Appendix

Example of a text translated automatically.
The text below took approximately 22 minutes to translate, which corresponds to less than one minute per sentence.

Danish Source Text	*Translated Swedish Text*
Strikkefasthed: 17 m og 21 p på p 5 i glatstrik = 10 x 10 cm. Ribkant: * 1 r, 2 vr *. Ryg og forstykke: Jakken strikkes frem og tilbage på rundp og deles ved ærmegabet. Slå 180 - 189 - 195 m op på rundp 3.5 med rødt, og strik 5 cm ribkant, skift efter 2 p til koral. Skift til rundp 5, samtidig med at der tages 24 - 27 - 33 m ud jævnt fordelt på 1. p = 204 - 216 - 228 m. Husk strikkefastheden! Strik mønster således (mønster 1 skal måle 18 cm i højden, hvis ikke, så afpas efter det glatstrikkede): 5 - 6 - 1 cm glat , mønster 1 , 7 - 9 - 9 cm glat. Str small og medium: Mønster 2, mønster 3, strik færdig med glat. Str large: Strik færdig med mønster 1. Samtidig strikkes: Når arb måler 40 - 45 - 50 cm , deles arb således: 50 - 53 - 56 m forstykke, luk 2 m af, 100 - 106 - 112 m ryg, luk 2 m af, 50 - 53 - 56 m forstykke. Hver del strikkes færdig for sig. Ryg: = 100 - 106 - 112 m. Fortsæt mønsteret. Luk til ærmegab på hver 2. p for 2 m x 2, 1 m x 2 - 1 - 2 = 88 - 96 - 100 m.	Masktäthet: 17 maskor och 21 varv på sticka nr 5 i slätst = 10 x 10 cm. Ribbkant: * 1 r, 2 avig *. Rygg och framstycke: Kavajen stickas fram och tillbaka på rundsticka och delas vid ärmhålet. Lägg upp 180 (189 - 195) maskor på rundsticka nr 3.5 med rött, och sticka 5 cm ribbkant, byt efter 2 varv till korall. Byt till rundsticka nr 5 samtidigt som 24 (27 - 33) maskor tas ut jämnt fördelat på 1:a stickan = 204 (216 - 228) maskor. Kom ihåg masktätheten! Sticka mönster på detta sätt (mönster 1 skall mäta 18 cm i höjden, om inte, så avpassa efter det slätstickade): 5 (6 - 1) cm slätst, mönster 1 , 7 (9 - 9) cm slätst. Stl small och medium: Mönster 2, mönster 3, sticka färdigt med slätst. Stl large: Sticka färdigt med mönster 1. Samtidigt stickas: När arb mäter 40 (45 - 50) cm delas arb på detta sätt: 50 (53 - 56) maskor framstycke, maska av 2 maskor, 100 (106 - 112) maskor rygg, maska av 2 maskor, 50 (53 - 56) maskor framstycke. Vart stycke stickas färdigt för sig. Rygg: = 100 (106 - 112) maskor. Fortsätt mönstret. Maska till ärmhål på varannan sticka av 2 maskor x 2 , 1 maska x 2 (1 - 2) = 88 (96 - 100) maskor.

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The Data Behind the Elsewhere Condition

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Kiparsky 1973 proposes the Elsewhere Condition, which is intended to pick out which pairs of rules are disjunctively ordered. He offers certain cases where his condition seemingly supersedes the *SPE* approach. In this paper, I re-examine the data from Finnish, Karok, Diola-Fogny and Sanskrit (both high-segment syllabicity and external sandhi). It appears that the Elsewhere Condition is not a necessary device for obtaining the right output and, also, that the real data lying behind the examples in each case constitutes no problem for the *SPE* approach. It is concluded that the theory of disjunctivity outlined by Kiparsky can not be shown to be superior to the *SPE* approach – at least, given the examples.

Foreword

It is a truism that conditions in linguistics are more abstract than the data. This ought to mean that the data are more basic, although there is not universal agreement on this point. In fact, in a casual conversation with another linguist while attending a summer school, I was amazed at her reaction to my work on checking Kiparsky's 1973 examples in favour of the Elsewhere Condition. She did not care about the relevance of the data – although gathered in support of a theoretical proposal – stating that these were just examples to show the workings of the condition. One may wonder whether this is a widespread view. The want of critical studies of proposed theoretical devices, centering on the real nature of the supporting evidence, adds weight to my thoughts in that direction. The present case does not appear to be an isolated instance either. Much energy has been devoted to the production of new general hypotheses while the true facts about the data at hand have sometimes dwelt elsewhere.

The examination of a case where an author appealed to the Elsewhere Condition first directed my attention to the proposal. Soon the actual nature of the arguments that Kiparsky adduces in favour of his condition aroused my interest. The question was whether, in light of the data, the conclusion was inevitable that the condition was superior to the *SPE* approach or whether there were other solutions. Once in focus, the project of solving the riddles – as I saw them – developed into an irresistible temptation. The

present paper appears to be the first critical examination of the data *per se* in Kiparsky 1973. Both Howard 1975 and Guerssel 1978 give arguments against Kiparsky's solutions, but mostly leave the data without noticing the discrepancies with reality. Guerssel has more external success than Howard due to his convention Constraint on Assimilation Rules (CAR). However, by not taking the real – or more credible – circumstances into account, he does not give too much support for CAR. Or so it seems in retrospect. Furthermore, the introduction of yet another condition is unwarranted in case the data can be dealt with in a satisfactory manner without making use of the device. The arguments involving other conditions – in need of attestation – are the weakest in Janda & Sandoval's 1984 arsenal of arguments and should be dismissed and replaced by arguments of a more conclusive character where possible. For the sake of comparison, I have therefore stuck to the standard *SPE* formalism, except that the lexical phonology framework is referred to in one case. Some non-standard features are used in two rules and a convention for the position of the pause as a phonological unit is employed and its consequences are explored. These deviations are however immaterial for the purpose of comparison of the two theories of disjunctivity. One of my goals with this paper is to show that Kiparsky's condition is not necessary for a formal description of the data which correctly accounts for the output. The other goal is to present a fresh look at the collection of examples. In short, what in a way started out as a simple investigation developed into a desire for the emancipation of the real data – which hold an interest in their own right.

