operation of extraprosodicity, the residue must be a heavy syllable.

Refinements to the analysis are introduced as each type of negation is examined in sections 4.1. to 4.3. The issue of the order of affixal segments is discussed in section 4.4., and direction and type of mapping in section 4.5.

4.1. 'Prefixation'

Type 1

Stems for Type 1 negation consist of a single syllable, under the hypothesis that the initial /i/ is prothetic and not present underlyingly. The operation of extraprosodicity then returns a residue equal to zero, and the negative formative is affixed to a zero string. Lombardi and McCarthy (1991: 56) encounter a similar result in their analysis of Alabama medial gemination, where the entire input string is made extraprosodic; they note that 'Nothing in prosodic circumscription theory prohibits cases ... where an entire form is extraprosodic.' The question arises as to whether the affix is prefixed or suffixed to the zero string. I claim that it is suffixed, as all other instances of negative affixation can be shown to be suffixation; the apparently variable mode of affixation is thus shown not to vary at all.

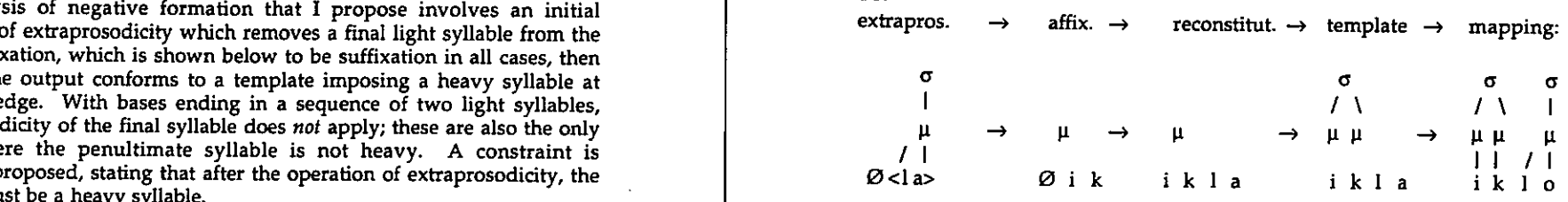
A derivation for a Type 1 verb is given in (9) (recall that the affixation of /o/ and the addition of high pitch are ignored):

9.

stem	*la*
extraprosodicity	*<la>*
residue	*Ø*
suffixation	*Ø-ik*
reconstitution	*ikIo*

It was noted in section 3.1. that although the affix template consists of a single mora, two moras are added to the weight of the input string in Type 1 negation. This is a result of the output template's insistence on a heavy penultimate syllable, which forces the weight to increase by one more mora, as shown in (10):

10.



4.2. Infixation

Type 2

In Type 2, the affix appears to substitute for the second mora of the penultimate syllable, rather than attach after it. Substitution is not a viable option in the theory of Prosodic Morphology, as it would mean that

site of affixation is unconstrained. If infixation must always be the result of an operation of prosodic circumscription plus ordinary affixation, the site of infixation is constrained by the requirement that both positive prosodic circumscription and operations of extraprosodicity refer only to prosodic constituents.

Although substitution is disallowed, successive applications of extraprosodicity are sometimes necessary. This method is utilised, for example, by Lombardi and McCarthy (1991) for Choctaw. If successive applications of extraprosodicity are used without restriction, the constrainedness of the theory is weakened, for obvious reasons. This issue is briefly returned to below.

The Type 2 Alabama negation can be derived by proposing that after the first operation of extraprosodicity, another operation makes the last mora of the form extraprosodic:

11.		
	stem	*hoopa*
	extraprosodicity 1	*hoo<pa>*
	residue	*hoo*
	extraprosodicity 2	*ho<o>*
	residue	*ho*
	suffixation	*ho-ki*
	reconstitution	**hokíopo*

In order to account for the fact that this form does not accord with the correct output, I adopt the plausible assumption that **hokíopo* is ruled out by syllable structure constraints. Although I can find no direct statements to this effect, there are no forms which include vowel sequences of the type /io/ in all the data given by Davis and Hardy (1988), Hardy and Davis (1988), Hardy and Montler (1988a, 1988b), Montler and Hardy (1990, 1991) and Lupardus's (1982) glossary. If it is correct that **hokíopo* is ruled out independently, the /o/ of the penultimate syllable will delete; the /i/ must then spread to fill the obligatory second mora of the syllable, giving the correct output *hokíipo*.

This derivation for Type 2 has the significant advantage over Montler and Hardy's (1991) analysis of explaining why the negative of *hoopa* is not **hookíipo*. Montler and Hardy do not explain the shortening of the long /oo/, but merely note that 'the geminate vowel of the stem appears to be degeminated' (1991:4).[8]

[8] The non-existence of **hookíipo* could be explained by the preference for antepenultimate syllables to be light (cf. Hardy and Montler 1988a: 385: 'Verbs ... prefer alternations of heavy and light syllables.' There are exceptions to this preference, however, as demonstrated by the existence of forms such as *naalíkko* (Type 4.b.).

The two rules of extraprosodicity must apply in the order given. This may appear to follow from the Elsewhere Condition (cf. Kiparsky 1982), as the first rule is the more specific. This can be seen when the formal statements for the two rules are compared:

12. extraprosodicity 1: $\Phi(\sigma_\mu, \text{Right})$ Condition: previous σ heavy
extraprosodicity 2: $\Phi(\mu, \text{Right})$

The usual interpretation of the Elsewhere Condition, however, is that after a more specific rule has applied, the more general rule is blocked from applying, which is not the case here. The order of the two rules must at this stage simply be stipulated.

