PĀṆINIAN LINGUISTICS

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1 Pāṇini's grammar

Pāṇini's grammar (ca. 500 B.C.) seeks to provide a complete, maximally concise, and theoretically consistent analysis of Sanskrit grammatical structure. It is the foundation of all traditional and modern analyses of Sanskrit, as well as having great historical and theoretical interest in its own right. Western grammatical theory has been influenced by it at every stage of its development for the last two centuries. The early 19th century comparativists learned from it the principles of morphological analysis. Bloomfield modeled both his classic Algonquian grammars and the logical-positivist axiomatization of his *Postulates* on it. Modern linguistics acknowledges it as the most complete generative grammar of any language yet written, and continues to adopt technical ideas from it.

  The grammar is based on the spoken language (*bhāṣā*) of Pāṇini's time, and also gives rules on Vedic usage and on regional variants. Its optional rules distinguish between preferable and marginal forms, and a few rules even have sociolinguistic conditions. It is entirely synchronic: variants are simply treated as alternate forms, indeed, the very concept of linguistic change is foreign to the tradition. The grammar consists of four components:

  a. *Aṣṭādhyāyī*: a system of about 4000 grammatical rules.

  b. *Śivasūtras*: the inventory of phonological segments, partitioned by markers *(anubandhas)* to allow abbreviations for classes of segments to be formed by a technique described below *(pratyāhāras)*.

  c. *Dhātupāṭha*: a list of about 2000 verbal roots, with subclassification and diacritic markers encoding their morphological and syntactic properties.

d. *Gaṇapāṭha*: an inventory of classes of lexical items idiosyncratically subject to various rules.

The rules of the *Aṣṭādhyāyī* make reference to classes defined on the elements in the other three components by means of conventions spelled out in the *Aṣṭādhyāyī* itself. Thus, while none of the components is intelligible in isolation, together they constitute a complete integrated system of grammar.

There are also various peripheral adjuncts to the system. The most important of these are the *Uṇādisūtras*, which extend the Pāṇinian technique to analyze unproductive and irregularly formed derivatives from roots. Though mentioned in a few rules of the *Aṣṭādhyāyī*, many of the words they derive are treated as underived there, and they are probably post-Pāṇinian at least in their present form.

2 The Indian grammatical tradition

The science of language in India probably has its ultimate intellectual roots in the richly developed science of ritual (Staal 1988). The *sūtra* style of analysis and some of the technical concepts of grammatical description originated in the methods developed for codifying complex Vedic sacrifices. On a philosophical level, ritual is probably also the origin of a leading idea behind grammar as well as other disciplines such as yoga in ancient India: that human activities, even those normally carried out in an unconscious or unselfconscious way, can be analyzed by explicit rule systems, and that performing those activities in awareness of the rules that govern them brings religious merit.

The predecessors of Pāṇini's grammar and its compositional history are largely unknown. The *Aṣṭādhyāyī* itself cites a number of earlier grammarians, whose works have not survived. It has been suggested that its first redaction dealt with root derivation and inflection, and that rules for compounds and denominal *(taddhita)* formations were incorporated into it later from another source (Joshi and Roodbergen 1983). The early grammatical tradition appears to have had ties to the editorial activity which led to the standardization of Vedic texts [.Thieme 1935, Bronkhorst 1981.], and the technique of grammatical analysis probably evolved from related but less sophisticated methods like those used in the *Prātiśākhyas*, treatises that give the phonological rules relating the word-by-word *(padapāṭha)* version of Vedic

works to their connected text *(saṃhitā)*. These works share the goal of providing explicit and general rules for linguistic regularities, but they do not deal with morphology and syntax, and are confined to accounting for the data in a single Vedic text. By dealing with all levels of structure and not being bound to a particular corpus Pāṇini's grammar attains an incomparably greater depth of analysis, and does justice to the unbounded nature of language.