Thanks to the persons who once read the first version of this paper and gave their comments. A long time has lapsed since then. I may have forgotten some comments, but I think the remarks from Thore Pettersson and Merle Horne (both at the Department of Linguistics, Lund) and from Sjaak de Mey were the most important. I am of course solely responsible for all statements and conclusions.

Introduction

This paper deals with the requirements for disjunctive ordering in the phonological component. The theory of disjunctivity set out in *SPE*, i.e. Chomsky & Halle 1968:77, states that rules are disjunctively ordered if the abbreviatory use of parentheses or angled brackets is required to make their description simpler. Otherwise, the ordering is conjunctive. Kiparsky 1973 presents cases against the *SPE* assumption and proposes an alternative

convention for disjunctive rule ordering. I intend to re-examine Kiparsky's cases once more, with special attention to the underlying data.

Kiparsky gives English verb stress as a neutral example of how the two conventions work. The penult of an English verb is stressed if the last syllable has a lax vowel followed by at most one consonant – e.g. *pérish*, *búry*. Rule (1) handles this case:

(1) $V \rightarrow [1 \text{ stress}] / \_\_ C_0 \check{V} C_0^1 \#$

Elsewhere stress falls on the last syllable. This happens in a number of distinct environments, which may be described by:

(2) $V \rightarrow [1 \text{ stress}] / \_\_ C_0 \#$

Rule (2) covers the verbs that end in more than one consonant (e.g. *objéct*, *insúlt*) and those which have a final tense vowel (*detáin*, *avóid*) and finally monosyllabic verbs (*nód*, *líck*). The only exceptions to this quite general rule are the stems to which (1) is applicable. This ordering is explained in *SPE* as a consequence of the abbreviability of (1) and (2), as in (3):

(3) $V \rightarrow [1 \text{ stress}] / \_\_ C_0 (\check{V} C_0^1) \#$

If and only if two rules are abbreviable by parentheses or angled brackets, then the ordering is disjunctive in the *SPE* system. Kiparsky 1973 assumes that this condition for disjunctive ordering is inadequate and proposes another condition which should decide if a given pair of rules will interact disjunctively. It seems that he does not question the abbreviatory conventions in *SPE* as such – only their use in determining disjunctivity. Kiparsky prefers to look at the stress case as one where (1) bleeds (2). A principle called the Elsewhere Condition (henceforth the EC) is set up in order to determine disjunctivity:

(4) Two adjacent rules of the form
$A \rightarrow B / P \_\_ Q$
$C \rightarrow D / R \_\_ S$
are disjunctively ordered if and only if:
(a) the set of strings that fit PAQ is a subset of the set of strings that fit RCS, and
(b) the structural changes of the two rules are either identical or incompatible

The condition implies that a restricted rule (the special case) takes precedence over a general one when a conflict arises between them.

Kiparsky then draws on some data in favour of the idea that abbreviability of rules (by means of parentheses, angled brackets and the like) is an insufficient condition for determining disjunctivity and is in fact detached from it.

Howard 1975 remarked that the structural changes are only identical in stress rules. If stress rules are written in a specifically metrical theory, the EC does not need both conditions in (4b). Therefore Kiparsky 1982:8, 84 concludes that the EC may be reformulated as (5), ignoring the stress rules:

(5) Rules A, B in the same component apply disjunctively to a form Φ if and only if
(i) the structural description of A (the special rule) properly includes the structural description of B (the general rule).
(ii) the result of applying A to Φ is distinct from the result of applying B to Φ.
In that case, A is applied first, and if it takes effect, then B is not applied.

Janda & Sandoval 1984 have collected some fifty arguments for the use of the EC (and its less widely quoted predecessors, e.g. Anderson 1969) in phonology, but conclude that none of these is valid (they have not found any evidence that the principle would be at work in syntax either but they say that a similar device may have bearing upon morphology).

In the following sections I will, however, discuss the cases in Kiparsky 1973 anew. This seems to be justified because my treatment of the problems differs from earlier approaches. The data at hand are this time confronted with other views about their exact nature. In addition, I have used as evidence neither some new sort of general principle for determining disjunctivity nor hypothetical forms (i.e. made-up examples from a devised model language, which in virtue of their unnatural forms lead to a reductio ad absurdum). Another reason is that the condition is invoked and used as a supposedly validated tool in several recent contributions to phonology.