The use of two operations of extraprosodicity raises the question of how site of affixation is constrained (cf. the discussion above). Operations of extraprosodicity will not cause unconstrained derivations if they can be shown to be independently motivated. This does appear to be the case for the second operation needed for Type 2 negation. An operation making the second mora of the penultimate syllable extraprosodic is motivated for Choctaw (Lombardi and McCarthy 1991: 62), for reduplication in Koasati (another related language; here the first mora of the penultimate syllable is reduplicated and the second mora ignored (Kimball 1988: 432-33)), and also for /h/-infixation in Alabama (/h/ is inserted after the head of the penultimate syllable (Hardy and Montler 1988a: 386)).

Type 3

Type 3 forms are derived in exactly the same manner as Type 2 forms:

13.		
	stem	*talwa*
	extraprosodicity 1	*tal<pa>*
	residue	*tal*
	extraprosodicity 2	*ta<l>*
	residue	*ta*
	suffixation	*ta-ki*
	reconstitution	*takílwo*

Type 3 indicates that the heavy syllable output template is satisfied only after reconstitution. If the template were satisfied before reconstitution, we would expect outputs for Type 3 such as **takíilwo*. McCarthy and Prince's (1990) analysis of the Arabic broken plural involves template satisfaction before reconstitution; they state that 'Material ... in the residue ... will be unaffected by this template-mapping morphology', and that 'the residue ... becomes accessible after template mapping' (McCarthy and Prince 1990: 246). The template for Alabama negation, as opposed to that of the broken plural, must be a constraint strictly on the output of derivations, and is not obligatorily satisfied until all other aspects of the derivation have taken place. This is assumed to be the case for all types of negative; while Type 3 provides the only instance which

conclusively shows that derivation must take place in this order, this order is compatible with all other types.

The inclusion of reconstituted material in mapping to the template contrasts with the claim, made in section 3.3., that the template is a heavy syllable occurring at the right edge of the form, disregarding extraprosodic material. This may indicate a difference between the two operations of extraprosodicity; operation 1 may (as tentatively argued above) reflect a phonological extraprosodicity of final syllables in Alabama, while operation 2 is purely morphological, allowing material made extraprosodic by operation 2 to form part of the prosodic core after reconstitution. Material which is phonologically extraprosodic remains unavailable for mapping to the template.

Types 4.a and 4.b.

In Types 4.a. and 4.b., infixation occurs after the penultimate syllable. It might appear that Types 4.a. and 4.b. differ from Types 2 and 3 in lacking the second operation of extraprosodicity, and this is a possible analysis, as outlined in (14) for Type 4.a.:

14.	stem	*liska*
	extraprosodicity 1	*lis<ka>*
	residue	*lis*
	suffixation	*lis-ik*
	reconstitution	*lisíkko*

The non-application of the second operation of extraprosodicity to these forms would be a matter for stipulation — an undesirable situation. There is, however, another possibility, which draws on a diachronic analysis of Types 4.a. and 4.b.

Montler and Hardy (1990: 269, 1991: 15) note that the *-ka* ending which appears in Types 4.a. and 4.b. is derived from an earlier *ka* auxiliary, which came to be attached to the preceding word. I suggest that the *-ka* ending is still a separate word underlyingly, and is not adjoined to the previous word until a late stage in the derivation of the surface forms (after negation has applied). (Types 4.a. and 4.b. forms ending in /k/ followed by another vowel are treated similarly, by analogy with the *-ka* forms (Montler and Hardy 1990: 269).) This means that Types 4.a. and 4.b. are exactly parallel to Type 1, as demonstrated in (13) and (14) (note that the rule of extraprosodicity 2 could also apply vacuously to these forms, although it is not included in the derivations):

Type 4.a

15.	stem	*ka*
	extraprosodicity 1	*<ka>*
	residue	*Ø*
	affixation	*Ø-ik*
	reconstitution	*íkko*
	adjunction	*lisíkko*

The coda of the penultimate syllable in the affirmatives of Type 4.a. becomes an onset in the negative. This follows from normal rules of prosodization, which attach an intervocalic consonant preferably to the following syllable.

Type 4.b

16.	stem	*ka*
	extraprosodicity 1	*<ka>*
	residue	*Ø*
	affixation	*Ø-ik*
	reconstitution	*íkko*
	adjunction	**afaaíkko*

**Afaaikko* is ruled out by syllable structure constraints, as it contains a super-super-heavy syllable. Shortening of the offending syllable gives the correct output *afaíkko*.

Evidence that the derivation of forms like *afaíkko* does involve a step producing intermediate forms like **afaaíkko* is provided by Montler and Hardy (1991: 5, fn 10), who note the existence of the alternative outputs *afaahíkko, naaliihíkko*. The /h/ in these forms is 'phonologically predictable following a root-final sonorant ... and before any vowel-inital negative or pronominal suffix' (Montler and Hardy 1991: 5). There appears to be a choice of methods to eliminate the disallowed **afaaíkko*; speakers can either insert an /h/ or delete an /a/.

Analyzing the Type 4.a. and 4.b. forms in this diachronic way makes the affixation process less stipulative, as the difference between Types 2/3 and 4.a./4.b. is explained without the need arbitrarily to refer to the presence or absence of /k/ in the final syllable. Note that the /k/ in the negative affix is not relevant to the /k/ in the final syllable, as the same distinction between /k/-containing bases and non-/k/-containing bases is evidenced in affirmative affixation, where the affix does not contain a /k/ (see Montler and Hardy 1990). The fact that some forms alternate between Types 2/3 and Types 4.a./4.b. (for example *palki* → *pakílko* or *palíkko* 'fast' (Montler and Hardy 1991: 5) may indicate gradual change away from the diachronic analysis of these words.

