Economy and the Construction of the Śivasūtras

Paul Kiparsky
Stanford University

(1)

1.	a	i	u			Ṇ
2.				ṛ	ḷ	K
3.		e	o			Ñ
4.		ai	au			C
5.	h	y	v	r		Ṭ
6.					l	Ṇ
7.	ñ	m	n̄	ṇ	n	M
8.	jh	bh				Ñ
9.			gh	ḍh	dh	Ṣ
10.	j	b	g	ḍ	d	Ś
11.	kh	ph	ch	ṭh	th	
			c	ṭ	t	V
12.	k	p				Y
13.		ś	ṣ	s		R
14.	h					L

This is Pāṇini's *akṣarasamāmnāya*, the enumeration and grouping of the sounds of Sanskrit popularly called the *Śivasūtras* (or *Maheśvarasūtras*). The *Śivasūtras* form an indispensable part of the grammar, and their structure is thoroughly intertwined with, and determined by, that of the *Aṣṭādhyāyī*. Abbreviations *(pratyāhāras)* are defined on the *Śivasūtras* and other similarly organized lists by the convention that if x_q is followed in the list by the marker Q, then x_pQ denotes the set of elements x_p, x_{p+1}, ... x_q. The phonological classes defined in this way are referred to in hundreds of rules in the *Aṣṭādhyāyī*.

Both traditional and modern discussions of the *Śivasūtras* recognize that their structure is motivated in large part by the fundamental principle of economy (simplicity, *lāghava)*, which governs Pāṇini's entire grammatical system. The reasoning from economy goes like this. To be grouped together in a *pratyāhāra*, sounds must make up a continuous segment of the list. Economy requires making the list as short as possible, which means avoiding repetitions of sounds, and using as few markers as possible. Consequently, if class A properly includes class B, the elements shared with B should be listed last in A; the marker that follows can then be used to form *pratyāhāras* for both A and B. In this way the economy principle, by selecting the

shortest grammar, determines both the ordering of sounds and the placement of markers among them.

For example, the order of simple vowels at the beginning of the *Śivasūtras* (see the first two rows of [1]) is constrained by the fact that the grammar must refer to the following groupings of them:

(2) a. *a, i, u, ṛ, ḷ (= aK)*[1]
b. *i, u, ṛ, ḷ (= iK)*[2]
c. *u, ṛ, (ḷ) (= uK)*[3]
d. *a, i, u (= aṆ)*[4]

which, by the reasoning of the preceding paragraph, requires the partial ordering

(3) $a < i < u < \underset{\cdot}{r}, \underset{\cdot}{l}$

and markers after *u* and after the liquids.

Much of the structure of the *Śivasūtras* has been successfully explained by this kind of reasoning from economy (Faddegon 1936, Thieme 1935, Staal 1962, Cardona 1969). But there remains a substantial residue where economy is at first sight not at stake. For example, the order of *ṛ* and *ḷ* in row 2 could be reversed without complicating the grammar, because every *pratyāhāra* needed in the grammar that includes one of them can also include the other. The same is true of *e* and *o* in the next row.[5] The systematic character of Pāṇini's grammar makes it likely that there is a rational basis for the order of these elements as well — but what?

Staal (1962) and Cardona (1969) have each suggested such a rational basis for the cases that are not explained by economy. Staal's idea is that among alternative equally simple orderings, that of the previous set of homorganic elements is given preference.[6] Though Staal does not actually discuss the vowels, his proposal would readily explain the order *e, o* as continuing the order *i, u* of the first row.

Cardona argues instead that some aspects of the *Śivasūtras* reflect the strictly phonetic arrangement of the *Prātiśākhyas* which served Pāṇini as a starting point. This was modified as necessary by inserting markers into it and by reordering its elements, and otherwise retained. On this view, the *Śivasūtras'* order *e, o* would

[1] 6.1.101 ff., 6.1.182.

[2] 1.1.3, 1.1.48, 1.2.9, 5.1.131, 6.1.77, 6.2.52, 6.1.127, 6.2.52, 6.3.61, 6.3.121, 6.3.123, 6.3.134, 7.1.73 ff., 8.2.76.