An investigation of the arguments for the EC

Palatalization in Karok

Kiparsky says that there are rules which are disjunctively ordered without being abbreviable by the conventional parenthesis notation and also rules that must be shortened with parentheses but are conjunctively ordered. He

exemplifies the latter discrepancy by a Karok rule (as described by Bright 1957): *s* is palatalized after a front vowel or glide where a consonant may intervene:

(6) $$s \rightarrow \check{s} \; / \; \begin{bmatrix} \text{-back} \\ \text{-consonantal} \end{bmatrix} (C) \_\_$$

Thus we have *ʔúskak* 'he jumps' but *iškak* 'jump' and *níkšup* 'I pointed'. Though the rule's formulation predicts disjunctivity in the traditional system because of the optional intervening consonant, there exist forms like *íššaha* 'water' with a double palatalized *s*. Kiparsky infers that the first *s* would not be affected in the *SPE* framework, so that the rule must generate *ísšaha*. This is because the expanded structural description – with the intervening consonant – takes effect. The shorter structural description cannot apply then, as parentheses are regarded as implying a disjunctive relationship. The EC, on the other hand, correctly generates the expected form, as there is no conflict between the two subrules. As Bright points out (vid. Howard 1975:114) this apparent failure of the *SPE* framework might instead depend on a gemination process whereby all consonants except the glides (*v*, *j*, *h*), *ʔ* and the single liquid *r* are doubled intervocalically. Kiparsky claimed that we would not expect a rule that generates *ísšaha* anyway. This is no merit for the EC unless a rule that operated in a parallel manner (without additional rules like doubling) was found to be part of a description based upon the *SPE* system, which I doubt.

Jensen 1974:685 argued for another solution to this problem. Palatalization could according to him be a general process affecting all consonants in an iterative manner and *níkšup* might then in reality surface as *níkǐšup*. This is due to Jensen's Relevancy Condition, according to which material that intervenes between focus and determinant must be irrelevant as input or else participate in the rule as both input and determinant. According to this condition, all intervening consonants are palatalized in Karok.

Howard 1975:114-15 makes use of his Crossover Constraint in order to solve the problem without the help of the EC and assumes, with data from Bright 1957, that there is no prominent palatalization of other segments than *s* in Karok. His opinion is, however, questionable – from several points of view. The more obvious difference between *s* and *š* makes it easy to overlook other instances of palatalization. The investigator – Bright – is furthermore an American and probably less acquainted with palatalization than e.g. a Russian investigator would have been. In addition, due to

American English loans *š* has become a marginal phoneme in Karok and its existence might therefore be especially striking. The rule could be written quite naturally as (7) if this assumption holds true, using Wood's 1982 features and my subset specification (Olsson 1992), where the colon basically is an implication mark that narrows the scope of the [+vocalic] subset. Subset specification replaces curly brackets in all instances where an abbreviatory convention of this kind appears as a natural solution. (The advantage of using Wood's feature system was pointed out to me by one of the early readers.)

(7) $$[+\text{cons}] \rightarrow [+\text{palatal}] \,/\, \left[\begin{array}{l} +\text{palatal} \\ [+\text{vocalic:}] \\ -\text{velar} \end{array}\right] \_\_$$

Nothing hinges on the use of Wood's features and my convention, since the solution would be almost as simple (technically speaking) in the standard format.

I have here presented two alternative solutions to the Karok problem, depending on the actual nature of the data, none of which makes reference to the EC.

Alleged -k in Finnish

A usual case where parentheses are not used and where the EC is said to cope with the problem is a disjunctive relation between assimilating and deleting processes. Kiparsky's examples are from Finnish and Diola-Fogny and will be discussed in this and the following subsection. It will be evident that these examples in fact need quite different treatments, due to the very real difference between the data.

Kiparsky intends to show that word-final *-k* in West Finnish assimilates completely to a directly following consonant but otherwise (before vowels and pauses) is lost. Examples are *menek#pois* → *menep#pois* 'go away', *menek#kotiin* → *menek#kotiin* 'go home', *menek#alas* → *mene#alas* 'go down', *menek#* → *mene#* 'go'. In the *SPE* framework the context must here be doubly and complementarily specified, or final *k* would wrongly be pushed away if the next segment also were *k*:

(8) (a) $k \rightarrow C_i \,/\, \_\_ \,\#\, C_i$

(b) $k \rightarrow \emptyset \,/\, \_\_ \,\#\, \left\{\begin{array}{l} V \\ \text{pause} \end{array}\right\}$

Many speakers delete rather than assimilate before clusters and for those cases the deletion rule has to be changed along with the assimilation rule:

(9) (a) $k \rightarrow C_i \,/\, \_\_ \,\#\, C_iV$

(b) $k \rightarrow \emptyset \,/\, \_\_ \,\#\, \left\{\begin{array}{l} V \\ CC \\ \text{pause} \end{array}\right\}$

Furthermore, there are dialects which exhibit deletion instead of assimilation in front of *h* or *f* or both. Kiparsky shuns the double specifications by using the EC – as in (10) only the assimilating context then needs to be mentioned and the EC deletes final *k* elsewhere.

(10) (a) $k \rightarrow C_i \,/\, \_\_ \,\#\, C_i$

(b) $k \rightarrow \emptyset \,/\, \_\_ \,\#$

My objection is that Kiparsky's postulation of an underlying consonant is mistaken. There is no way whatsoever to synchronically determine the shape of this postulated segment. According to Kiparsky it might be analyzed as *h*; yet another possibility is *p* – the latter because final consonants that were not coronal dropped out at a certain step in the history of the language. Alternation is lacking. The same applies to strong structural patterning, which together with surface presence might suffice as evidence for alleged abstract solutions, e.g. in Yawelmani Yokuts (Kenstowicz & Kisseberth 1979 (part of chapter 4)). But see Olsson 1992:63-64, 176 for a non-abstract solution to such cases. Interestingly, Finnish words may end in *k* if they are newer loanwords or their final vowel has disappeared through some phonetic process in dialects (Itkonen 1964:272), e.g. *tīstak* < *tīstaki* 'Tuesday'. Thus we find that the original process or processes are gone and what is left is just a set of gestures. The Finnish case in (8) ends up with the following interpretation (where *M* indicates a morpheme with alleged final *k*):

(11) $\emptyset \rightarrow [\text{-syll}]_i \,/\, M \,\_\_\, [\text{-syll}]_i$

This solution of course also works well for cases where the post-boundary part does not include *f* and the like – only the said part needs a restricted specification. In dialects without doubling, (11) is not at work.