4.3. Suffixation

Type 5

Type 5 provides evidence for a constraint on the first operation of extraprosodicity, to the effect that the residue from this operation must not end in a light syllable. In Type 5, which is the only type where the input

contains a light penultimate syllable, the first operation of extraprosodicity does not take place. The second operation does, however:[9]

17.	stem	*isi*
	extraprosodicity 1	n/a
	extraprosodicity 2	*is<i>*
	residue	*is*
	affixation	*is-ki*
	reconstitution	*ísko*

The onset of the affirmative's final syllable becomes a coda in the negative, by the normal process of mapping to the output template.

Type 6

Type 6 follows straightforwardly from the analysis so far, except that the second operation of extraprosodicity does not apply:

18.	stem	*bit*
	extraprosodicity 1	n/a
	extraprosodicity 2	d.n.a.
	residue	*bit*
	affixation	*bítko*

It is puzzling that extraprosodicity 2 does not apply to Type 6 forms. Note that it is not the case that extraprosodicity 2 only operates on vowels (nuclear moras), as shown by Type 3 *talwa* → *takílwo*, where the coda consonant of the penultimate syllable becomes extraprosodic before suffixation of /ki/. The only explanation I have at present for the difference between Types 5 and 6 is a rather unsatisfactory one. It could be the case that in Type 5, extraprosodicity 1 *does* take place, but the output from it is ruled out (as it ends in a light syllable). In this case, extraprosodicity 2 is free to apply. In Type 6, however, extraprosodicity 1 cannot apply at all, as its structural description is not met. In this case, extraprosodicity 2 does *not* apply. It may therefore be the case that the inapplicability of extraprosodicity 1 causes the cessation of all extraprosodicity operations; in other words, the extraprosodic mechanism 'looks no further' if it denied at its first try.

The output form *hapkíico* in Type 6 differs from other Type 6 forms in that the affix appears in the penultimate rather than the final syllable. This form also follows from the analysis, provided that the causative suffix *-ci* is affixed after negation. After the negative formative is affixed,

[9] Thanks to Patricia Shaw (personal communication) for pointing out that extraprosodicity 2 is applying here. Montler and Hardy (1991: 11) also assume that the final vowel is extrametrical in this negation type.

the addition of *-ci* means that the heavy syllable template applies to the syllable containing the negative affix. This provides additional evidence that the template is only satisfied after the complete negative affixation process, as spreading of the negative vowel /i/ to become /ii/ only becomes necessary after addition of *-ci*.

4.4. Order of affix segments

The issue of the order of segments in the negative affix has been ignored until now, but follows straightforwardly from the analysis proposed here. The segments occur in the order /ik/ in Types 1, 4.a. and 4.b., and in the order /ki/ in all other types. If we assume the diachronic hypothesis for the derivation of Types 4.a. and 4.b., the generalization can be made that the order of elements /ik/ occurs only word-initially, /ki/ (including /kii/) occuring elsewhere. This complementary distribution follows from the constraint in Alabama against vowel-initial syllables anywhere other than in word-initial position.[10] The affix is therefore underlyingly in the order /ik/; if it attaches in a non-word-initial position, syllable structure constraints force it to metathesize to /ki/. This accounts for all occurring and non-occurring orders of the affix segments over the six types, and also provides additional evidence for the analysis of Types 4.a. and 4.b. provided above.

4.5. Direction and type of mapping

The affix template, which consists of a single mora, can provide no information about direction or method of mapping. The output template indicates, however, that mapping is right to left, as the template is satisfied at the right edge of the domain.

5. Summary and Conclusions

The questions posed above in section 3 can now be answered as follows:

A. The affix consists of a mora template and the melodic material /ik/.

B. The output template is $\sigma\mu\mu$.

C. The affix is suffixed in all cases, and the different sites of affixation follow from the interaction of two operations of extraprosodicity (and in the case of Types 4..a and 4.b., from the fact that the stem-final *-kV* is underlyingly analysed as a separate word).

[10] It is therefore crucial for my analysis to adopt Hardy and Montler's (1988a: 380) statement about onsetless syllables, rather than Lupardus's (1982: 56); cf. discussion in Section 1.1.

D. The underlying order of elements is /ik/; when the affix is attached in a non-word-initial position, syllable structure constraints rule out this order and /ki/ is produced.

E. Association to the templates proceeds from right to left.

F. The morphological base undergoes two operations of extraprosodicity, the first of which makes a final light syllable extraprosodic when it is preceded by a heavy syllable, and the second of which makes the final mora extraprosodic. The rules apply in the order 1, then 2; if the first operation is unable to apply, the second does not apply. The formal characterization of these operations is as in (19):

19. extraprosodicity 1: $\Phi(\sigma\mu, \text{Right})$. Condition: previous σ heavy.
extraprosodicity 2: $\Phi(\mu, \text{Right})$.

It has been demonstrated in this paper that the theory of Prosodic Morphology allows for an insightful analysis of Alabama negation data. The constraints imposed by the theory promoted the search for wide-reaching generalizations and allowed the reduction of the apparent complexity of negation types to the interaction of two operations of extraprosodicity.

The Prosodic Morphology analysis is superior to Montler and Hardy's (1991) treatment in several respects. First, it provides full empirical coverage, unlike Montler and Hardy's Negative Placement rule (section 2.2.). It reduces the apparently varying mode of affixation to suffixation in all cases, and characterizes the place of infixation not by stipulation, but by independently motivated operations of extraprosodicity (see sections 3.2., 4.2.). The order of affix segments follows from syllable structure constraints, once the parallel is drawn between Type 1 and Types 4.a. and 4.b. (again by an independently motivated proposal, namely a diachronic analysis of Types 4.a. and 4.b.). Finally, the application of Prosodic Morphology is attractive because it provides a constrained framework within which analyses can be evaluated and compared.