The text of the *Aṣṭādhyāyī* is rather accurately preserved. It came quite early to be regarded as canonical, and only relatively minor and easily detectable changes were made in its wording. The problems lie in its interpretation. Even though Pāṇini's grammar is a complete self-contained system of rules, some of the principles that determine how those rules are to be applied are not stated, and must be inferred. A massive commentatorial tradition is concerned with just this. By far the most important work is Patañjali's *Mahābhāṣya*, the 'Great Commentary', which incorporates and discusses Kātyāyana's earlier notes *(vārttikas)* on Pāṇini. It broaches topics ranging from minutiae to major philosophical questions, and attempts to remedy apparent lapses of the grammar by reinterpreting its rules, or, if that is not possible, by rephrasing them. It is one of the great works of Sanskrit literature, remarkable for its elegant dialectic structure and luminous style. Its conclusions are adopted in all later works. Pāṇini, Kātyāyana, and Patañjali are referred to as the 'three sages' *(muṇitraya)* and considered authoritative by all later grammarians.

The *Kāśikā* provides an explicit rule-by-rule paraphrase of the *Aṣṭādhyāyī*, and explains the wording of each rule with appropriate examples. It simplicity, like that of the modern translations of Pāṇini which are largely based on it, can be deceptive: the interpretation which it states apodictically for a rule may just be the tip of the *Mahābhāṣya's* enormous iceberg of (sometimes inconclusive) argumentation about it.

The text most commonly used to teach the system in India is Bhaṭṭojī Dīkṣita's *Siddhānta-Kaumudī*, which reorganizes the rules according to grammatical topics and takes the student through Pāṇini's whole system in an orderly way. Since the rules that come into play in any particular derivation are likely to be scattered all through the *Aṣṭādhyāyī*, this reorganization is a great help to the learner. The drawback of this method is that the architecture of the system is obscured. For example, the wording of a rule must usually be completed in context from the rules preceding it according to certain conventions, but this context is lost when the rules are rearranged as in

the Siddhānta-Kaumudī.

The standard treatise on the principles and metarules *(paribhāṣās)* of the system is the *Paribhāṣenduśekhara* of the great 18th century grammarian Nāgojībhaṭṭa (a.k.a. Nāgeśa). At an even higher level of generalization, Bhartṛhari's *Vākyapadīya* deals with topics in the philosophy of language from a grammatically sophisticated point of view.

These later works in the Pāṇinian tradition make important contributions in their own right. The innovations they come up with are prompted by several circumstances. (1) Careful analysis of Pāṇini's grammar reveals occasional gaps and inconsistencies in its formulations, both at a descriptive level and in matters of theory. (2) After Pāṇini's time, new words and forms not covered by his rules appeared in the Sanskrit language. (3) The original intent of some rules had been forgotten because of discontinuities in the early grammatical tradition. Increasingly reluctant to tamper with the wording of the rules, grammarians after Pāṇini prefer to fix the problems by devising ingenious reinterpretations. These reinterpretations, while extending the coverage of the grammar in the intended ways, can also cause considerable overgeneration, and sometimes obscure the original rigorous simplicity and beauty of the *Aṣṭādhyāyī*. One of the urgent tasks of current Pāṇini research is to reconstruct the original design of the system and the evolution of the interpretive apparatus later built on top of it. This can be done by a combination of philological and analytic research. It is often possible to recover the intent of a doubtful rule by examining the relevant usage in actual Sanskrit literature, especially the surviving works of Pāṇini's time (Brāhmaṇas and early Upaniṣads). Analysis of the internal structure of the system has even revealed underlying principles in the *Aṣṭādhyāyī* of which the commentators and the earlier Western scholars who followed them were wholly unaware (Kiparsky 1979, 1982).

3   The method of grammatical analysis

The *Aṣṭādhyāyī* is formulated in a morphologically, syntactically, and lexically regimented form of Sanskrit. To maximize concision with a minimum of ambiguity, rules are compressed by systematically omitting repeated expressions from them, according to a procedure modeled on natural language syntax *(anuvṛtti)*. Co-ordination and certain types of compounding are assigned standardized interpretations. And the nominal cases of the language

are used in a conventional way to designate the elements of grammatical rules.

From the viewpoint of their role in the system, rules can be divided into four types: (1) definitions (*saṃjñā*), (2) metarules (*paribhāṣā*), (3) headings (*adhikāra*), and (4) operational rules (*vṛtti*).