Instead of the usual zero outcome in most Finnish dialects, the Savo dialects exhibit a glottal sound prevocally after the exceptional morphemes.

Itkonen 1964:265-6 shows that it is the result of a later development. Its phonetic realizations range from *ʔʔ* to the weak *ˀ*. Statistically there is a positive correlation between slow and distinct pronunciation (especially before a rather strongly stressed word) and the articulatorily strong long *ʔʔ*. Indistinct and rapid pronunciation (especially before a rather weakly stressed word) similarly tends to promote the short variants and zero (Itkonen 1964:217). There are also dialectal differences concerning the relative frequency of these realizations.

It is clear that in dialects with a prevocalic geminate glottal, the preconsonantal counterpart to original *-k* is a copy of the initial consonant phoneme (Itkonen 1964:38, 219). The reason for this is obvious. In most Savo dialects, there is usually a prevocalic glottal sound (Itkonen terms it glottal catch) after any consonant (p. 259); the sound varies between *ʔ* and *ˀ*, depending on the stress of the following syllable (p. 249). This helps to preserve the difference between e.g. *se nappi* 'that button' and *sen appi* 'his father-in-law' (p. 263) as "the glottal catch, by its very physiological nature, strengthens the impression of the syllable-boundary as being placed after the final consonant" and "the syllable-boundary in a two-consonant sequence is normally between conso-nants in Finnish" (p. 266). Itkonen 1964:267 explains the geminate glottals in prevocalic position after words that used to end in *-k* by a tendency to generalize the geminate pattern to cover all presegmental positions. As the glottal catch was present in the Savo dialects in the juncture, it could, although not a phonemic unit, serve as basis for this unification. The important relation types are indicated by examples in (12), where geminates are in bold face type and the strongest glottal is given in both cases.

(12)

	Finnish	*West Finnish*	*Savo*
Not M		sen appi	sen ʔappi
M	menek **k**otiin	mene alas	mene**ʔ** **ʔ**alas

The occurrence of the prevocalic, nonphonemic glottal catch is then the only factor that makes the Savo dialects different from West Finnish as regards the problem at hand. In both cases (11) applies and gives the right output to underlying *mene alas*.

An interesting fact is that geminated *h*, which due to its articulatory inconvenience and otherwise restricted occurrence tends to be unrealized, shows a heavy preponderance in the Savo dialects (Itkonen 1964:73f.). This should be due to the support from the related geminate glottal in these dialects (p. 267).

Thus, what appeared as a problem with the specification of the deletion rule really melted away when confronted with the actual data, as it became apparent that there was no deletion rule.

Diola-Fogny consonant sandhi

A more complicated example consists of the Diola-Fogny consonant sandhi, which Sapir 1965 briefly describes as made up by (a) a reduction where only the last consonant in the cluster remains, and (b) an assimilation of a nasal wherever it cannot be deleted. The examples show that a nasal is assimilated (a) before any morpheme-initial nasal which is followed immediately by a vowel and (b) before any obstruent. Accordingly there is an assimilation in *faŋ+faŋ* → *faŋfaŋ* 'lots' (the assimilation product *ŋ* is not explicitly mentioned by Sapir, but is inferred here from his general statements), *na+tiːŋ+tiːŋ* → *natiːntiːŋ* 'he cut (it) through', *ni+gam+gam* → *nigaŋgam* 'I judge', *naʃum#tɔ* → *naʃuntɔ* 'he stopped there', *pan+ɟi+maɲʃ* → *paɲɟimaɲʃ* 'you (pl.) will know' and *na+miːn+miːn* → *namiːmmiːn* 'he cut (with a knife)'. A morpheme-final nasal is deleted in e.g. *takun+mbi* → *takumbi* 'must not...', *na+laɲ+laɲ* → *nalalaɲ* 'he returned', *na+waɲ+aːm +waɲ* → *nawaɲaːwaɲ* 'he cultivated for me' and *ban#ɲa* → *baɲa* 'finish now'. Other consonants are deleted before consonants as in the following examples: *lɛt+ku+ʃaw* → *lɛkuʃaw* 'they won't go', *kutɛb#sinaŋas* → *kutɛsinaŋas* 'they carried the food', *ɛkɛt#bɔ* → *ɛkɛbɔ* 'death there'. Kiparsky first gives the rules in *SPE* format:

(13) (a) Deletion

$$\begin{bmatrix} C \\ +\text{nasal} \end{bmatrix} \rightarrow \emptyset \;/\; \_\_ \begin{Bmatrix} \begin{bmatrix} -\text{nasal} \\ +\text{obstruent} \end{bmatrix} \\ \#[-\text{obstruent}] \\ CC \end{Bmatrix}$$

$$\begin{bmatrix} C \\ -\text{nasal} \end{bmatrix} \rightarrow \emptyset \;/\; \_\_ +(\#)C$$

(b) Assimilation

$$\begin{bmatrix} C \\ +\text{nasal} \end{bmatrix} \rightarrow [\alpha\text{place}] \;/\; \_\_ (\#)C$$

Since it is clear that the alpha-mark must relate to the only segment in the external context, I have refrained from duplicating it (thus following Kiparsky in the Diola-Fogny example). In my notation (Olsson 1992), this problem disappears.