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An Assimilatory Neutralization in New Zealand English

Matthew Scott

Abstract. Research into neutralization phenomena is dicussed and issues raised for experiment design. A first experiment found that the assimilation of /t/ word-finally to a following /k/ does not result in neutralization in production. A further experiment suggested that the distinctions maintained are not perceptually salient, and hence that neutralization does occur in perception. To test the possibility that visual information aids discrimination, some subjects were shown a video record of the first experiment, while others had access only to the soundtrack. Visual information was not found to aid perception in the present case.

1. Introduction

In recent years, several basic phonological constructs have come under close experimental scrutiny; one such construct is that of 'neutralization'. In essence, neutralization describes the suspension of a contrast in certain contexts. Where forms contrast phonologically and phonetically in some circumstances but are phonetically indistinguishable in others, a rule of neutralization is offered to describe the latter. A celebrated case is that of Word-Final Obstruent Devoicing in German, whereby /t/ and /d/ for example, which contrast intervocalically, are said to be neutralized word-finally in favour of [t].

In an important summary of the evidence for neutralization, Dinnsen (1985: 265) observes:

> the phonetics of neutralization has largely been assumed on the basis of casual impressionistic phonetics ... Very little experimental work is available that would contribute to establishing the facts of neutralization.

This paper represents a modest contribution to ongoing research into the evidence for neutralization. While most of the evidence to date has come from acoustic analyses of production phenomena, the experiments detailed in this paper adopt an audition-based approach. They draw extensively on the insights and methodology of Kelly & Local (1990),

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whose sophisticated approach both to observation and analysis constitutes a major departure from the 'casual impressionistic phonetics' criticized by Dinnsen.

What of the evidence so far? Broadly speaking, results have failed to support the standard conception of neutralization. The 'standard conception' has followed the generativist assumption (cf. Chomsky & Halle (1968)) of an abstract phonology, in which the grammar (which includes phonological rules of neutralization) is neutral with respect to speaker and hearer. It has, however, been independently argued that production and perception are at least partly independent (see Dinnsen, (op.cit.) for a survey of the evidence). This raises the possibility that rules of neutralization may behave differently with respect to each. Following this assumption, Dinnsen distinguishes four logical categories of neutralization rules:

Table 1: Typology of Neutralization Rules

Type	Production Differences	Perceptual Differences
A	No	No
B	Yes	No
C	Yes	Yes
D	No	Yes

It will be evident that an experiment in which no production differences are found counts as evidence for Type A, even if no perceptual test is conducted, since Type D can never be attested due to the impossibility of perceiving differences where none exist. Type A receives limited empirical support. Fourakis & Iverson (1984) found complete neutralization for German Word-Final Devoicing in production, and Jassem & Richter (1989) found similarly for Word-Final Devoicing in Polish.

On the other hand, several studies examining the same phenomenon found neutralization to be incomplete in production, e.g. Slowiaczek & Dinnsen (1984) for WFD in Polish, Port & O'Dell (1985) for WFD in German. At first sight the evidence appears contradictory. However a closer examination of the experiments suggests an alternative explanation. Slowiaczek & Dinnsen, for example, used word-lists, the most formal and therefore maximally distinguished type of speech, while Jassem & Richter embedded the relevant tokens in sentences. The latter, are more formal than conversational speech, but less formal than word-lists. The difference in results may thus simply reflect the difference in register, with decreasing formality correlated with an increased likelihood of neutralization.

Other studies have demonstrated the influence of pragmatic factors (Port & Crawford (1989)), and stressed interspeaker variation (ibid.; Dinnsen & Charles-Luce (1984)), both in the occurrence of neutralization and in the means by which distinctions are maintained where neutralization is incomplete. All of these serve to undermine the abstractness and generality of neutralization as a phonological construct, and thus challenge those theoretical proposals which make crucial reference to neutralization under those terms.

Where production differences are found to be maintained, a rule of neutralization may be of either Type B or Type C above depending on the perceptual salience of these differences. Many studies which found differences were of production only, and thus do not contribute on this point. I am aware of no positive evidence for Type B; considerable evidence exists however for Type C (e.g. Slowiaczek & Szymanska (1989), Port & O'Dell (op.cit.), Port & Crawford (op.cit.)), which of course is not neutralization at all. All of these latter studies however tested the perceptual salience of speech produced in maximally formal (e.g. word-list) contexts, with the exception of Port & Crawford (op.cit.), whose material was more varied in formality. Predictably enough, perceptual salience decreased with formality (as did distinctiveness in production).

Many of these studies have been criticized on methodological grounds, highlighting a number of issues pertinent to experiment design. These include:

Hypercorrection

Various authors (e.g. Fourakis & Iverson (op.cit.) and Jassem & Richter (op.cit.)) have argued that orthographic influence, and a claimed desire on the part of informants to distinguish supposedly neutralized segments for the benefit of the experiment have compromised the results of some studies. The salience of these two factors is somewhat contingent on a third, namely the extent to which informants are aware of the purpose of the experiment. Clearly, if the informants' attention was drawn to the tokens being tested, or to the relationship between alternative tokens, the potential for hypercorrection is high.

I will not review here the debate over hypercorrection and its influence on results (but see Fourakis & Iverson (op.cit.), Jassem & Richter (op.cit.), Port & O'Dell (op.cit.), Port & Crawford (op.cit.) for some discussion). However, the implications for experiment design are clear enough. Firstly, it is impossible to eliminate the risk of orthographic influence without prohibiting the use of written texts in research. Without such written material, however, there seems no practical way of controlling for some parameters, e.g. register, or phonetic or sentential context (found by Port & Crawford (op.cit) to influence neutralization) in order to ensure broadly comparable data.