[3] 7.2.11, 7.3.51.

[4] 1.1.51, 6.3.11, 7.4.13, 8.4.57.

[5] Of course, if *e* and *o* were reversed, the *pratyāhāras* that now begin with *e* would begin with *o*. Since no *pratyāhāra* begins with either *ṛ* or *ḷ*, no rule would even have to be changed in any way if they were reversed.

[6] Notice that unlike the economy principle, this would be specific to the construction of the *Śivasūtras*.

simply reflect the order of the traditional listing *e, ai, o, au* (for which no particular reason is assumed to be necessary). So Cardona too appeals to a notion of continuity, only his continuity is historical, rather than structural and system-internal as Staal's is.

However, neither of these accounts, or even the two of them together, is probably the whole story. For example, the order of *ṛ* and *ḷ* in row 2 cannot be carried over from previous homorganic sounds in the list, for there are none. And it cannot be carried over from the *Prātiśākhyas'* sound lists, because they did not include *ḷ* (Cardona 1969, p. 38).

In this paper I shall argue, like Staal, that the structure of the *Śivasūtras* is entirely explicable on systematic grounds. However, I shall try to show that no other principles are needed than those used in the construction of the rest of Pāṇini's grammar, namely the principle of economy and the logic of the special case and the general case *(sāmānya/viśeṣa)*. If applied as rigorously in the construction of the metalanguage as in the formulation of the grammatical rules, they suffice to determine the structure of the *Śivasūtras*. As we have seen, the groupings of sounds needed for the grammar induce a set of partial ordering constraints on their listing. We will now show that these ordering constraints, when formulated in accord with Pāṇinian principles of economy and generalization, have as their unique solution the *Śivasūtras*.

In order to develop this idea, we must spell out exactly how economy figures in Pāṇini's system and how it is related to generalization.

Cardona (1969, pp. 28, 30, 41) argues that economy for Pāṇini is "consequent on generalization": "the analysis of linguistic materials in order to formulate generalized rules is Pāṇini's way of achieving economy *(lāghava)*". I think this view — which I thoughtlessly endorsed in Joshi and Kiparsky 1979, 227 — is not correct. It is certainly not true that Pāṇini avoids prolixity only where generalization is at stake.[7] The rules of the *Aṣṭādhyāyī* systematically maximize economy, whether or not this leads to generalization in any given case. *Anuvṛtti* often ranges over entirely disparate rules, in which case it achieves economy but not generalization (Staal 1970, 503). Indeed, some means of concision systematically employed in the grammar are *never* "consequent on generalization". For example, whenever Pāṇini can compress phrases into compounds, he invariably does so, even though this achieves nothing beyond the saving of syllables. This is true even for those compounds which are not derived from analytic expressions but are simply alternative expressions of the same semantic content, namely *dvandvas* and *bahuvrīhis*. The vowels of a given quality are invariably denoted by their short representative, even though by Pāṇini's *sāvarṇya* convention (1.1.69) the long one would have done as well. S.D. Joshi *(voce)* has brought to my attention the striking fact that Pāṇini even tends to order the words

[7] This point has been insightfully discussed by Henry Smith (Stanford University) in as yet unpublished work.

in a rule in such a way that the number of syllables in it will be minimized by sandhi.[8]

Still, this does not mean that Pāṇini is after economy for its own sake. The reverse of Cardona's formulation does hold: *economy is Pāṇini's way of achieving generalization.* More precisely, the metalanguage is so constructed that maximization of economy in the grammar ensures generalization. This can be concluded from the fact that Pāṇini introduces abbreviatory conventions into his metalanguage if, and *only* if, they make it possible to bring out significant generalizations in the grammar. So the theoretical goal of generalization is implemented by seeking the most economical description possible in the framework of an appropriately constructed metalanguage of grammatical description. The economy requirement works "blindly" in the service of this global objective, and is not expected to yield generalizations in each local instance.

