Appendix A

The Systematic Approach

In this appendix I intend to work out the systematic approach followed by the ancillary disciplines associated with the Vedas.[1] In particular, I examine the Ṛgvedaprātiśākhya,[2] the Baudhāyanaśulbasūtra,[3] and the Aṣṭādhyāyī.[4] My emphasis is to look into the formal aspects of their basic techniques. The chief outcome is the certainty that they follow a common methodology. Further, it leads to the determination and specification of the details of this systematic approach. The results are of significance as they provide the basis for a formal perspective on the Aṣṭādhyāyī of Pāṇini.

In the following, I briefly mention a conceptual plan for the subsequent investigations, including the new terms introduced by me. I shall use `typewriter` font whenever I want to emphasize their terminological character. These terms are needed to formulate the details of the systematic approach. They reflect the common character of the content and processes of these disciplines, and are needed to avoid the imposition of specific terms from any particular tradition with their established denotations for the general concepts. Their introduction is all the more necessary as the present study aims to point out features spanning across several disciplines.

The starting point is the observation that the above mentioned texts aim towards retention of a given `phenomenon`. By a given phenomenon I

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[1] The ancillary disciplines or the Vedāṅgas (lit. limbs of the Vedas) are: *Śikṣā* (phonetics), *Chandas* (prosody), *Vyākaraṇa* (grammar), *Nirukta* (etymology), *Kalpa* (instructions on ritual practice) and *Jyotiṣa* (astronomy). See (Gonda 1975 p. 34). For a summary of the literature on phonetics and grammar, see (Scharfe 1977), on ritual practices (Gonda 1977) and for astronomy, see (Pingree 1981).

[2] For our study, I use the Ṛgvedaprātiśākhya with the commentary of Uvaṭa edited by Virendrakumar Varma (2007) and occasionally an earlier edition by Mangal Deva Shastri (1959).

[3] For the purpose of this study, I am primarily using the edition of S. N. Sen and A. K. Bag (1983).

[4] For editions of the Aṣṭādhyāyī used by me, see p. 145.

mean any existing linguistic or cultural practice established over a number of generations. It is something which one has received as the standard and would like to protect and pass on intact to the next generation, for example, the recitation of the Vedic *mantra*s.

In order to achieve the goal of retention, these texts follow a common systematic approach which consists of two interdependent and complementary processes. The first one is an analysis of a given `whole` into constituent `components` and fundamental `units`. The other one is synthesis through rule-based `combination` of components and units to regain the given whole.

A basic operation which is needed for these processes is `characterization` of components and units. This involves attaching `attributes` to them to impart an identity and/or associating some information which they subsequently bear. The operations of characterization and combination are executed once certain `conditions` are satisfied.

The apparent cyclical exercise of first analyzing and then synthesizing comprehends the given phenomena in a systematic manner. This gives rise to an interconnected `structure` of components and units together with the conditioned operations. Such structures have the tendency to last longer and are explained on the basis of the underlying `system`. Structures facilitate variations and change.

In the following, I intend to demonstrate this systematic approach by means of examples to determine its chief features.

A.1 Analysis and synthesis

To begin with, we examine how the above mentioned texts perform the complementary processes of analysis and synthesis for the sake of comprehension of a given phenomenon.

A.1.1 Syllables (*Akṣara*s)

The first example we take up is the process of analyzing a given utterance into constituent syllables. Consider the following *mantra* of the Ṛgveda :

तत्सवितुर्वरेण्यम् । (ṚV. 3.62.10).

It is the given `whole` which can be analyzed into `components`. The components in this case are syllables (*akṣara*s). The Ṛgvedaprātiśākhya provides rules for analysis of a given utterance into constituting syllables. These are given as follows:

1. Both the short as well as long vowels (*svara*s) form a syllable.[5]

2. The nasal sound (*anusvāra*) and consonants (*vyañjana*) are part of the syllable.[6]

3. The consonants that are in between two vowels are part of the latter vowel.[7]

4. The nasal sound and aspirated sound (*visarjanīya*) form part of the preceding vowel.[8]

5. The first phoneme of a consonant conjunct (*saṃyoga*) if in between two vowels, optionally forms a part of the first vowel.[9]

An application of the above rules yields the following analysis. The separations are shown by the *daṇḍa* (।) sign.