Sapir's formulation involves according to Kiparsky an important insight that the standard theory is not capable of expressing in rules, namely that reduction and assimilation are complementary. His next statement – that each of the three rules must mention the feature nasality to the left of the arrow and that deletion consists of two parts that are uncombinable within the theory of *SPE* – is not correct. Nothing prevents us from combining the rules in (13a) without even mentioning the feature nasality. The assimilation rule does not need the restriction [+nasal] either, because Sapir writes: "Aside from nasal clusters the only others to appear, and those very rarely, are *lt* and *rt* in medial positions". Thus the rules can be relaxed as follows:

(14) (a) Deletion

$$C \rightarrow \emptyset \,/\, \left\{ \begin{array}{l} \left[\begin{bmatrix} \_\_ \\ -\text{son} \end{bmatrix} \; C \right] \\ \left[\left[\begin{bmatrix} +\text{son} \\ -\text{nasal} \end{bmatrix} \right] \right] \\ \begin{bmatrix} \_\_ \\ \#[+\text{nasal}] \\ CC \end{bmatrix} \end{array} \right\}$$

(b) Assimilation

$$C \rightarrow [\alpha\text{place}] \,/\, \_\_\; [\alpha\text{place}]$$

Now none of the rules mentions the feature nasality to the left of the arrow and the deletion rules are combined. In this form they are at least as simple as Kiparsky's rules, which even seem intricate in comparison:

(15) (a) Assimilation

$$\begin{bmatrix} C \\ +\text{nasal} \end{bmatrix} \rightarrow [\alpha\text{place}] \,/\, \_\_ \; \begin{array}{ll} \{(\#)[+\text{obstruent}] & (\text{i}) \\ [+\text{nasal}] & (\text{ii}) \end{array}$$

(b) Deletion (under Elsewhere Condition)

$$C \rightarrow \emptyset \,/\, \_\_ + \begin{array}{ll} \{(\#)C & (\text{i}) \\ CC & (\text{ii}) \end{array}$$

Disjunctive with the subrules in (a).

In the theory of lexical phonology, rule (15a) is better divided into two rules, because – as Mohanan 1982:55 puts the matter – it is "unstatable in the stratum framework as the Opacity Principle would prevent referring to junctures at different strata". The invoked principle reads (p. 29):

(16) The structure at one stratum is invisible at another stratum.

This division at first seems to strengthen the EC's credibility, since the following assimilation rules are disjunctive with the deletion rule under the EC (if the following consonant is single):

(17) (a) $[\text{-syll}] \rightarrow [\alpha\text{place}] \,/\, \begin{bmatrix} \_\_ \\ +\text{nasal} \end{bmatrix} + [+\text{nasal}]\,[+\text{syll}]$ Lexical

(b) $[\text{-syll}] \rightarrow [\alpha\text{place}] \,/\, \begin{bmatrix} \_\_ \\ +\text{nasal} \end{bmatrix} [\text{-son}]$

(c) $[\text{-syll}] \rightarrow \emptyset \,/\, \_\_ + [\text{-syll}]$

Intermorphemic processes, such as place assimilation for nasals before other nasals, take place at the lexical stratum. (17 b) also applies across word-boundaries and thus applies at both strata. Deletion takes place at both strata and may therefore be bled by (17a) as well as by (17b). The rare instances of liquid plus homorganic stop can be treated as underlying, for Sapir's description does not suggest anything else (otherwise deletion has to be altered – the input might be specified as [-vocalic], using a feature from Jakobson & Halle 1956).

There remains, however, the possibility of presenting the data without making use of the EC:

(18) (a) $[\text{-syll}] \rightarrow \emptyset \,/\, \begin{bmatrix} \underline{\quad\quad} \\ <+\text{nasal}>a \end{bmatrix} \begin{bmatrix} \text{-syll} \\ <\text{-son}>\,b \\ <+\text{nasal}>c \end{bmatrix} [+\text{syll}]$ c

Condition: if a, then neither b nor, at the lexical stratum, c.

(b) $[\text{-syll}] \rightarrow [\alpha\text{place}] \,/\, \_\_ + [\text{-syll}]$

The rules are clearly reminiscent of Sapir's 1965:17 statement that "Consonant reduction is achieved by eliding the first of two adjacent consonants. If the first consonant is a nasal it assimilates when possible without eliding". According to Kiparsky's 1973:97 criterion that a good correspondence to "Sapir's evidently correct verbal formulation" is valuable, (18) should therefore supersede (17), as the deletion rule specifies in what positions the nasal is deleted. Referring to a stratum as part of a condition should be principally possible. Evidently, the EC does not provide us with the only justifiable solution to this problem.

Sievers' law in Sanskrit

Kiparsky also finds evidence for the EC's superiority in metrics. In a paper from 1972, he argues that the high vowels and glides of Sanskrit must have been kept apart underlyingly at the time of the Rigveda. Now it is evident that a line need not fulfill the metrical demands on the final level but may be scanned at an intermediate level. Kiparsky says that it should be psychologically reasonable to assume as possible inputs to the metrical scheme only those strings that occur on some level in the phonological component. The distribution of glides and vowels necessitates according to him 1973 these two conjunctively ordered rules in the *SPE* system:

(19) $\begin{bmatrix}\text{+high}\\ \text{-consonantal}\end{bmatrix} \rightarrow \begin{cases}\text{[+syllabic]} & \text{(a)}\\ \text{[-syllabic] in environment G} & \text{(b)}\end{cases}$

Either all high non-consonants are syllabified and then the glide rule follows as in (19), or they are first made unsyllabic before the corresponding vowel rule appears. The problem is that in both cases an intermediate step must arise between underlying form and output, a middle step that is invisible to metrics. The EC takes care of this by eliminating fake intermediate forms like **aɟuṣadhuam*, where the only allowed scanning is *aɟuṣadhvam*. If rule (19) is correct, then the underlying form never becomes **aɟuṣadhuam* according to the EC because the glide producing rule is the special case and thereby prevents the application of the syllabifying rule wherever the structural description of (b) is met.