In consequence of its purely formal nature, the economy principle typically leads to *vacuous overgeneralization.* Simplification is mandatory even if it means extending the conditions of a rule to cases which can never arise. But (what is equally important) overgeneralized formulations are *only* chosen where economy requires it. Among a set of equally simple formulations covering all the cases, Pāṇini chooses the most restrictive one. There are, then, two principles at work which, tending in opposite directions, fix the form of the grammar: the dominant principle of *simplicity*, and the subsidiary principle of *restrictiveness:*

(4) *Simplicity:* Formulate grammatical generalizations in the simplest way.
Restrictiveness: Among equally simple formulations, choose the most restrictive.

Together, simplicity and restrictiveness govern all aspects of the system, including the use of *pratyāhāras.* Some examples follow.

Rule 8.4.53 [5] illustrates overgeneralization enforced by economy. Since *h* does not cluster with stops, the more restrictive *jhaR* (stops and fricatives) could have been used instead of *jhaL* (stops, fricatives, and *h*) in rule 8.4.53. Economy however forces *jhaL* because it is carried over by *anuvṛtti* into the next rule, 8.4.54, where it is absolutely necessary:

(5) 8.4.53 *jhalāṃ jaś jhaśi* 'obstruents *(jhaL)* are replaced by voiced unaspirated stops *(jaŚ)* before voiced stops *(jhaŚ).*

[8]Therefore, the maxim *Ardhamātrālāghavena putrotsavaṃ manyante vaiyākaraṇāḥ* 'grammarians value the saving of half a mora like the birth of a son' has more than a grain of truth, and Cardona (1969, 41) is wrong in ridiculing the "mania for *mātralāghava*" as "a property of lesser original Indian grammarians [sic]". It is quite natural to have faith in a principle which, in concert with an appropriately designed metalanguage, reveals deep generalizations in the grammar of Sanskrit.

(6) 8.4.54 *abhyāse car ca* (53 *jhalāṃ jaś*) 'in reduplication, (obstruents) are replaced by (voiced unaspirated stops) and by voiceless unaspirated segments *(caR)*'

Similarly, the class *yaṆ (y, v, r, l)* is specified as the prevocalic replacement of the single root *iṆ* 'go' in 6.4.81 *iṇo yaṇ*, where obviously the more specific *y* would have done equally well. The reason is that *yaṆ* is continued into the more general rules that follow (6.4.82-6.4.87), where its extra coverage becomes functional. Examples of this type can easily be multiplied.[9]

Among equally economical formulations, the most restrictive is chosen. For example,

(7) 7.4.61 *śarpūrvāḥ khayaḥ* (60 *śeṣaḥ)* 'unvoiced stops *(khaY)* after fricatives *śaR* remain'

which states that fricative+stop clusters are exceptions to the general rule deleting all but the first consonant in reduplication could have been vacuously generalized to apply after the more inclusive set of sounds *śaL (ś, ṣ, s, h)* rather than after just the fricatives, for *h* never clusters with stops. Pāṇini has chosen the more specific formulation of the rule, which only extends to the actually occurring cases. Similarly,

(8) 8.3.33 *maya uño vo vā* (32 *aci)* '*uÑ* is optionally replaced by *v* between *m, n̄, ṇ, n (maY)* and a vowel or diphthong *(aC)*'

specifies *maY*, which includes *m, n̄, ṇ, n*, rather than *ñaY (ñ, m, n̄, ṇ, n)*, even though the overgeneralization would have been harmless, as *ñ* does not occur in word-final position.[10]

All this holds equally for the construction of the metalanguage. Technical terms are never introduced solely for brevity's sake. Their purpose is rather to allow the rules of the grammar to express significant generalizations. But if Pāṇini needs to coin a new word for this purpose anyway, he makes it maximally short, usually no more than a mora (cf. such cover terms as *bha, ghu, ghi, ṭi* and abstract underlying forms of the type *yu, vu, jhi, v, l, cli*). And nothing in the metalanguage is motivated solely for the purpose of avoiding vacuous overgeneralization. Specifically, no markers in the *Śivasūtras* are introduced just in order to avoid overgeneral *pratyāhāras*. E.g. *uK* in 7.2.11 includes *u, ṛ, ḷ*, but since there are no roots in *ḷ* the last case never arises. A *pratyāhāra* that excludes it, however, would require a new marker and in the absence of positive motivation, such a marker is not put in.