<p align="center">तत् । स । वि । तुर् । व । रे । ण्यम् ।</p>

It should be noted that the components are dependent upon the given whole and in this sense, do not have an independent existence. They have relevance only as long as they can be combined to form the original.

The results of analysis are not unique. This is because there are more than one possible options to dissect a given whole. Another variation of the above analysis could be:

<p align="center">त । त्स । वि । तु । र्व । रे । ण्यम् ।</p>

The process of synthesis in this case is simple. It consists of only one rule, that of uttering or placing the analyzed components one after another, without any pause or space in between, while following the original sequential order. Both the processes of analysis and synthesis are rule-based. The rules of analysis are mentioned explicitly while the rules for synthesis are understood implicitly.[10]

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[5] उभये त्वक्षराणि । (ṚVPr. 1.19).

[6] अनुस्वारो व्यञ्जनं चाक्षराङ्गम् । (ṚVPr. 1.22).

[7] स्वरान्तरे व्यञ्जनान्युत्तरस्य । (ṚVPr. 1.23).

[8] पूर्वस्यानुस्वारविसर्जनीयौ । (ṚVPr. 1.24).

[9] संयोगादिर्वा । (ṚVPr. 1.25).

[10] The rules to determine the syllables in the Vājasaneyiprātiśākhya are more detailed. Apart from the above mentioned cases, it also include instances when the consonants result from reduplication. For example, *pārśśvyam* (VS. 25.5) consists of *pārś* । *śvyam* where the first reduplicated consonant ś belongs to the former syllable and the second to the latter. See (VPr. 1.99-106).

A.1.2 The falcon shaped fire altar (*Śyenacit*)

We now consider an example from the Baudhāyanaśulbasūtra. The Śulba-sūtras were primarily meant for piling-up of the fire altar (*agnicayana*) and preparation of the sacrificial arena.[11] Accordingly, these are usually mentioned as part of the general instructions for performance of the Vedic rituals (*Śrautasūtras*).[12] The Baudhāyanaśulbasūtra describes the construction of the sacrificial ground (*mahāvedi*), provides for the distance, relative positions and shape of the pits for the three fires—the *gārhapatya*, the *āhavanīya* and the *dakṣiṇāgni* as well as various altars (*vedi*s), including piling-up of the bricks for fire altars (*citi*s).

Consider the *śyenacit* or the fire altar in the shape of falcon with curved wings and extended tails.[13]
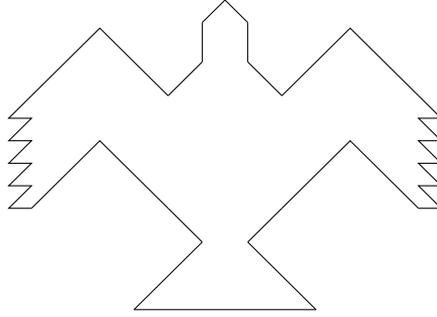

It is an altar having the above form and consisting of 1000 bricks piled in five layers, with 200 bricks in each layer. The entire area of the altar should be $7\frac{1}{2}$ times the area of a square with length equal to the height of the sacrificer (*yajamāna*).[14] From a systematic point of view, this *śyenacit* altar is the given `whole` which is to be retained. The Śulba-sūtra enunciates its `components`. The figure is first divided in four parts: the main core (*ātman*), the head (*śiras*), the tail (*puccha*) and the two wings (*pakṣa*).

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[11] On the terms *śulba* (or *śulva*) and Śulbasūtra see (Michaels 1978 p. 162-165). For an introduction to piling up of the fire altar (*agnicayana*), see (Michaels 1978 p. 36-43). Frits Staal (1983) provides a more detailed description of the ritual processes.