The distribution of glides and vowels (i.e. the descriptions of environment G and its counterpart V) is truly complex. According to Kiparsky 1973:99 it follows Sievers' law.

(20)

GLIDES (y, v)	VOWELS (i, u)
V __ V	__ C
$\begin{cases}\breve{V}\\ \text{\# (C)}\end{cases}$ __ V	CC __ V
	$\bar{V}C_1$ __ V

The crucial matter in this connection seems to be that the above chart accounts for the "surface distribution". A closer look at the problem reveals that the support for G and V as abbreviations for environments which determine syllabicity at the same level is not too strong, something which has repercussions for Kiparsky's analysis.

Kiparsky 1972 gives another picture of Sievers' law. Sievers himself assumed that the sound law in question only applied in prevocal position

and this view seems to be shared by Kiparsky, who – further – apparently recognizes alternations among suffixes only (p. 180). This reduces the environments in (20) by three.

Sanskrit syllables are divided into light and heavy and this distinction is important for metrics. Light syllables have a single syllable kernel and a single final consonant (if any), while the heavy syllables have a long syllable kernel, or more than one consonant in final position. (It may be noted that this use of the terms light and heavy, as pertaining to the syllable, differs from that in Vennemann 1988:6. The concept of heaviness for syllables may be real enough, but apparently in some languages the contrast looks different.) Now Kiparsky claims that Sievers' law is active in prevocalic position where it produces glides after heavy syllables and vowels after light syllables. When the underlying form disagrees with the output, the poet has a choice.

He posits some tests in order to decide whether the underlying segment is syllabic or not. First, a glide that (a) alternates with a long vowel or (b) may be accented is underlyingly syllabic, as it would be hard to derive these features if a glide were underlying (length is distinctive only for vowels, while accentuation – a property of vowels – must be assigned prior to any relevant syllabification rule). The third criterion for syllabicity is (c) that a segment behaves just like a vowel in hiatus position.

We may set up the following rule:

(21) $\begin{bmatrix}\text{+high}\\ \text{-consonantal}\end{bmatrix} \rightarrow [\alpha\text{vocalic}] \,/\, [\alpha\text{heavy}] \_\_ \begin{bmatrix}\text{+vocalic}\\ \text{-consonantal}\end{bmatrix}$

Another, yet more restricted version of Sievers' law is presented in Horowitz 1974:66 who mentions it as the process whereby "a prevocalic syllabic resonant lost its syllabicity after certain short syllables ending in a consonant, but not after long syllables".

It could be that either the process described by (21) or the process hinted at by Horowitz lies behind the syllabicity. What emerges as clear, however, is that if any of these latter treatments is right (which seems quite plausible), then the EC has no advantages to offer in the present case.

Steriade 1988:100, referring to "the debated distinction between underlying glides and underlying vowels [in Sanskrit]", reinforces the doubts.

External consonant sandhi in Sanskrit

In his last examples Kiparsky touches upon two different ways of extending the EC.

One of the proposals to change the EC comes from certain cases of external sandhi in Sanskrit. The possible use of the principle here is to let it be blind for the exposed segment and just be valid for the external context (i.e., the description of changing segments may differ and two given rules will still be disjunctive if their contexts exhibit a subset relationship and if there is a conflict between them).

Sanskrit is totally imbued with different sandhi processes and it is not easy to untangle a small problem without touching on a number of others, but hopefully the following account will be reasonably clear.

Below in (22) is a chart of the Sanskrit consonant system. C' indicates an allophone in final position that results from external sandhi.

(22)

labial	*dental*	*retroflex*	*palatal*	*velar*	*laryngeal*	
p	t	ṭ	c	k		*Voiceless*
pʰ	tʰ	ṭʰ	cʰ	kʰ		*stops*
b	d	ḍ	ɟ	g		*Voiced*
bʰ	dʰ	ḍʰ	ɟʰ	gʰ		*stops*
m	n	ṇ	ɲ	ŋ		*Voiced*
v	l	r	j		ɦ	*sonorants*
ɸ'	s	ṣ	ś	χ'	ḥ'	*Spirants*

The allophone *visarga*, which Pāṇini calls *visarjanīja*, is here conventionally noted as *ḥ* (the IPA transcribes it by [h]). Before external sandhi takes place, all consonants that are disallowed in word-final position change their appearance to one of the allowed consonants in that position. Macdonell and others mention *k*, *ṭ*, *t*, *p*, *ŋ*, *n*, *m* and *visarga* as the permitted finals and thus the only segments that remain as inputs for the sundry assimilation rules. Renou 1946:6 remarks upon certain irregularities in the formation of permitted finals. For instance, *j* is usually transformed into *k* but sometimes it becomes *ṭ* (the outcome seems to be lexically conditioned). The segments which are assumed to have changed in the merger phase act completely as their new forms predict as regards sandhi, irrespective of their original shapes. The postulation of a merger phase where some features are lost before the proper sandhi enters should therefore be well-founded.