Given the subgroupings which the grammar must refer to, these considerations alone dictate the organization of the *Śivasūtras*. This will now be shown.

[9] E.g. *jhaY* rather than *jhaŚ* in 8.4.62 because of 8.4.63, *jhaL* in 8.2.26 because of 8.2.31.

[10] The avoidance of vacuous overgeneralization is however not observed as rigorously as the economy principle. Especially *jhaL* (e.g. 1.2.10) and *aC* (e.g. 7.2.89), which are practically synonyms of "consonant" and "vowel" are often overused. Another case is *iṆ* for *iṬ* in 8.3.57.

The complex vowels and diphthongs *e, o, ai, au* must be placed right after the simple vowels, because of the groupings

(9) a. *a, i, u, ṛ, ḷ, e, o, ai, au (= aC)*[11]
b. *i, u, ṛ, ḷ, e, o, ai, au (= iC)*[12]
c. *e, o, ai, au (= eC)*[13]
d. *ai, au (= aiC)*[14]
e. *e, o (= eṆ)*[15]

The semivowels must be grouped with the vowels into

(10) a. *y, v, r, l (= yaṆ)*[16]
b. *a, i, u, ṛ, ḷ, e, o, ai, au, h, y, v, r, l (= aṆ)*[17]
c. *i, u, ṛ, ḷ, e, o, ai, au, h, y, v, r, l (= iṆ)*[18]
d. *a, i, u, ṛ, ḷ, e, o, ai, au, h, y, v, r (= aṬ)*[19]

and with the other consonants into

(11) a. *h, y, v, r, l* plus consonants *(= haL)*[20]
b. *y, v, r, l* plus consonants *(= yaR)*[21]
c. *v, r, l* plus consonants *(= vaL)*[22]
d. *r, l* plus consonants *(= raL)*[23]

Together, [9], [10], and [11] yield, in addition to confirmation for $a < i$ in [3], the new ordering constraints

(12) a. $h < y < v < r < l$
b. simple vowels < complex vowels, diphthongs < semivowels

So far, this adds up to:

(13) a. The simple vowels must be listed together.
b. The complex vowels *(e, o)* must be listed together.

[11] 1.1.10, 1.1.14, 1.1.47, etc.
[12] 6.1.104, 6.3.68.
[13] 1.1.48, 6.1.45 ff., 6.1.78, 8.2.108.
[14] 1.1.1, 7.3.3, 8.2.106.
[15] 1.1.2, 6.1.69, 6.1.94, 6.1.109.
[16] 1.1.45, 6.1.77, 6.4.81, 6.4.156.
[17] 1.1.51, 6.3.111, 7.4.13 ff., 8.4.57.
[18] 1.1.69.
[19] 8.3.3, 8.3.9, 8.4.2, 8.4.63.
[20] 1.1.7, 1.2.10, 1.2.26, 1.3.3 etc.
[21] 8.4.45 ff.
[22] 6.1.66, 7.2.35.
[23] 1.2.26 ff.

c. The diphthongs *(ai, au)* must be listed together.

d. The semivowels must be listed together.

e. Simple vowels, complex vowels, diphthongs, and semivowels must be listed together.

f. The order of the series must be: simple vowels < complex vowels, diphthongs < semivowels.

g. Within the vowels, the order must be: $a < i < u < ṛ,\ ḷ$.

h. Within the semivowels, the order must be: $h < y < v < r < l$.

Note that the order within both vowels and semivowels in [13-7, 13-8] coincides almost completely with the "sonority hierarchy" assumed by modern phonologists and phoneticians. Although no such hierarchy was to my knowledge ever explicitly proposed in India, it emerges here as a by-product, as it were, of Pāṇini's purely distributional analysis of Sanskrit phonology.

An equally remarkable outcome is that in terms of place of articulation, the ordering of vowels in [13-7] is fully consistent with the ordering of the corresponding semivowels in [13-8]. In this case, of course, Pāṇini must have been well aware of the phonetic classification behind the correspondence. However, the fact that it emerges from the distributional analysis is still significant. It shows that even if Pāṇini had begun with altogether different assumptions, or with none at all, he would still have come up with a parallel arrangement of vowels and semivowels.