[12] There are Śulbasūtras ascribed to: Baudhāyana, Āpastamba, Vādhūla (belonging to the Taittirīyasaṃhitā of the Kṛṣṇayajurveda), Manu and Varāha (Maitrāyaṇīsaṃhitā of the Kṛṣṇayajurveda) as well as Kātyāyana (Vājasaneyisaṃhitā of the Śuklayajurveda). Their relative as well as absolute chronology is unclear (Michaels 1978 p. 51-57). Scholars, however, place them between 5th to 2nd century BCE, with Baudhāyanaśulbasūtra being one of the earliest (Pingree 1981 p. 4-5).

[13] This is mentioned in the tenth chapter (BŚuS. 10.1-20). Here I follow the number according to the edition by S. N. Sen and A. K. Bag (1983).

[14] See, for example, (BŚuS. 10.4-9).
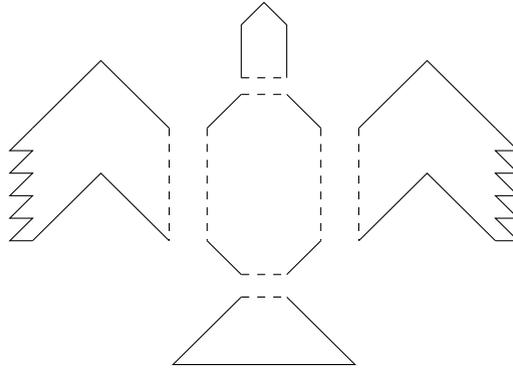
The analysis is not unique. It could have been analyzed into a different set of components. Moreover, the analyzed components are dependent upon the given whole and lack independent existence or usage in the sacrificial activities.

The analyzed components are further dissected into five different shapes of smaller components that correspond to the five types of bricks.
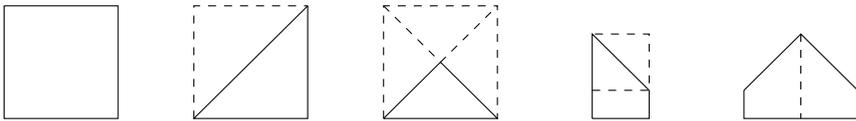
1. The first type (B1) are square bricks having the size of one-fourth of a *puruṣa*. They are therefore called *caturthī* bricks.

2. The second type (B2) are triangular bricks obtained by cutting the *caturthī* bricks (B1) along the diagonal. These are called *ardhā* bricks as they have half the area of the B1 square bricks.

3. The third type (B3) are again triangular bricks obtained by cutting B1 across the diagonals. These are termed *pādyā* bricks having one-quarter of the area of B1.

4. The fourth type (B4) are four-sided quarter bricks formed by adding an isosceles triangle of two equal sides with length 1 pada and the hypotenuse with length $\sqrt{2}$ pada combined with a rectangle with along the length having measurements of length 1 pada and breadth $1\frac{1}{2}$ pada.

5. The fifth type (B5) are bricks obtained by joining two B4 bricks along their longest side. Its shape is like the beak of a swan, hence it is called *haṃsamukhī*.

The components in this case are evident and are literally the building blocks of the given whole. The components depend upon the original. They do not have independent employment or usage in the sacrificial rituals. Further, the

components are also not unique. There can be a different set of components, constituting the same whole.

The second set of components, namely the *caturthī*-bricks etc. are parts of bigger components like the main core (*ātman*) or the head (*śiras*) etc. Although more granular than the first set, the components belonging to the second set are formally speaking not different from the first.[15]

The process of synthesis is rule based. The nature of rules is placing the components in a manner so that the original form is regained. These are specified, for example, in (BŚuS. 10.10-20).

A.1.3 Saṃhitā-pāṭha and Pada-pāṭha

The main function of Prātiśākhyas is to provide for the synthesis of continuous recitation (*saṃhitā-pāṭha*) from the word-for-word recitation (*pada-pāṭha*).[16]

An application of the process of analysis to the continuous recitations (*saṃhitā-pāṭha*)[17] of the *mantra*s of the Ṛgveda, yields individual *pada*s or words. Their sequential enunciation is called word-for-word recitation (*pada-pāṭha*).[18] The given whole in this case, therefore, is the continuous recitation of any *mantra* of the Ṛgveda and their analyzed elements i.e. the *pada*s are its `components`.