Definitional rules introduce the technical terms of the grammar. Metarules constrain the application of other rules throughout the grammar. Headings supply a common element for a group of rules. A heading must be read into every rule in the domain over which is valid unless it is semantically incompatible with its wording. Headings can extend over large stretches of the grammar (over a thousand rules in some cases), dividing it into overlapping topical sections.

Operational rules are the workhorses of the system. Subject to the applicable definitions, metarules and headings, they carry out four basic types of operations on strings: replacement, affixation, augmentation, and compounding. The basic format of a operational rule is [1a], represented in the grammatical system by the case frame shown in [1b]:

(1)   a. A → B / C __ D ('in the context between C and D, A is replaced by B')

   b. A$_{\text{Genitive}}$ B$_{\text{Nominative}}$ C$_{\text{Ablative}}$ D$_{\text{Locative}}$

This use of the cases to mark the elements of rules is absolutely consistent. However, the same cases are also used in their in ordinary language meanings (in general, Pāṇini's metalanguage allows ambiguity but not inconsistency). For example, the locative case, in addition to its technical use in marking a right-hand context in [1], figures in conditions limiting processes to certain meanings, dialects, genres, and connotations, such as 'in the meaning "action"', 'in the country of the Easterners', 'in Vedic literature', 'in a derogatory sense'.

The format in [1] covers most operational rules in the system. That includes not only standard replacement operations, but also deletion, which is treated as replacement by a null element (defined as invisibility). Several types of replacement processes, however, require a formally richer type of structural change. Certain phonological coalescence rules (*ekādeśa* 'single substitute' rules) effect replacement operations of the form [2a], and reduplication requires 'doubling' operations of the form [2b]:

(2)   a. A B → C

b. A → A A

Insertion of affixes (only suffixes actually occur, prefixation being treated as compounding) is done by rules of the same same format as replacement (see [1]), except that since nothing is replaced there is no genitive. Augments, which differ from suffixes in that they become part of the element they are added to, are also inserted by such rules but with a different interpretation ('A gets the augment B in the environment C ⎽⎽ D'). A diacritic marker on the augment shows whether it is to be put before, after, or inside the base. The fourth type of operation on strings is the combination of two or more words to form a *samāsa* 'compound'. The format is

(3) $A_{\text{Nominative}}$ $B_{\text{Instrumental}}$ = 'A is compounded with B'

where A is the governed member of the compound *(upasarjana)*.

Lexically, the grammar makes a fundamental distinction between technical terms and ordinary language expressions. The convention on their respective interpretations is that *ordinary language expressions denote their own form and technical term denote their referents.* Thus, the expression *gauḥ* 'cow' in a grammatical rule refers only to the word *gauḥ* (not, for example, to a cow, or to words meaning 'cow', or to words denoting particular kinds of cows), whereas the technical term *pada* 'word' refers to any element defined as a *pada* in the system.

Two kinds of technical terms are used: *primitive* and *theoretical (śāstrīya).* The meaning of primitive terms is assumed to be known from outside grammar, partly from other sciences and partly from ordinary language. For example, the technical terms of phonetics *(śikṣā)* and of ritual and Vedic studies, and certain semantic and logical terms, are taken as primitive terms within grammar. Also primitive are the notion of a rule *(vidhi)* and such associated notions as *ādeśa* 'substitute, replacement', *sthānin* 'substituendum, item to be replaced', *(a-)siddha* '(not) effected', *vipratiṣedha* 'conflict (between rules)'. Theoretical terms are defined by a network of rules in the *Aṣṭādhyāyī* on the basis of these primitive terms and lists of linguistic primes (sounds, roots etc.). Expressions which have both an ordinary meaning and a theoretical meaning may be used used in the grammar in both meanings. On the other hand, if a theoretical term is defined in the grammar, no other term, theoretical or primitive, is ever used in that meaning. In other words, ambiguity is permitted but inconsistency is not.