More importantly, careful design will seek to keep the focus of the experiment hidden from informants, reducing the chance of deliberate attempts to distinguish tokens, or of close attention being paid to orthography. An effort has been made to do this in the present study.

Parameter Selection

In order to establish that neutralization in production has taken place, it would be necessary to examine every phonetic parameter relevant to the case being tested, e.g. to obstruent voicing in the case of WFD. As Dinnsen argues (op.cit.: 267 note 3) the full range of parameters associated with obstruent voicing is not yet known; results indicating that neutralization has taken place may thus simply have failed to examine the parameters which were marking distinctions.

This problem cannot be obviated by careful experiment design. However, where exhaustive analysis is impossible, careful parameter selection is still necessary. The present study focuses on those parameters most frequently identified as marking distinctions between the segments being examined.

Parameter Control

The wide variety of linguistic and pragmatic factors found to be relevant to neutralization necessitates careful constraints on the data being elicited in order to ensure comparability. This is especially so where the sample is small, as in the present case.

An attempt has been made to control the pragmatic, semantic and phonetic context of the neutralization being tested, both to control for the influence of these on production, and to minimize their effect on perceptual judgement.

Information available to Analyst/Informants

Kelly & Local's (1990: 35ff) discussion of the contribution of visual information to the perception of speech raises a further issue for research. While the sufficiency of aural information for most communicative purposes is undeniable, the possibility remains that visual information may aid perceptual discrimination of tokens that are difficult to distinguish auditorily.

By way of example, Kelly & Local discuss a case of assimilation not unlike the neutralization examined in this paper. Given the sentence *This shop's a fish shop*, they observe (ibid.: 38):

> Here, though there may be similarity of juncture between the words *this* and *shop* on the one hand and *fish* and *shop* on the other in terms of tongue body disposition, it is frequently the case that the onset and timing of lip rounding in the two cases relative to other articulatory components is different.

This difference is most evident visually. If such distinctions are salient for the analyst, could they not also be salient for an informant making perceptual judgements? This possibility is tested in the experiments below.

2. A Case of Assimilatory Neutralization in English

The case of neutralization under examination is the result of an assimilation of place of a word-final alveolar consonant /t/ to a following velar /k/, with the result that pairs such as *light candles* and *like candles* become homophonous.

This neutralization does not appear to have been systematically described with any great degree of phonetic detail. Gimson (1970: 294f) for example, gives a list of consonant combinations which give rise to this type of neutralization, and transcribes his examples phonemically, e.g. /ˈræŋ ˌkwɪklɪ/ (=*ran* or *rang quickly*).

Recent discussions of this assimilation have undermined its supposed neutralizing status. Gillian Brown (1990: 64) writes:

> In cases where final /t,d,n/ and a velar consonant are involved, the transcription [e.g. [ˈwəʊŋk ˈgəʊ] *won't go* (ibid.: 63)] is again misleading. It suggests that the velar stop is untouched by the assimilatory process affecting the preceding consonant. It is true that the velar stop in each case remains identifiably velar but the stop is pulled forward on to the palate rather as it is in the articulation of /k/ in *key*.

This suggests that colloquial pronunciations of e.g. *bat can* vs. *back can*, rather than being homophonous, would differ in the place of [k] in *can*, the former being more advanced than the latter. If this is so then the place of the preceding [k] might also be expected to differ. The immediately preceding vocalic nucleus might likewise be expected to vary, the [æ] in *bat* being more advanced than that in *back*.

Of course, if any of these segments should be found to vary, claims of homophony and hence of neutralization in production are incorrect, and neutralization in perception is no longer assured.

Kelly & Local (op.cit.: 155ff) present strong evidence to this effect, with regard to production. Comparing tokens of *ran* and *rang* for four speakers in the context *ran quickly, rang quickly*, they discovered that no two cases were homophonous, and that regular distinctions were evident between tokens of *ran* and of *rang*. Those of *rang* had 'audibly fronter contact/resonance for the final consonantal portions than do the tokens of RAN', while 'the tokens of RAN all have nuclei which in whole or in part are more retracted and more open than those in the tokens of RANG' (ibid.: 157).

Brown's evidence highlights the significance of the place of the following consonant; Kelly & Local's points to the place of the assimilated consonant and the character of the preceding vowel. Given the earlier discussion on Parameter Selection, the present analysis has paid particular attention to these.

3. Experiment One: Production

Aims

This experiment set out to address the following questions:

1. Does the assimilation of word-final /t/ to an immediately following /k/ result in neutralization in production?

2. If not, what are the phonetic characteristics by which the contrast in maintained?

Method: Data Collection

Two native speakers of New Zealand English were asked to read a list of 23 sentences in front of a video camera. In 12 of the sentences, tokens subject to the kind of assimilation under examination were embedded. The subjects were both female, one aged 21, the other 18. Both were born of middle-class white New Zealand parents. They are henceforth referred to as 'Speaker 1' and 'Speaker 2' respectively.

In line with the discussion of Hypercorrection above, the experiment was designed so that subjects would be unaware of what was being sought. Hence a number of 'dummy' sentences were included. Subjects were not told the purpose of the experiment, but were simply asked to read the sentences casually, as if talking to a friend. They were not given more than a minute to look at the sentences before reading, in case the experiment's purpose became evident. Inasmuch as the informants' attention was not drawn to the tokens being examined, the possibility of hypercorrection due to orthographic influence or intentional distinction, though not eliminated, was minimized.