The task of analyzing a given continuous expression into individual *pada*s is largely a heuristic process and there are no rules following which

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[15] See below the discussion in sectionA.2.

[16] The name Prātiśākhya indicates that they correspond to a particular branch (*śākhā*) of the Veda. Among the available ones, the Ṛgvedaprātiśākhya (attributed to Śaunaka), Taittirīyaprātiśākhya, Vājasaneyiprātiśākhya and Ṛktantra are the most important. The chronology of these texts is not setteled.

[17] The definition of *saṃhitā* in Ṛgvedaprātiśākhya indicates the process of combining the components: पदान्तान्पदादिभिः संदधदेति यत् सा कालाव्यवायेन। (ṚVPr. 2.2). [*Saṃhitā* is that which combines the final parts of the *pada*s with the initial parts of the following ones, without the intermission of time.] On the other hand, the Vājasaneyiprātiśākhya does not use the components *pada*s but defines it on the basis of continuous recitation of the phonemes. वर्णानाम् एकप्राणयोगः संहिता। (VPr. 1.158). [*Saṃhitā* is the conjunction of phonemes uttered in one breath.]

[18] The collections are respectively called the Saṃhitā-pāṭha (1933) and the Pada-pāṭha (1947). Vājasaneyiprātiśākhya terms the analyzed position as *asaṃhita* in contradistinction to the combined state as *saṃhita*. पूर्वेणोत्तरः संहितः । पदविच्छेदोऽसंहितः । (VPr. 1.155-156). See (Varma 1987 p. 90-92).

the individual components can be identified.[19] Their recognition is possible as they are meaningful components that are used interchangeably in the recitations.[20] It is facilitated by the process of concurrent presence (*anvaya*) and concurrent absence (*vyatireka*).[21] As an example, we take the first *mantra* in the beginning of the Ṛgveda (1.1.1) and provide first the given whole and then its analyzed components:[22]

Saṃhitā-pāṭha (the given `whole`)
agnim īḷe purohitaṃ yajñasya devam ṛtvijam / hotāraṃ ratnadhātamam /

Pada-pāṭha (analyzed `components`)
agnim / īḷe / puraḥ'hitaṃ / yajñasya / devam / ṛtvijam / hotāram / ratna'dhātamam /

Prātiśākhya texts provide rules for combination of *pada*s in order to regain the continuous recitation or Saṃhitā-pāṭha. The question as to what comes first—whether Pada-pāṭha has its origins in Saṃhitā-pāṭha or *vice versa*—is discussed by the commentators. The assertion संहिता पदप्रकृतिः in (ṚVPr. 2.1) can be understood in two different ways: *saṃhitā* whose *prakṛti* (origin) is *pada* or *saṃhitā*, which is the *prakṛti* (origin) of *pada*. Commenting on this, Uvaṭa says that:

> *saṃhitā*, whose constituents are *pada*s, is here a modification of the constituting *pada*s. For example, the modifications *ṣatva* or *ṇatva* occur in *saṃhitā* only. Because they are the constituents, therefore, *pada*s are established original forms.[23]

Yāska in his Nirukta also states that "*saṃhitā* is the one having *pada*s as its constituent and all the branches of the Veda consider it to be so."[24] Commenting

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[19] There are, however, some exceptions, for example, the fifth chapter of the Vājasaneyiprātiśākhya which gives some rules to identify the *pada*s within the Saṃhitā-pāṭha. See (Varma 1987 p. 335-363).

[20] Vājasaneyiprātiśākhya defines a *pada* as that component, which is "capable of possessing an independent sense". अर्थः पदम्। (VPr. 3.2). Yāska in Nirukta mentions four kinds of *pada*s : nouns (*nāman*), verbs (*ākhyāta*), prepositions (*upasarga*) and indeclinables (*nipāta*). चत्वारि पदजातानि नामाख्याते चोपसर्गनिपाताश्च तानीमानि भवन्ति। (N. 1.1). K. V. Abhyankar provides a compendium on Pada-pāṭha and specifies *pada* (meaningful unit), their compact expression (*vṛtti*) and their types, *vigraha* or analysis of the conjoined expressions, resulting nodes or breaks (*parvan*), stops (*avagraha*), accentuation (*svara*) and other special features of Pada-pāṭha in (Abhyankar 1974).