A large number of technical terms denote classes of linguistic elements. Some rules must apply not just to specific segments, morphemes, stems etc., but to whole classes of them, and since the same or related classes tend to reappear in many different rules, listing all the individual members of those classes in each rule would be unnecessarily complicated. Indeed, it would be impossible because some of those classes have no upper bound, there being no limit on the length of derived words, stems, or even roots. Providing terms for each of these classes makes it possible to refer to them in rules in a simple way. In accord with the economy requirement (*lāghava*) that governs Pāṇini's entire grammatical system, all and only the theoretical terms that can be defined within grammar are defined, and each term is defined as simply as possible and without redundancy.

Many lists of grammatical elements are divided into grammatically relevant subclasses. Instead of defining terms *ad hoc* for each subclass, Pāṇini provides standardized procedures for generating them from the lists themselves. In this way, the theoretical terminology includes several kinds of expressions freely generated and defined by conventional procedures specified in the grammar.

A key technique of generalization used by Pāṇini is to organize rules into hierarchies of generality. There is always an 'elsewhere' case, covered by the maximally general applicable rule *(sāmānya)*, and where necessary it is restricted by special rules *(viśeṣa)*, each of which can itself be restricted by still more special rules, and so on. If the set of forms to which rule A is applicable is properly included in the set of forms to which rule B is applicable, then A is automatically interpreted as superseding B in the shared domain (a convention which has been taken over in modern linguistics). This blocking relation between special and general rules can be generalized from pairs of rules to sets of arbitrary size. A special rule S can be considered to block a *set* G = G_1, G_2, ... G_n of general rules if the environments of S are properly included in the combined environments of G. Because of this convention, as well as *anuvṛtti* and other devices, the import of a rule does not come just from its wording but from its relation to other rules in the system.

The order in which the rules of the *Aṣṭādhyāyī* are to be applied is determined in the following way. In general, any applicable rule, no matter where it occurs in the grammar, is to be applied to a form, and the resulting form is again subjected to any applicable rules, until no more rules are applicable. This procedure goes a surprisingly long way. Additional constraints are,

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however, required for those cases where this procedure allows or even forces wrong derivations. Pāṇini clearly assumes such constraints, but he does not state them explicitly, and they must be inferred from the way he phrases his rules. Traditionally they are assumed to be the following (see e.g. Buiskool 1939):

(4) Rule A has priority over rule B if A is

    a. ordered after B (*para*)

    b. applicable whether or not B applies (*nitya*)

    c. conditioned internally to B (*antaraṅga*)

    d. applicable in a proper subset of the cases to which B is applicable (*apavāda*)

These principles form a hierarchy of increasing strength, so that the last is strongest of all. All cases of 'conflict' between simultaneously applicable rules are assumed to be resolved by them. Not included in this list, but tacitly assumed by the tradition, is the *feeding* principle, that when a rule can apply to the output of another, it does, unless this is blocked by some other constraint or rule.

The *para* principle [4a] and the *antaranga*-principle [4c] have probably been overgeneralized by the tradition, though both have a valid kernel. Modern scholars agree that the former is intended to apply only in the section which provides definitions (1.4–2.3). More controversial is the claim that the latter should be restricted to give priority to word phonology over sentence phonology,

(5) *The Word-integrity Principle*: Rules apply first within words and then to combinations of words.

and that the *nitya* and feeding principles are to be unified into the *siddha*-principle, which, with the *apavāda*-principle, is solely responsible for the ordering of rules within words:

(6) *The Siddha-principle:* When any rule is applied, the rules pertinent to its application should be 'effected' (*siddha*).

Here A is defined as *pertinent* to the application of rule B with respect to a form F if the result of applying A and B to F in that order is different from the result of applying A and B to F simultaneously.

The advocates of the revised system [5, 6] note that it unifies the basic ordering principles, eliminates a series of subsidiary *paribhāṣās* posited to deal with the unwanted side effects of the *antaraṅga-paribhāṣā*, and explains the wording of many of its rules. In particular, exactly in those cases where these principles would yield the wrong result for some rule, Pāṇini imposes special conditions on it to contravene them (Joshi and Kiparsky 1979). For example, a block of rules at the end of the grammar must be applied exactly in the order listed (technically, this is achieved by the condition that each rule is *asiddha* 'not effected' with respect to all rules that precede it). This block of strictly ordered rules contains only rules whose relationship to the other rules of the system is not determined by [5] and [6], and rules which they in turn feed.