Kiparsky gives these assimilations of word final *s* and *t* before voiceless segments.

(23)
t#ṭ → ṭ#ṭ
t#c → c#c
s#ṭ → ṣ#ṭ
s#c → ś#c
s#p → ɸ#p or ḥ#p
s#k → χ#k or ḥ#k
s#ś → ś#ś or ḥ#ś
s#ṣ → ṣ#ṣ or ḥ#ṣ
s# → ḥ#

The situation is, thus, that a final dental obligatorily assimilates in place to a following coronal stop.

(24)
$$[+\text{coronal}] \rightarrow [\alpha\text{place}] \;/\; \_\_ \;\#\; \begin{bmatrix} \alpha\text{place} \\ +\text{coronal} \\ -\text{continuant} \end{bmatrix}$$

But *s* may also optionally assimilate to the next segment.

(25)
$$\begin{bmatrix} +\text{coronal} \\ +\text{continuant} \end{bmatrix} \rightarrow [\alpha\text{place}] \;/\; \_\_ \;\#\; [\alpha\text{place}]$$

Opinions differ about this assimilation, both in the Old Indian grammars and in the modern literature (vid. also. Kiparsky 1979:174). Varenne 1971:24 says that "Au contact des occlusives sourdes gutturales (*k, kh*) et labiales (*p, ph*), le *visarga* subsiste, inchangé". And further (p. 25): "Au contact de toute sifflante, le *visarga* peut se transformer en ladite sifflante (*ḥ+ś = śś*) mais, dans la pratique, il reste inchangé". This shows clearly the difficulty implicit in any Sanskrit description. We may note that Varenne regards Kiparsky's *s* as *visarga*.

Elsewhere – that is if a pause follows or the optional assimilation rule has not taken place – *s* is converted to *ḥ*.

(26)
$$\begin{bmatrix} +\text{coronal} \\ +\text{continuant} \end{bmatrix} \rightarrow \text{ḥ} \;/\; \_\_ \;\#\; \left\{ \begin{array}{l} \{[-\text{coronal}] \\ \;\;[+\text{continuant}]\} \\ \text{pause} \end{array} \right\}$$

Rule (26) – which Kiparsky terms "the 'elsewhere' case" – must be explicitly written so as not to be applicable before a coronal stop, i.e. the sole case where the obligatory assimilation rule occurs. If the principle only comprises the external context, the addition will be unnecessary:

(27) $\begin{bmatrix}\text{+coronal}\\ \text{+continuant}\end{bmatrix} \rightarrow$ ḥ / __ #

But it will be shown that a neat solution is possible without the help of the EC.

First, a good deal indicates that dental non-continuous segments – *n* and *t* – work as a group separated from the corresponding continuous segments – *s* and *r*. Before *l*, *t* assimilates fully and *n* changes into nasalized *l*.

(28) $\begin{bmatrix}\text{+coronal}\\ \text{+anterior}\\ \text{<+nasal>}\end{bmatrix} \rightarrow \begin{bmatrix}\text{+lateral}\\ \text{<+nasal>}\end{bmatrix}$ / __ [+lateral]

Furthermore, *n* and *t* are assigned the corresponding place before coronal stops and *ś* – but not *ṣ*. This development is camouflaged because *ś* – except together with a voiceless consonant – is realized as the aspirated stop *c*^{h}, after *t* obligatorily and on the whole always after *n*. The other voiceless segments only change the palatal fricative to a small extent.

Underlying *s* and *r* also constitute a group in some contexts. They are realized – except in some easily defined environments, which will be described below – as *r* before voiced segments. *s* and *r* which are not followed by voiced segments issue in *visarga*. Both these developments are specific for *s* and *r*. The assumption that *visarga* is a kind of intermediate stage in e.g.: *s* → *ṣ* / __ # *ṭ* is supported by Macdonell 1927:21 when he speaks of it as "the spirant to which the hard s and the corresponding soft r are reduced *in pausā*". Macdonell thinks that *visarga* is mostly converted into *r* in voiced environments.

This traditional account is untenable from a generative point of view. Most words with original *-s* are regularly converted into *r* when a voiced sound follows, e.g. *gaur gacch*^{h}*ati* 'the cow walks'. A subgroup of the words ending in *s* – those with a preceding *a* or *ā* – do not change their final into *r* before vowels or voiced consonants. The outcome of original *-ās* is e.g. *-ā*, as in: *aśvā amī* 'those horses'. In the few instances in which there is an underlying final *r* (Macdonell 1927:22 says "etymological *r*") which is preceded by *a* or *ā* everything follows the general pattern – as in *dvār eṣā* 'this door'.

Macdonell deals with these instances of *s* and *r* (grouped under the common term *visarga*) before voiced segments:

(29) 1. *Visarga* (except after the *a* sounds): *r*.
2. *Visarga* after the *a* sounds: other, peculiar changes.
3. *Visarga* after the *a* sounds, reflecting "etymological r": not subject to the changes hinted at in 2 but instead "reverting to" *r*.

I think that even phonologists that assume abstract segments would dislike this set of rules, where a segment which is lost in the derivation suddenly turns up again. Apart from the inherent clumsiness in (29), it may be said that historical considerations should not be our concern here, because what has been is no longer to be seen.

Kiparsky instead takes the position that external sandhi applies earlier before voiced segments than before pauses and voiceless segments. That is, no voiced initial segments are left when (24) and (25) apply.