[21] On this process, see (Cardona 1967a p. 313-352).

[22] The transliteration I use is the one generally adopted in western scholarship. I have not added accent marks here. George Cardona (1997 p. li-lxiv) discusses the different transliteration issues. Peter M. Scharf and Malcom D. Hyman (2012) provide a detailed study of various issues involved in encoding Sanskrit in computers.

[23] पदानि प्रकृतिभूतानि यस्याः संहितायाः सा पदप्रकृतिः संहितात्र विकारः। तथा हि षत्वणत्वादयो विकाराः संहिताया एव भवन्ति। प्रकृतिभूतत्वाच्च पदानां सिद्धत्वम्। Uvaṭa on (ṚVPr. 2.1).

[24] पदप्रकृतिः संहिता। पदप्रकृतीनि सर्वचरणानां पार्षदानि। (N. 1.17).

upon this, Durgācārya takes up the question in a detailed manner and puts forward two possible cases:

1. "That, which is the cause of *pada*s, that (*saṃhitā*) is *pada-prakṛti*. Why? Because *pada*s are formed out of *saṃhitā*. Therefore, some consider *saṃhitā* to be the original form (*prakṛti*) and *pada*s to be their modifications (*vikāra*)."[25]

2. "Others, however, understand the statement *padaprakṛtiḥ saṃhitā* to be *saṃhitā*, whose cause are the *pada*s. Why? Because *saṃhitā* is gained out of the combinations of *pada*s only. Therefore, *pada*s are the original form and *saṃhitā* is their modification."[26]

He further raises the question, which option is better: to consider *pada*s to be the original form and the *saṃhitā* to be their modification or *vice versa* and decides for the latter giving several justifications based on the earlier usage of Saṃhitā-pāṭha.[27] It follows that the Prātiśākhya texts perform the task of analysis of *saṃhitā-pāṭha* into *pada-pāṭha* and then provide a rule based process to combine the *pada*s to regain the *saṃhitā-pāṭha*.

To sum up, we can identify the processes of analysis of a given whole into its components, and complementary to it the synthesis from components to the given whole in the examples taken from different texts. In particular we noticed the following instances:

1. Sanskrit expression into syllables (*akṣara*) : The example from the Prātiśākhya shows that both the process of analysis of a Sanskrit utterance into syllables as well as the reverse process of synthesis are rule based.

2. In case of a ritual formation like the *śyenacit* the process of analysis into components like the *caturthī* bricks is teleological. The reverse process of synthesis on the other hand is rule based.

3. The analysis of *saṃhitā-pāṭha* into the *pada-pāṭha* is again teleological, while synthesis is rule based.

4. The process of analysis of Sanskrit expressions into components like the roots (*prakṛti*) and suffixes (*pratyaya*) is again teleological, while synthesis is rule based.

We now look into the constituents that are gained by further analyzing the components.

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[25] पदानां या प्रकृतिः सेयं पदप्रकृतिः । किं कारणम्? संहितातो हि पदानि प्रक्रियन्ते । तस्मात्संहितैव प्रकृतिर्विकारः पदानीत्येवमेके मन्यन्ते। Durgācārya on (N. 1.17).

[26] अपरे पुनः पदप्रकृतिः संहितेति पदानि प्रकृतिर्यस्याः सेयं पदप्रकृतिरिति। किं कारणम्? पदान्येव हि संहन्यमानानि संहिता भवति। तस्मात् पदान्येव हि प्रकृतिर्विकारः संहितेति। Durgācārya on (N. 1.17).