4 Morphology/Syntax

The *Aṣṭādhyāyī* is not rigidly divided into subcomponents, and one should beware of mechanically imposing categories of Western linguistics on it. However, there is some basis for a distinction between the rules which build up words ('morphology') and determine how they can be combined with each other ('syntax'), which form one subsystem (roughly, the rules of chapters 1-5), and the rules which determine how morphemes and words are modified in combination with each other ('phonology', chapters 6-8).

The two types of word-formation in the *Aṣṭādhyāyī* are compounding and suffixation. Suffixation consists of adding a *pratyaya* 'suffix' either to a (verbal) root (*dhātu*), or to a (nominal) stem (*prātipadika*), or to a word (*pada*). The resulting form itself belongs to one of these three categories. The following seven subtypes of word-formation occur:

a. [Root + Suffix]$_{\text{Root}}$: desideratives, intensives, causatives.

b. [Word + Suffix]$_{\text{Root}}$: denominal verbs.

c. [Root + Suffix]$_{\text{Stem}}$: primary *(kṛt)* suffixes.

d. [Word + Suffix]$_{\text{Stem}}$: secondary *(taddhita)* suffixes.

e. [Word + Word]$_{\text{Stem}}$: compounding.

f. [Root + Suffix]$_{\text{Word}}$: verb inflection.

g. [Stem + Suffix]_{Word}: noun inflection.

A word is defined as anything that ends in an inflectional suffix. The definition covers indeclinable words too, for they are all assigned nominal inflectional endings, which are then deleted. Similarly, each member of a compound is a word because it contains a later deleted case ending. The reason for this procedure is that it simplifies the morphological derivation of compounds and automatically accounts for certain phonological phenomena. For example, in *rājapuruṣa* 'king's servant' the first member *rājan-*, being a word, gets its correct form by an independently motivated phonological rule which deletes word-final -*n*.

A general constraint of the grammar restricts word-formation rules to semantically connected (*samartha*) elements. Hence, in a string such as *bhāryā rājñaḥ, puruṣo devadattasya* 'the wife of the king, the servant of Devadatta', the semantically unrelated words 'of the king' and 'servant' cannot be compounded with each other, which would yield the incoherent **bhāryā rājapuruṣo devadattasya* '*the wife the king-servant of Devadatta'.

Morphological alternants can be handled both with the replacement technique and with the blocking technique described above. In either case, one form in a set of alternating forms is chosen as basic, in such a way as to allow the simplest overall description. Unless other considerations intervene, the simplest description results if one of its actually occurring forms is chosen, and among those the one with the widest distribution. If replacement is used, the basic form is introduced by a general rule everywhere and then replaced by the other alternants in specific contexts. If blocking is used, the basic form is introduced by a general rule and the alternants by special rules which block the general rule in specific contexts. (The grammarians were well aware of the conceptual relationship between replacement and blocking; indeed Kātyāyana uses the term *utsarga* for the basic form in both senses, the substituendum and the 'elsewhere' form.) Pāṇini typically uses blocking in derivational morphology and replacement in inflectional morphology. There are several interesting reasons for this. The most important is that, by convention, replacements inherit the morphological properties of the elements they replace (for example, they have the same effects on the vowel shape and accent of the stem to which they are added as the original morphemes do). These properties are typically invariant in inflectional alternants, but vary in derivational alternants.

More complex relationships can be represented by a combination of the

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replacement and blocking techniques. This method involves setting up a wholly abstract underlying form, and a rule replacing it by the basic alternant, which in turn is blocked by the special alternant.

A descriptive problem which arises in especially acute form in dealing with *taddhita* suffixes (denominal 'secondary derivation') is that most suffixes have a range of different meanings with different stems and most meanings are expressed by several suffixes, with considerable semantic overlap between them. Modern linguistics has not found the right tools for dealing with the intricate web of polysemy and synonymy that such systems constitute. Pāṇini achieves this by organizing the *taddhita* section in an ingenious way. He separates the affixation rules from the rules assigning meanings to the affixes, which allows concurrent blocking at both the morphological and semantic level.