Inevitably the speech elicited was not completely 'natural'. The presence of not simply a microphone but a camera, in addition to the requirement of reading a list of sentences, combined with the interview-style context to militate against naturalness. The resulting speech is 'located' somewhere between the formality of a word-list and that of free speech within an interview context; thus conclusions about the neutralization being examined pertain to a somewhat formal speech register.

Materials

To confine the scope of the investigation, monosyllabic words of the format

$$X\left[\begin{matrix}V\\ 1\ \text{stress}\end{matrix}\right](V)\left\{\begin{matrix}t\\ k\end{matrix}\right\}\#$$

were chosen. The set described by this format is still phonologically diverse, but semantic considerations meant it could not be further restricted. These semantic issues pertain to the Perception Experiment and are discussed under 4. below. The words chosen needed to be minimal pairs for there to be potential neutralization of a kind relevant to perception.

The words chosen are listed in Table 2.

Table 2: Token Words

1. *bat*	2. *back*	followed by *quickly*
3. *debt*	4. *deck*	followed by *cleared*
5. *net*	6. *neck*	followed by *can*
7. *light*	8. *like*	followed by *candles*
9. *might*	10. *Mike*	followed by *creates* (9); by *controls* (10)
11. *bite*	12. *bike*	followed by *quite*

The sentences were constructed so that both members of each minimal pair would be similarly stressed in its sentence, as is evident from Table 3 below.

Table 3: List of Sentences

1. He tried the *bat quickly* before finally going home.
2. She fixed the *back quickly* and moved on to other things.
3. He soon had the *debt cleared* and could afford to relax a bit.
4. He wanted the *deck cleared* without delay.
5. Working with a damaged *net can* impair your effectiveness.
6. Fixing up a damaged *neck can* cost a lot of money.
7. I don't usually *light candles* on such occasions.
8. I don't usually *like candles* like this.
9. I think too often *might creates* disaster.
10. I think quite often *Mike controls* the way things happen around here.
11. He was having to *bite quite* hard to accomplish anything.
12. I needed to *bike quite* carefully so as not to distract anyone.

Due to a recording error, Sentence 12 for Speaker 1 was destroyed, and so a comparison of 11. and 12. could not be made for this speaker. Sentence 11 was retained for use in the perception experiment.

Method: Observation and Analysis

The methodology adopted here reflects the issues discussed in 1. above. In particular, the use of a video camera made visual information available to the analyst in line with the practice of Kelly & Local.

Further, not all of the segments have been transcribed in equal detail. Close attention has been restricted to the supposedly assimilated consonantal portion, the preceding vocalic nucleus, and the subsequent consonant, as these were the parts of the words in which the distinction

was found by Kelly & Local (op.cit.: 157) and implied by Brown's comments (op.cit.: 64).

Likewise, while any exceptional feature was marked in, close attention was paid in particular to those parameters which the literature has found to be important distinguishers, namely, the place of articulation of the assimilated stops, and the lateral and vertical location of the preceding vowel.

The transcription focussed on the relationship between the members of each minimal pair. The phonetic value of a transcribed segment is thus not precisely comparable with a similar segment *outside* the minimal pair in which it appears. For example, a given [k̟] is equal in value to any other [k̟] in the same minimal pair (on the parameters examined), but may differ in, say, degree of advancement from a [k̟] in any other minimal pair. To have accurately characterized the degree of advancement of all [k̟]s relative to all other [k̟]s in the data would have required a more precise notational set than that offered by the IPA. Since this degree of precision was not necessary, the conventional notation was retained, and the scope of precise comparison restricted to within each minimal pair. Gross comparisons are of course still possible, since for example, any given [k̟] will be advanced with respect to any [k], regardless of where in the data they appear.

To facilitate comparison, two video recorders were used simultaneously during analysis, with one member of each pair of sentences on each recorder. Comparable tokens could thus be heard in quick succession.

Results and Discussion

The transcript is reproduced on the following pages for each speaker.

The record for both speakers is striking in its variability. In particular, the realization of place of the word-final consonant varies from a clearly released, completely unassimilated (on the parameters examined) consonant (no. 1.5), to an apparently fully-assimilated one (no. 2.5). To some extent this variation no doubt reflects the optional status of the assimilation and the conflicting demands of an unnatural setting and the request for 'casual speech'.

Also evident is the absence of any instance of complete homophony. All minimal pairs differed in at least one of the parameters examined, usually more. In all cases the supposedly assimilated word-final segment differed in place from its lexically-velar counterpart, where assimilation was evident at all (nos. 1.9, 1.11, 2.5). The preceding vowel and following consonant also varied within pairs. Neutralization is not evident in the data.

Because the data are varied and not abundant, no significant consistent patterns emerge. However, a few points bear mention. Firstly, more complete assimilation occurred for Speaker 1 following stumbles which may have helped to distract her attention from careful pronunciation. She appeared to find the sentence containing 1.9 semantically odd, and repeated it after stumbling at *might*. She repeated Sentence 11 after stumbling at *bite*, perhaps paying less attention the second time through due to increased familiarity.

This may suggest that the incidence of assimilation would have been higher had the subjects been more familiar with the sentences. However, increased exposure to the sentences might well have disclosed their purpose, as nearly happened for Speaker 2, and this would have drawn the subjects' attention directly to the potential assimilations.

Secondly, the phasing of the onset of lip rounding was earlier with respect to intraoral articulation in 1.4 and 2.4 than in 1.3 and 2.3 (as indicated by the placement of the rounding diacritic). Kelly & Local found this to be a relevant distinguisher in the case of *this shop* vs. *fish shop*, as mentioned earlier. The parallel is not precise, however, since the word-final segment has not assimilated place for either speaker.