Because the ordering constraints [3], [12-1] are subjected to the same logic of generalization as everything else in the system, they are combined and generalized to:[24]

(14) velars/pharyngeals < palatals < labials < retroflexes < dentals

The generalized ordering constraint [14] fixes the so far indeterminate order of the syllabic liquids *ṛ, ḷ*, the complex vowels *(e, o)*, and the diphthongs *ai, au*.

The ordering of *e, o* before *ai, au* is dictated by simplicity because it allows a shorter *pratyāhāra* for the class *e, o, ai, au*, viz. *eC* (rather than **aiN̄)*.

This establishes the first six *Śivasūtras* in full:

(15)

a	i	u				Ṇ
			ṛ	ḷ		K
	e	o				N̄

[24] Within the grammar, the convention holds that vowels and consonants are not homorganic (1.1.10). But such generalizations as [14] are of course not part of the grammatical system, and logically prior to it, so they naturally do not obey its rules (though they are arrived at by the same general form of reasoning as the rest of the system).

	ai	au			C
h	y	v	r		Ṭ
				l	Ṇ

The groupings in [16] require, by the same reasoning as above, that the nasals and voiced stops come next in that order. They are demarcated by *M, Ś*, respectively, giving the *pratyāhāras*

(16) a. vowels, diphthongs, semivowels, nasals, voiced stops *(aŚ)*[25]

b. semivowels, nasals, voiced stops *(haŚ)*[26]

c. *v, r, l*, nasals, voiced stops *(vaŚ)*[27]

d. voiced stops *jhaŚ*

e. vowels, diphthongs, semivowels, nasals *(aM)*[28]

f. *y, v, r, l*, nasals *(yaM)*[29]

Notice that the previously seen subdivisions of the semivowels reappear in *vaŚ* and *yaM*, reaffirming [12] and the generalized [14].

The voiceless stops and the fricatives must follow, in that order, with the marker *Y* after the former, to give the groupings

(17) a. *y, v, r, l*, nasals, voiced stops, voiceless stops *(yaY)*[30]

b. nasals, voiced stops, voiceless stops *(maY)*[31]

c. voiced stops, voiceless stops *(jhaY)*[32]

d. voiceless stops *(khaY)*[33]

and with the marker *R* after the latter, to give

(18) a. *y, v, r, l*, nasals, voiced stops, voiceless stops, fricatives *(yaR)*[34]

b. voiced stops, voiceless stops, fricatives *(jhaR)*[35]

c. voiceless stops, fricatives *(khaR)*[36]

[25] 8.3.17.
[26] 6.1.74.
[27] 7.2.8.
[28] 8.3.6.
[29] 8.4.64.
[30] 8.4.58.
[31] 8.3.33.
[32] 5.4.111, 8.2.10, 8.4.62.
[33] 7.4.61, 8.3.6.
[34] 8.4.45 ff.
[35] 8.4.65.
[36] 8.3.15, 8.4.55.

d. fricatives *(śaR)*[37]

Within the voiceless stops, aspirated stops precede unaspirated stops in order to allow the latter to be grouped with the fricatives *(caR)*.[38] The same order is motivated in the voiced stops by the fact that *bh* patterns with the sonorants *(yaÑ)*, on which see below.

The consonant *h*, already listed as the first of the semivowels, must be listed a second time at the very end of the *Śivasūtras,* because it must also be included in two sets of groups: among the obstruents *(haL)* and the fricatives *(śaL)*, as well as in the classes *vaL* and *raL* mentioned above. This is the only repetition which is necessary in the system.

In sum, the order of the series must be

(19) nasals < voiced aspirates < voiced unaspirates < voiceless aspirates < voiceless unaspirates < fricatives < *h*.

If we now arrange the series of consonants according to [19], put the consonants within each series according to place of articulation according to [14], and add *pratyāhāras* where needed, we get

(20)

n̄	ñ	m	ṇ	n	M
gh	jh	bh	ḍh	dh	Ṣ
g	j	b	ḍ	d	Ś
kh	ch	ph	ṭh	th	
k	c	p	ṭ	t	V
		ś	ṣ	s	R

from which the arrangement of the actual *Śivasūtras* can be derived by the minimal local modifications needed for consonantal *pratyāhāras* as follows.