Unlike the phonology and morphology of the *Aṣṭādhyāyī*, the syntax is strictly structure-building. There are no rules that replace words and no rules that delete them. Passive sentences are not derived from actives, and nominalizations are not derived from sentences. They are in fact generated in parallel by the same rules in a way which permits their structural parallelism to be captured to the fullest extent. Pāṇini does assume an extragrammatical process of ellipsis, by which words which are obvious from the context can be omitted. Although ellipsis is not a rule of grammar, Pāṇini has carefully considered its consequences for his grammatical system and explicitly taken account of them in several syntactic rules of his system. Not surprisingly since Sanskrit is a 'free word order language', the grammar says nothing about word order, even though in fact not every permutation of words in a sentence is equally felicitous and there do exist constraints.

Pāṇini accounts for sentence structure by a set of grammatical categories which allow syntactic relationship to be represented as identity at the appropriate level of abstraction. The pivotal syntactico-semantic categories which do this are roles assigned to nominal expressions in relation to a verbal root, called *kārakas*. A sentence is seen as a little drama played out by an Agent and a set of other actors, which may include Goal, Recipient, Instrument, Location, and Source. These roles are systematically related to semantic categories, but the correspondence is not one-to-one. One *kāraka* can correspond to several semantic relations and one semantic relation can correspond to several *kārakas*, in ways duly stated in the grammar. *Kārakas* in turn are the categories in terms of which the assignment of case and other morphological elements is formulated. They are essential to accounting for the active

and passive diatheses (including impersonal passives), for the syntax of finite verbs and nominals, for the use of the cases, and for the identification of the understood agent of infinitives and participles (control). The use of *kārakas* eliminates the need for deletion or of designated null elements as in many modern treatments of these constructions, and makes the category of 'subject' unnecessary.

The key principle is that every *kāraka* must be *expressed* (*abhihita*) by a morphological element, and none can be expressed by more than one. For example, the Agent can be expressed by the active endings and by Instrumental case, but because every role must be expressed exactly once, Instrumental case must mark the Agent if the verb is passive, and it cannot mark the Agent if the verb is active.

Another principle ensures that any given argument gets only one role. For example, in *dhanuṣā vidhyati* 'he pierces by means of a bow' (i.e. with arrows shot from a bow), *dhanuṣ* 'bow' satisfies both the definition of the instrument role (*karaṇa*) and the definition of the source role (*apādāna*), since it is both the 'means' for launching the arrows and the 'fixed point' from which the arrows move off, but in fact it only gets the former role, hence 'with', not 'from' a bow (instrumental case).

5   Phonology and phonetics

When morphemes and words are combined, they may undergo contextual phonological modifications. Many phonological rules have morphological conditions on their operation. Some are restricted to word-final position, some to a stem-suffix boundary, some to compounds. If such a condition is shared by several rules, they can be grouped together under a heading which supplies it for the lot. Other rules apply to specific morphemes, or to classes of morphemes, ranging from general classes such as roots to utterly idiosyncratic classes whose members must be listed or identified by markers. Those phonological rules which apply across the board, both inside and across words, appear in several blocks under the heading *saṃhitāyām* 'in close contact'. These are the *sandhi* rules proper.

Pāṇini's grammar does not define phonetic categories but presupposes them, nor does it deal with purely phonetic combinatory processes. This is assumed to be the province of *śikṣā*. According to this remarkably sophisticated theory of phonetics, resonance *(dhvani)* in the vocal tract is pro-

duced either by tone *(nāda)*, if the throat aperture is closed, or by noise *(śvāsa)*, if it is open; the results are respectively voicing *(ghoṣa)* and voicelessness (*aghoṣa*). Aspiration is considered to depend on the degree of air flow *(vāyu)*. High pitch *(udātta)* is ascribed to tenseness of the articulatory organs, resulting in constriction of the glottis *(kaṇṭhabila)*; low pitch *(anudātta)* to relaxation of articulatory effort with consequent widening of the glottis. Pāṇini's grammar makes important use of certain phonetic notions, such as *savarṇa* 'having the same oral articulation' (but possibly differing in length, nasality, and the laryngeal features of voicing, aspiration, and pitch). See PHONETICS, INDIAN.