[27] आह। किं पुनरत्र साधीयः पदानां प्रकृतित्वं संहिताया विकारत्वमुत वा विकारत्वं पदानां प्रकृतित्वं संहिताया इति? उच्यते संहितायाः प्रकृतित्वं ज्यायः। आह। किं कारणम्? उच्यते। मन्त्रो ह्यभिव्यज्यमानः पूर्वमृषेमर्न्त्रदृशः संहितयैवाभिव्यज्यते न पदैः। Durgācārya on (N. 1.17).

A.2 Components and units

The process of analysis is carried further in the case of linguistic as well as geometrical components. The `components` are further sub-divided into fundamental `units`.

The linguistic components are analyzed into the basic sound units or the phonemes. For example,
Components: *tat / sa / vi / tur / va / re / ṇyam /*
Units: *t / a / t / s / a / v / i / t / u / r / v / a / r / e / ṇ / y / a / m /*

As in the case of components, the units are dependent upon the given phenomena. For example, the set of phonemes is dependent upon the type of sounds comprising a particular language. For some other language, this set may be different.[28] But, unlike the components, units are *unique* and *fundamental*. Uniqueness implies that there cannot be two different sets of units corresponding to the same phenomenon. And fundamental means that they can not be analyzed further.

The geometrical components are also further dissected into more basic units, namely points and lines. For example, the *pādyā* brick is analyzed as follows:

The set of units in this case would consist of *point*, *line*, *surface* etc. It should be noted, that as in the case of phonemes where, for example an element of the set represents a *type* that can have several instances, having different length and accents, similarly here, the elements stand for the fundamental *types* which may have different length or area etc. Thus, in this case as well, the set of units is fundamental and unique.

We have identified two different categories of constituents of a given `phenomena`.

1. The first category is what we name as `components`. Examples are *pada*, *prakṛti*, *pratyaya*, *akṣara*, *śiras*, *puccha*, *caturthī*-bricks.

2. The second category is what we define as the `units`. The examples of units are phonemes for linguistic-components and lines and points for geometrical-components.

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[28] For example, certain sounds like *ḻh*, jihvāmūlīya, upadhmānīya are a part of the Vedic expressions but not of classical Sanskrit.

To elucidate the difference between the components and units, we note that the units are fundamental constituents that cannot be divided further. What is meant here is that if one were to analyze them further, the same type would result. They are physical entities with some audible / visible form. In the case of linguistic units, the form would be the sound which one hears, and for geometrical units it is the visible shape. Further, we stipulate that a unit is characterized *only* through its form. In order to specify this, we need first to look into the process of characterization of units. Characterization in general is the process of identifying any object on the basis of certain features that help in differentiating it from dissimilar objects, and relating it with similar ones. The characteristics which identify units are related to their physical form. We call them `features`.

Let us look into the definitions in the Ṛgvedaprātiśākhya where the fundamental units are defined. These units, in the case of linguistic phenomena are the phonemes. The manner in which the characterizing features are assigned to them is by direct specification of the type: "the phoneme *x* has the feature *f*". If more than one phoneme shares the same feature then they are referred to collectively. In order to refer to them, a list is provided at the beginning. The rules of the Ṛgvedaprātiśākhya refer to such a list. As an example, consider the very first rule: *aṣṭau samānākṣarāṇyāditaḥ* (ṚVPr. 1.1) [Eight are samānākṣara in the beginning]. This statement attaches the feature samānākṣara (monopthongs) to the phonemes: { a, ā, ṛ, ṝ, i, ī, u, ū }. Here, the relevant phonemes are put in a group. The name of the group is then the feature which is attached to the individual unit belonging to that set. In a similar manner, other features like *sandhyakṣara* (dipthongs), *svara* (vowels), *vyañjana* (consonants), *sparśa*, *varga* (the five groups of five each), *antaḥsthā* (semi-vowels), *ūṣman* (spirants), *aghoṣa* (sonant, voiceless), *soṣman* (aspirates), *kaṇthya* (velar) etc. are assigned to the respective phonemes.[29]

Here, one must note the difference between *definition* of some sound and its *specification* within some linguistic expression. Consider the example of nasal sound (anunāsika). It is defined in that it is uttered in the list of sounds and later named or referred to as anunāsika.[30] In the Aṣṭādhyāyī, this defining characteristic about its phonetic form is mentioned as that utterance which is spoken simultaneously with mouth and nose.[31] Its specification, on the other hand, is the determination that in a particular expression, some specific sound happens to be anunāsika.