When I also reject this view and prefer to look at the segments in question as simultaneously derived from a single rule, this is based on the simplicity criterion. With a fusion of the rules for *r* and *s* (using the Jakobsonian feature [vocalic]) everything may be formalized as follows:

(30) (a) $\begin{bmatrix}\text{+continuant}\\ \text{-high}\end{bmatrix} \rightarrow \begin{bmatrix}\alpha\text{consonantal}\\ \alpha\text{vocalic}\end{bmatrix}$ / __ [αvoice]

(b) ḥ → [αplace] / __ + $\begin{bmatrix}\alpha\text{place}\\ \text{+coronal}\\ \text{-continuant}\end{bmatrix}$

(c) (optional) ḥ → [αplace] / __ + [-syll]

The rules converting a low vowel + *s* which precede a voiced segment take place earlier in the derivation than the rules in (30). The (a) rule changes the remaining *s* / *r* into either *r* or *ḥ* depending on the value for voice in the following segment. Rules (b) and (c) remind much of (24) and (25) but, like Varenne, I consider *visarga* as the direct source.

The rules reflect the weakening in word-final position which is a basic feature of Sanskrit phonology (and phonology in general) and which is pertinent to this case. The later assimilation of *visarga* is not surprising either if the universal tendency for the laryngeal semivowel to get (partly) assimilated is considered. Vid. e.g. Matthews 1973, who establishes this for *h* in the presence of vowels and remarks that sonorants also have this assimilatory effect – he presumes that in the Old English *hlāford* 'lord' the laryngeal agreed with the lateral in most features, except voice.

The optional *ḥ* assimilation rule concludes the cases where Ø will affect the formalism because the input totally or partially will be assimilated to

the zero value – given the simplest description. Note that *SPE* seems to disallow this use of the pause, as word boundary – its actual counterpart – is characterized (just like the other boundaries) by the feature [-segment] (pp. 366-71) and the necessary phonetic features are described as distinctive features of the segments (p. 176). This view is accordingly tradition within generative phonological theory. The first case where the interpretation of pause matters is (11) where the prediction made by the formalism is correct – zero becomes zero in the position before a pause. Then in (17c) and (18b) we must add a boundary mark or else any word final consonant will be deleted. In (30a) [-voice] as elsewhere covers not only voiceless segments but pauses as well. The stipulation works well for this case. As to (30c), someone suggested that because Ø has no place, the rule is inapplicable before a pause. Yet Ø will under the present analysis contain negative values for all place features and the boundary again solves the difficulty.

It may be of interest to look at the treatment of the pause from the other perspective, i.e. the *SPE* system. As to (11), the rule would not take effect before Ø, since the external context then specifies a non-syllabic segment. In this case, no change is needed in the formal description. In (18b), it becomes possible to skip the specification [+segm], and the same thing goes for (30c). In (17c), the boundary is needed anyway. The traditional view of the pause as not being [-voice] would, however, necessitate a split of (30a) – or at least a more complicated solution. In the cases where the *SPE* view is advantageous, the rules involve place assimilation and cluster simplification. On the other hand, the success of the [-syll] view is, as in Olsson 1992, striking in cases where the element in the outer context makes reference to [voice]. So, the objection that the pause has no place might be valid.

Conclusion

During this work my primary aim has been to investigate cases that were assumed to show that the EC works better than the extrinsic ordering approach. It has been noted, however, that a number of cases for the EC are merely illfounded. The case of the high segments in Sanskrit remains obscure and it would be of interest to see this problem definitely settled.

Even if the EC can not be regarded as superior to the extrinsic rule ordering approach, at least given these examples, it might still turn out to be equal to the *SPE* framework. Considerations of theoretical elegance and psychological relevance would then be important in the choice of ordering principle. But the issue is hard to decide. Sag 1974 reports that Pāṇini

preferred a similar intrinsic ordering priciple for the bulk of rules in his grammar (consisting of over four thousand rules), but had to take resort to extrinsic ordering for three or four hundred of them. Future research will possibly tell if this was only a shortcoming of the Old Indian linguist.

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Tense

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many mental representations are kinematic or dynamic; they take place in time, yet no one has much of an explanatory model of time itself. Models either make a direct use of time, or else they simulate it. We use or mimic time; we do not have an explanation of it; we merely work with it so well that we think we understand it.

P.N. Johnson-Laird 1983:10

Introduction

Practically all modern analyses of tense systems are ultimately based on Reichenbach 1947 and by that, at least indirectly, on Jespersen 1924. Although different models vary in certain details, they all refer to the Jespersen–Reichenbach time axis. The function of tense (and aspect for that matter) in discourse has frequently been characterized as giving information about the temporal and spatiotemporal relationship between discourse events as such, as well as between the speaker and the discourse (e.g. DeLancey 1982, Kamp & Rohrer 1983, Partee 1984, Comrie 1976, 1985, Cooper 1986, Dowty 1986, Hinrichs 1986). One can observe that in volumes such as Tedeschi & Zaenen 1981 or Hopper 1982 there is not one single paper that queries Reichenbach's time concept. Even cognitively oriented linguists who otherwise focus upon the parallel between language and spatial relations do adhere truly to Reichenbach's paradigm. The distinction between the "three natural and fundamental aspectual classes" proposed by Langacker 1982: 265, i.e. imperfective processes, perfective processes and states, are characterized in terms of duration and their trajectories are related to the time axis (cf. Gawrońska 1993:73f.). Evidently, Aristotle's idea concerning the nature of the verb category is very firmly rooted in contemporary linguistics, even among those representatives of the discipline who bear a reputation of utmost sophistication in philosophical matters.