Some grammatically relevant phonological categories cannot be defined purely by their phonetic properties. A number of special conventions specify terms for these, which can be used in rules in exactly the same way as designations of individual sounds or morphemes. Most importantly, the underlying segments of the language are enumerated and grouped into classes in the *akṣarasamāmnāya*, popularly called the *Śivasūtras*:

(7) 1.	a	i	u			Ṇ
2.				ṛ	ḷ	K
3.		e	o			Ṅ
4.		ai	au			C
5.	h	y	v	r		Ṭ
6.					l	Ṇ
7.	ñ	m	ṅ	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

The consonants at the end of each group (here capitalized for easy reference) are markers. Abbreviations *(pratyāhāras)* are defined on the *Śivasūtras* and other similarly organized lists in the following way. If a list contains the sequence of elements ... x_p, x_{p+1}, ... x_qQ..., where Q is a marker, then x_pQ

denotes the set x$_p$, x$_{p+1}$, ... x$_q$. (Similar lists and abbreviations are used to organize morphological paradigms). Some examples of *pratyāhāras* defined on the *Śivasūtras* by this procedure are:

(8) a. iK = i, u, ṛ, ḷ

     b. aC = a, i, u, ṛ, ḷ, e, o, ai, au

     c. yaṆ = y, v, r, l

     d. jhaL = obstruent

     e. haL = consonant

     f. aL = segment

Of the 292 *pratyāhāras* of two or more segments which can be formed from the *Śivasūtras*, 42 are used in the rules of the *Aṣṭādhyāyī*. The *Śivasūtras* form an indispensable part of the grammar, and the phonological classes defined by them are referred to in hundreds of rules. It is said that god Śiva revealed these fourteen classes of sounds to Pāṇini to get him started on the *Aṣṭādhyāyī*. The deeper point behind this legend is that the structure of the *Śivasūtras* is thoroughly intertwined with, and determined by, that of the *Aṣṭādhyāyī*. Indeed, if we did not have the text of the *Aṣṭādhyāyī*, but merely a pretheoretical description of Sanskrit phonology, the main properties of Pāṇini's grammar could be inferred just from the way the phonemes of Sanskrit are organized in the *Śivasūtras*. In particular, their structure is determined in large part by the requirement of economy. To be grouped together in a *pratyāhāra*, sounds must make up a continuous segment of the list. Economy requires the shortest possible list: no repetitions of sounds if possible, and 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 economy, *qua* brevity, determines both the ordering of sounds and the placement of markers among them (Staal 1962). In fact, together with the logic of the special case and the general case *(sāmānya/viśeṣa)*, it fixes the structure of the *Śivasūtras* completely (Kiparsky 1991).

As an example of how the classes so defined enter into phonological rules, we take the process which replaces *i, u, ṛ, ḷ* by their nonsyllabic counterparts *y, v, r, l* before a vowel. As the reader can verify from [7] and [8], this is the replacement of *iK* by *yaṆ* before *aC*. To get Pāṇini's formulation of the rule, we combine *ikaḥ* (genitive), *yaṇ* (nominative), and *aci* (locative), in accord with the schema in [1], and apply sandhi to the combination:

(9) 6.1.77 iko yaṇ aci

This rule replaces an entire *class* of vowels by the *class* of their nonsyllabic counterparts. The proper pairings $i \rightarrow y$, $u \rightarrow v$, $ṛ \rightarrow r$, $ḷ \rightarrow l$, (rather, than, for example, $i \rightarrow r$) are ensured by a further general condition: among alternative possible replacements, the *closest* must be chosen. The closest of the replacements which the rule allows are precisely y for i, v for u, r for $ṛ$, and l for $ḷ$, as desired.

6 Outlook

'One of the greatest monuments of human intelligence' (Bloomfield) is only beginning to claim its rightful position in linguistics. Many of its insights still remain to be recaptured, but those that are already understood constitute a major theoretical contribution. Its impact on generative grammar was felt first in phonology (the Elsewhere Condition, unmarked rule ordering), and more recently in syntax (linking theory). The rewards for the currently burgeoning study of morphology promise to be richer still.

15

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