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[29] See (ṚVPr. 1.1-18).

[30] अनुनासिकोऽन्त्यः (ṚVPr. 1.14) [The last phoneme of each of the 5 groups is anunāsika].

[31] मुखनासिकावचनोऽनुनासिकः ॥१.१.८॥ ▶ from mouth and nose uttered sound is anunāsika.

A.2.1 Characterization

Let us now look at the characterization of components. A component is composed out of one or more units. In the case of linguistic components, this combination is a sequential concatenation of the individual sound units. Characterization of its physical/phonetic `form`, therefore, is in terms of the features of the constituent units. There are, however, other characteristics that are assigned to components. We call them `attributes` in order to distinguish them from the `features`. While features correspond only to those properties that refer to the physical form of a unit, attributes refer to the following additional aspects.

There are attributes whose assignment involves conditions which depend upon the distribution of phonemes within an expression. One such attribute is *guru* (heavy syllable). Apart from syllables having *dīrgha* (long) vowel, the other ones, namely the one having *hrasva* (short) vowel, are also *guru* if *saṃyoga* (consonant cluster) or *anusvāra* (nasal sound) follows.[32] There are attributes which depend upon the distribution of components, for example, the term *aṅga* which is attached to that part which is before the suffix for which some operation is specified.[33] The most common condition for attributes, however, is on the basis of their belonging to a particular set. For example, the group of suffixes (k)ta and (k)tavat(u) are called *niṣṭhā*.[34]

The question that may be asked here is, why do we need these attributes? One requires attributes to formulate the rules of synthesis. It is very common that commentators mention the instances of rules where the attributes are used. For example, in the very first rule of the Ṛgvedaprātiśākhya, the purpose of coining the attribute *samānākṣara* is mentioned to be its use in formulation of a subsequent rule.[35] Thus, the main justification for specifying an attribute is its use in the formulation of the `system`. We would not need attributes if we do not want to formulate our rules in terms of them. Attributes, therefore, contain and represent grammatical information. They encode information which originates from the system.

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[32] गुरूणि दीर्घाणि। तथेतरेषां संयोगानुस्वारपराणि यानि। (ṚVPr. 1.20-21).

[33] यस्मात्प्रत्ययविधिस्तदादि प्रत्ययेऽङ्गम् ॥१.४.१३॥ ► that part which enjoins a pratyaya based operation, before that the sequence is aṅga.

[34] क्तक्तवतू निष्ठा ॥१.१.२६॥ ► (k)ta and (k)tavat(u) are niṣṭhā.

[35] समानाक्षरसंज्ञायाः प्रयोजनं समानाक्षरे सस्थाने इति। Uvaṭa on (ṚVPr. 1.1). The purpose of the term *samānākṣara* is its use in the rule समानाक्षरे सस्थाने (ṚVPr. 2.15).

A.2.2 Combination of units and components

In section A.1 we noted that the components are combined in a rule based manner which results in the synthesis of the original given whole. Thus, the syllables are combined to form the original linguistic expression. The *pada*s of the Pada-pāṭha are combined following the rules of the corresponding Prātiśākhya to regain the original Saṃhitā-pāṭha. The bricks of the *śyenacit* like the *caturthī*, *ardhā*, *pādyā* etc. are combined to form the head (*śiras*), the main core (*ātman*) etc. which again are combined to form the original *śyenacit*. The components like roots (*prakṛti*) and suffixes (*pratyaya*) are combined to form expressions of standard speech.

A.2.3 Constructs

Next we consider combinations of units in order to form components. At this stage, we need to determine an important category of elements, which we term as the `constructs`. In order to introduce the basic idea about constructs, let us first consider an example from the Śulbasūtra. We have seen that a given phenomenon, like the *śyenacit*, is analyzed into components like head (*śiras*) and the main core (*ātman*), which are further dissected into components like the *caturthī*-bricks. Further, there are fundamental units, that are gained by analyzing the components. The question which can now be asked is: what can be constructed by combining the fundamental units in a rule based manner? As will soon become clear, we need to introduce a new category to represent the results of application of a rule-based procedure of combinations of the fundamental units. We call them `constructs`. For example, if we apply the rules mentioned in (BŚuS. 1.3-4) then we can form a square (*caturasra*).