The three nasals *n̄, ṇ, n* must be grouped together as a class which figures in

(21) 8.3.32 *n̄amo hrasvād aci n̄amuṇ nityam* 'after a *pada* ending in *n̄am* preceded by a short vowel and followed by a vowel or diphthong *(aC)*, [the initial augment] *n̄am* is obligatorily inserted'

Theoretically, the palatal nasal *ñ* could be included in *n̄aM* too, because palatals cannot occur at the end of a *pada*, as noted at [8]. Hence there are two possible specific *(viśeṣa)* ordering constraints for nasals that could override the general *(sāmānya)* ordering constraint [14]:

[37] 7.4.61, 8.3.28, 8.3.35 ff., 8.3.58, 8.4.49.
[38] 1.1.58, 8.4.54 ff.

(22) a. ñ, m < n̄

b. m < n̄, ñ

These alternatives can be visualized as rearrangements of [14] by moving either the velar to the right after the labial or the labial leftwards to the beginning of its row. As far as the rules of the grammar are concerned, there is no difference in simplicity between the two; both differ from the general place ordering constraint [14] in the minimal possible way.

Pāṇini's choice of [22-1] over [22-2] is justified by two independent considerations. One is that the restrictiveness principle dictates that vacuous overgeneralization be avoided. On the second alternative, *ñaM* would include not only *ñ, ṇ, n* but vacuously also *ñ*. Therefore the first, which is equally simple but allows a more restrictive formulation, is preferred.

Independently of that, the simplicity principle also requires the choice of [22-1]. For [22-1] generalizes to both the aspirated and unaspirated series of voiced stops in several desirable ways. First, the order corresponding to [22-1] yields classes which exclude the palatal stops are required for the "Grassmannn's Law" alternations *(budh-s → bhut-s)*, in which *jh, j* do not participate *(jabh-s → jap-s)* (8.2.37). If [22-1] is extended to nasals, these classes can be designated as *baś, bhaṣ*.[39] Doing this by [22-1] has the additional advantage of restricting *yaÑ*. This *pratyāhāra*, which defines the environment for stem-final lengthening (7.3.101, 102), must cover *n, m, y, bh* but could be allowed to include vacuously *gh* (and indeed all the voiced aspirates except for *dh*). By generalizing [22-1] from nasals to the voiced aspirates, the vacuous overgeneralization is reduced to the necessary minimum *(jh)*.

So the optimal special *(viśeṣa)* ordering constraint, superseding the general ordering constraint [14] in the overlapping domain, is

(23) palatals < labials < velars (for voiced consonants)

Could [23] be generalized even further, to *all* the consonants? The answer is no. In the two voiceless stop series, the coronal consonants *ch, ṭh, th, c, ṭ, t* must be grouped together. This requires the special ordering

(24) kh, ph < ch, ṭh, th, c, ṭ, t < k, p

which, with the applicable cases of the general constraints [14] and [19] within each subgroup, yields Pāṇini's ordering of these series. Insertion of the marker *V* after the coronals allows them to be grouped as *chaV* (8.3.7).

Putting the above constraints together, we get

[39] To be precise, *baś* requires this order by economy; *bhaṣ* could in principle include all the aspirates because 1.1.50 *sthāne 'ntaratamaḥ* 'in replacing, the closest [replacement is chosen]' would give the right results; exclusion of *jh* from it is however preferred because it avoids vacuous overgeneralization.

(25)							
	7.	ñ	m	n̄	ṇ	n	M
	8.	jh	bh				Ñ
	9.			gh	ḍh	dh	Ṣ
	10.	j	b	g	ḍ	d	Ś
	11.	kh	ph	ch	ṭh	th	
				c	ṭ	t	V
	12.	k	p				Y
	13.		ś	ṣ	s		R
	14.	h					L

which completes the construction of the *Śivasūtras*.