Other data appear to conflict with regard to predictions. Thus, of the three cases where assimilation has clearly taken place, only 2.5 conforms to Brown's prediction that the following consonant will advance under the influence of the assimilated alveolar. 1.9 shows the opposite relationship, where *Mike controls* (1.10) has more advanced [k]s than *might creates* (1.9). (This is also reflected in the relative retraction of the word-initial [k] in 2.9). The other case, 1.11, lacks a counterpart for comparison due to a recording error.

Transcript: Speaker 1

1.1	debt cleared	1.2	deck cleared
	deʔt̚ k̟l̥iəd		dḙk̚ k̟l̥iəd
1.3	bat quickly	1.4	back quickly
	bæʔ kʷw̥ɪkli		bæ̞k̚ ʷk̟w̥ɪkli
1.5	net can	1.6	neck can
	netʰ kʰɪn		nḙk̚ kʰɪŋ
1.7	light candles	1.8	like candles
	lʲʌ̥iʔ kʰæ̃nduɯz ↑ less clear than 1.8		lʲʌ̥ik̟̚ ↑ kʰæ̃nduɯz slight hesitation

1.9	might creates mɒik˺ kɻieits repeated after stumble at *might*	1.10	Mike controls mɔiḳ˺ ḳʰəntɹoʊlz
1.11	bite quite bɔik kʷɻɔit repeated after stumble at *bite*	1.12	(destroyed)

Transcript: Speaker 2

2.1	debt cleared deʔt͡˺ kl̥ʲiəd	2.2	deck cleared dḛkʰ kl̥ʲiəd
2.3	bat quickly bæʔt͡˺ ḳʷɻɪkli	2.4	back quickly bæk˺ kʷɻɪkli
2.5	net can neḳ˺ kʰn̄	2.6	neck can nḛk˺ kʰæŋ slight hesitation
2.7	light candles laɪt˺ ḳʰæ̃ndɯz	2.8	like candles lɑik˺ kʰæ̃ndɯz
2.9	might creates mɑiʔt͡˺ ḳɻieits	2.10	Mike controls mɑik˺ kʰəntɹoɯz
2.11	bite quite bɔit˺ kʷɻɔit apparent vowel harmony	2.12	bike quite bɒik˺ kʷɻɔit slight hesitation

Conclusion

While the data are too disparate to yield strong results, it is clear the assimilation to [k] has taken place only infrequently. Other phonetic realizations are more common, namely [t, ʔ, ʔt]. However, the acoustic correlates of *unreleased* [k, t, ʔ, ʔt] are not as clearly distinctive as their varied articulation suggests, and this may indicate less perceptual salience than might otherwise be expected. This will be considered in section 4 below.

Even where assimilation has occurred, neutralization has not. Phonetic differences are still evident between members of each pair. Some of these may prove to be linguistically significant given a large enough sample of data.

Moreover, as Dinnsen (op.cit.: 267 fn.3) points out, the range of potentially significant parameters is very large; only a few are examined here. It is entirely possible that other parameters not noted in the present data may prove to be significant distinguishers of the assimilated vs. lexically-velar stop.

4. Perception : Experiment Two

Aims

This experiment set out to address the following questions:

1. Does the assimilation of word-final /t/ to an immediately following /k/ result in perceptual neutralization ?
2. Does visual information aid in disambiguation of auditorily neutralized or near-neutralized speech ?

Method

Ten subjects were asked to participate in a listening test. All were white New Zealanders and native speakers of English. Due to a complication, only nine informants were eventually included. Of these, two were aged over 55, the rest between 18 and 21. There were four females and five males.

Subjects were divided into two groups. Each informant was given a duplicate of the sentences given to the subjects in Experiment One, with a blank in the space where token words would be heard.

Those in the first group were then individually played a video recording of each interview in Experiment One. They were asked to observe the video closely, to listen attentively, and in a pause after each sentence to write the word they heard in the blank space. They were permitted to listen to each sentence up to three times if they wished, but most did not feel they needed to.

The second group were identically treated, except that they had access only to the soundtrack, and were tested as a group. There were five in the first group, and four in the second.

As with the Production Experiment, the intent was to keep the purpose of the experiment hidden from the informants. Had informants been aware of the alternatives for each blank space, the possibility of unwanted influences on perception would have been much higher. In particular, the tendency to preempt a choice on the basis of semantic

preference would have been reinforced. Further, prior awareness of two alternatives could have led to the deliberate selection of either in each relevant sentence in order to ensure a pattern according to expectations.

A similar danger arises through overstimulation. The use of data from only two speakers, where token words were embedded in sentences rather than heard in isolation, and where these sentences were themselves included among non-significant 'dummies', meant that the listening task was relatively brief and discontinuous. The risk of biased perception arising from overstimulation was thereby reduced. It is not possible to determine the extent to which these extra-linguistic factors might, despite careful design, have influenced the results.

Materials

In addition to the phonological criteria described earlier, choice of words and of sentences was constrained by semantic criteria. In order to minimize the tendency for informants to respond on the basis of what word they would *expect* to appear in a given space, an attempt was made to ensure that the members of each minimal pair would fit equally naturally and sensibly into either sentence in which they were embedded.

In order to check the materials, a test was conducted in which five individuals evaluated the sentences and their corresponding pairs of words. Each sentence was listed together with the two possible alternatives for each space. These informants were asked to circle the word which would be more appropriate/natural in the sentence. If both seemed equally natural, they were to circle both; if neither, they were to circle neither. Results are given in Table 4 below. Although 'both' and 'neither' are separately listed, they count equivalently with respect to semantic bias.