The difference between a `component` and a `construct` is that while the former is a tangible part of the given `phenomenon`, the latter is an abstraction of it resulting out of rule-based combinations of the `units`. The passage from the square-shaped *caturthī*-bricks to the concept of square, and consequently supplying rules for its formation is the significant step, which according to Axel Michaels (1978 p. 17-20), indicates the origin of the science of geometry. In our case, constructs represent not only the concept of a square, but equally important is the condition that they are *constructed* out of rule-based combinations of the fundamental units. Hence the choice of the term. It needs to be clarified here, that the constructs are also tangible and physical entities and represent the generalized concept of that entity and not its instantiation in the world of phenomena.

Another example is construction of syllables from the set of phonemes. The rules mentioned on page 132 specify this. Here again, syllables represent the conceptual constructs that are generated through rule-based combinations of phonemes. It should be noted that not all the syllables that can be theoretically constructed are instantiated as actual syllables belonging to some linguistic expression (*akṣara*s). Further, syllables as constructs are also physical entities. Syllables as components, however, are constituents of a given linguistic expression. A phoneme sequence like *bmha*, although a syllabic construct, is not a syllabic component of the Sanskrit language.[36]

`Constructs` are abstractions of the `components` that are generated through a rule-based combination of `units`. Those constructs that are also constituents of a given phenomenon are instantiated as components of that phenomenon. This distinction between the `constructs` and `components`, as we shall see, is important to differentiate between the process of synthesis and the possibilities for formalization.

A.3 Structures, variations and change

The application of the systematic approach on a set of phenomena results in the evolution of a comprehending `structure`. The nature of such a structure is an interconnected network of components on the basis of their characteristics. The rules of synthesis specify this network or interconnection.

Thus, the rules of the Prātiśākhyas provide for the possible connections and combinations of the components (i.e. the *pada*s) and the units (or the phonemes). Similarly, the rules of the Śulbasūtras specify the combinations of the components like the *caturthī* bricks as well as units or lines and points. In the case of grammar, again the rules provide for the interconnections of the components, i.e. which component can be combined with which other.

The systematic approach of analysis and synthesis not only provides a mechanism to retain a given phenomenon, but also facilitates the recording of variations and brings about change. There are two ways in which variation is comprehended. Firstly, while formulating the rules, provision for alternatives is provided. Pāṇini, for example, uses the expressions *anyatarasyām*, *vibhāṣā* and *vā* to accommodate the variations (Kiparsky 1980). Secondly, there are additional conditions which specify the varying contexts. In the case of the Aṣṭādhyāyī, some of these contextual variations are those corresponding to

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[36] Ulrich Stiehl provides a list of attested syllabic components. See `http://www.sanskritweb.de/` (accessed on 09.07.2012).

the usage in the Vedic literature[37] or geographical[38] or even the opinions of
others[39].

The existence of a system brings about consolidation of change by in-
corporating the *new* or not yet comprehended phenomena within the
descriptive structure. This is facilitated because the new phenomena partially
contains components that are already collected in the structure and partially
extra fresh components are to be conceived. Changes can thus be integrated
by minor adjustments in the structure.

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[37] E.g. विभाषा छन्दसि ॥१.२.३६॥ ▶ In recitation of Veda (*chandas*), ekaśruti is optional (vibhāṣā).

[38] E.g. एङ् प्राचां देशे ॥१.१.७५॥ ▶ eṅ in case of expressions referring to the eastern region.

[39] E.g. संबुद्धौ शाकल्यस्येतावनार्षे ॥१.१.१६॥ ▶ according to Śākalya o(t) is termed pragṛhya if it is
sambuddhi and when iti that is not Vedic (*ārṣa*) follows.