Having seen how the *Śivasūtras'* ordering of the consonants follows from Pāṇinian principles of generalization, we can compare it to Cardona's alternative account. This involves starting with the *Prātiśākhyas'* listing of consonants by place of articulation going from the back of the mouth to the front:

(26) n̄ ñ ṇ n m

To get from [26] to the first row in [25] we would then have to assume that two sounds, *m* and *ñ*, were moved to the left to create the actual *Śivasūtra* grouping. *But there was no need to move the latter.* Simply moving *m* to the head of the list, and leaving *ñ* in place, would have been sufficient, for the reasons explained above.

A similar problem would arise for the voiced stops if we assume, with Cardona, that the *Śivasūtras* were made by minimally reordering an original

(27)					
	gh	jh	ṭh	dh	bh
	g	j	ṭ	d	b

The *pratyāhāra yaÑ* must include *bh* and exclude *dh*, and *gh, jh, ḍh* may or may not be included in it because they don't begin any sufiixes of the relevant class. So the minimal change was then merely to shift *bh* to the left of *dh*. Why then was it shifted so far to the left? (Our answer is that it is not shifted: in virtue of [14], it is already there). And for the voiced unaspirated stops, the question is: why move the labial at all? (Our answer is that they are not moved.)

I conclude that the assumption that the *Śivasūtras* have been reordered from an earlier *Prātiśākhya*-type listing does nothing to explain their structure.

By this I do *not* mean that Pāṇini in fact started from scratch in constructing the *Śivasūtras*. On the contrary, it is virtually certain that he was acquainted with one or more phonetically arranged listings of sounds such as those found in the *Prātiśākhyas*, and it is even quite possible that there were previous *Śivasūtra*-style arrangements that he knew. It is also quite possible that Pāṇini started with one of those earlier arrangements and reordered it. What I do claim is rather that such earlier works are in no way required to explain the *Śivasūtras*, and that therefore we cannot make any inferences about Pāṇini's sources for the *Śivasūtras* from their structure.

An analogy may help to make the point clearer. An examination of Pāṇini's phonological rules shows that many of them are similar to sound changes assumed to have taken place in earlier stages of Sanskrit, and that moreover the order in which the rules have to be applied is similar to the relative chronology of the corresponding sound changes. But it would be absurd to conclude from this that Pāṇini based his grammar on a historical phonology of Sanskrit, reordering its rules where necessary.[40] Rather, because of an interesting property of language its synchronic and diachronic analyses are going to be significantly related even if they are arrived at independently. Similarly, the fact that phonetic and phonological works on Sanskrit arrived at closely related classifications of its sounds is the result of a fundamental fact about language itself — that phonetic and phonological features are drawn from the same set — and that does not warrant the conclusion that one classification was historically modeled on the other.

It is said that god Śiva revealed these fourteen classes of sounds to Pāṇini to get him started on the *Aṣṭādhyāyī*. We might now want to see a deeper point in this legend. Our conclusions imply that if we did not possess the text of the *Aṣṭādhyāyī*, but merely a pretheoretical description of Sanskrit phonology, the main principles of Pāṇini's grammar could be inferred just from the way the phonemes of Sanskrit are organized in the *Śivasūtras*.

[40] A contemporary generative phonology of a language would have the same property, and if the job was done right it should make no difference whether or not the author knew anything about the history of the language.

Cardona, George. 1969. Studies in Indian Grammarians I: The Method of Description Reflected in the Śiva-sūtras. *Transactions of the American Philosophical Society* 59, 1, 3–48.

Faddegon, Barend. 1936. *Studies on Pāṇini's Grammar*. Verhandelingen der koninklijke Akademie der Wetenschappen, Nieuwe Reeks, Amsterdam.

Joshi, S.D. and Paul Kiparsky. 1979. *Siddha* and *asiddha* in Pāṇinian Phonology. In *Current Approaches to Phonological Theory*, Dan Dinnsen, (ed.) Indiana University Press, Bloomington, Ind..

Staal, J. F. 1962. A Method of Linguistic Description: the Order of Consonants According to Pāṇini. *Language* 38, 1–10.

Staal, J. F. 1970. Review of Cardona 1969. *Language* 46, 502–507.

Thieme, Paul 1935. Pāṇini and the Veda: Studies in the Early History of Linguistic Science in India, Allahabad.