Table 4: Semantic Appropriateness Judgments

Actual Word	Most Appropriate/Natural			
1 *debt*	debt: 2	deck: 0	both: 3	neither: 0
2 *deck*	debt: 1	deck: 2	both: 2	neither: 0
3 *bat*	bat: 2	back: 0	both: 2	neither: 1
4 *back*	bat: 1	back: 0	both: 2	neither: 2
5 *light*	light: 3	like: 0	both: 2	neither: 0
6 *like*	light: 1	like: 2	both: 2	neither: 0

7 *might*	might: 0	Mike: 3	both: 1	neither: 1
8 *Mike*	might: 0	Mike: 4	both: 1	neither: 0
9 *net*	net: 0	neck: 2	both: 3	neither: 0
10 *neck*	net: 2	neck: 0	both: 2	neither: 1
11 *bite*	bite: 2	bike: 0	both: 1	neither: 2
12 *bike*	bite: 3	bike: 0	both: 1	neither: 1

While significant patterns fail to emerge from so small a sample, it is clear that in most instances little semantic bias is predicted. Exceptions, where the neutral category both+neither is outweighed by one of the pair, are as follows:

1. both sentences 7 and 8 involving *might* and *Mike* respectively, are weighted toward *Mike*, the latter heavily so (80%).
2. sentence 5., containing *light*, is slightly weighted in favour of *light*.
3. sentence 12., containing *bike*, is slightly weighted in favour of *bite*.

The discussion following takes into account the predicted bias.

Results and Discussion

Overall Perceptual Accuracy

Table 5: Overall Perceptual Accuracy

	Speaker 1	Speaker 2	Overall
/t/	57% correct	48% correct	53% correct
/k/	80% correct	76% correct	78% correct
Overall:	68% correct	63% correct	65% correct

Overall % Tokens interpreted as /t/: 38%

Overall % Tokens interpreted as /k/: 62%

Informants had considerably greater success in identifying words ending in /k/ than words ending in /t/. This result suggests that the overall auditory effect is of assimilation to [k], as shown by the fact that

62% of all /t, k/ were judged as /k/. Production distinctions do not in general appear to be perceptually salient for this data. Most of the distinctions were more significant articulatorily than auditorily.

On the whole, informants were similarly successful with both speakers' data.

Audio vs. Audio-Visual Data

Table 6: Audio vs. Audio-Visual Perception

	Audio-Visual	Audio Only
/t/	48% correct	58% correct
/k/	75% correct	82% correct
Overall:	61% correct	70% correct

Surprisingly, the informants performed better when presented with audio data alone than when presented with audio-visual data. With a small sample this may simply reflect the varied abilities of the informants. However, it is possible that in being asked to concentrate on visual as well as auditory features the first group neglected the latter, which are undoubtedly the more important in general. As analyst I found the visual record invaluable. However, its use required some knowledge of what might prove significant, knowledge which the informants did not have.

Comparison of Sentences

Table 7: Comparison of Sentences

(Ref. refers to numbers on transcript)

Accuracy	Sentences
100%	**1.5, 2.10, 2.11**
89%	**1.10, 1.11, 2.2**
78%	1.4, 2.4, 1.8, 2.8, 1.2, 1.6
67%	2.12
56%	1.1
44%	2.1, 1.7, 2.5, 2.6, 2.9
33%	1.9, 2.7
22%	1.3, 2.3

Reasons are not hard to find for the high degree of success with the first few in the list (in bold). In 1.5, the [t] of *net* was clearly aspirated, and hence auditorily distinct. In 2.10 and 1.10, the semantic strangeness of *might* appears to have influenced the choice towards *Mike*, as predicted earlier. (Informants reacted with surprise when they were later read the sentence containing *might*). In 1.11, *bite* was repeated following a slip. Although the second *bite* appeared to undergo assimilation, the first was clearly aspirated, and it is likely the respondents were influenced by this. 2.2 was also clearly aspirated.

It must be acknowledged that perceptual bias arising from the influence of semantic preference and production errors — slips, hesitations — may be significant in so small a sample. Only a much larger study can avoid such problems.

It is not clear why 2.11 was always correctly identified; there seem to be no obvious semantic, pragmatic or phonetic reasons for this.

All of the ten least correctly identified tokens except 2.6 ended in /t/. The result probably reflects the general trend in the data, which — while articulatorily distinct — are auditorily close to unreleased [k].

Comparison of Informants

Informants varied widely in their discriminatory skills, from 58% to 75% accuracy. Lowest scores were found among those informants who had access to visual information (discussed earlier). Two informants (one from each group) were remarkable for their pervasive tendency to perceive both members of pairs as ending in [k]. Again, given the small size of the sample, the undue influence of these two on the results must be acknowledged.

5. Concluding Discussion

The assimilation of place of /t/ word-finally when followed by /k/ does not appear to be fully neutralizing in production in formal speech. However, the production distinctions made do not appear to have strong perceptual salience. Neutralization thus appears to occur in perception.

Within the typology proposed by Dinnsen, the present study counts as evidence for a Type B neutralization, in which underlying phonological distinctions are maintained in production but are not salient to perception. It thus offers further support for the notion that perception and production are at least partly independent, and — to the extent that neutralization is ultimately retained as a phonological construct — that the grammar is *not, pace* Chomsky & Halle (1968), neutral with respect to speaker and hearer.

Visual information was not found to aid informants' perception in the present case, although its usefulness for the analyst has been

convincingly argued by Kelly & Local. Much further research is needed to clarify the relationship of sound and vision in the task of perception.

Given the small size of the sample and the limited number of parameters examined, the evidence presented in this paper must be regarded as provisional. However, careful design has left these experiments less open to allegations of hypercorrection or related problems than other, larger studies.

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