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EXOCENTRIC (BAHUVRĪHI) COMPOUNDS IN CLASSICAL SANSKRIT

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1 Introduction

Constituency grammars originated with Leonard Bloomfield (1933) and were developed during the nineteen forties and nineteen fifties by a number of American structuralist linguists, including Harris (1946) and Wells (1947) — to mention just two. In the late nineteen fifties, Chomsky (1957) suggested that constituency grammars could be formalized as context free grammars. It is now clear that context free grammars fall short of properly formalizing the constituency grammars of the American Structuralists (Manaster-Ramer and Kac 1990). Indeed, in the nineteen sixties, Chomsky himself formalized a number of other important aspects of constituency grammars, introducing more complexity to the labels, both terminal and non-terminal, and permitting the use of null elements.

Though constituency grammars were initially conceived of as applying to phrases, work in the nineteen eighties (Di Sciullo and Williams 1987; Selkirk 1982; Williams 1981) showed that such rules could be used to analyze profitably compounds and derivational morphology of English. Gillon (1995) showed that the same analysis extended to the analysis of compounds and derivational morphology in Classical Sanskrit.

The aim of this paper is to look more carefully at the application of constituency rules to the analysis of exocentric (*bahuvrīhi*) compounds. In particular, using a conjecture by Bhartṛhari pertaining to non-constituent (*a-samārtha*) compounds, I wish to show that both Sanskrit non-constituent (*a-samārtha*) compounds and Sanskrit exocentric (*bahuvrīhi*) compounds can be analyzed in terms of constituency grammar, suitably augmented with argument frames, a generalization of subcategorization frames. Argument frames, as I shall show, play a key role in providing a satisfactory analysis of both kinds of compounds.

if it modifies a noun in the nominative, singular, neuter, say *patram* (*blade*), then it has the form *tīkṣṇam*. Now consider the compound *dīrgha-kaṇṭha*. If it is to be construed with a masculine, singular noun in the nominative case, say *puruṣaḥ* (*man*), to yield the sense *long-necked man*, then the compound must have the nominative, masculine, singular form, namely, *dīrgha-kaṇṭhaḥ*. If it is to be construed with a feminine, nominative, singular noun, say *strī* (*woman*), to yield the sense *long-necked woman*, then the compound must have the feminine, nominative, singular form, *dīrgha-kaṇṭhā*. And finally, if it is to be construed with a neuter, nominative, singular noun, say *mitram* (*friend*), to yield the sense *long-necked friend*, then the compound must have the neuter, nominative, singular form, *dīrgha-kaṇṭham*.

Next, adjectives in Sanskrit can be turned into abstract nouns by the affixation of the suffix *-tva* (*-ness*): for example, the adjective *kṛśa* (*thin*) may be converted into the abstract noun, *kṛśa-tva* (*thin-ness*). Exocentric *bahuvrīhi* compounds are susceptible of the same conversion: for example, *dīrgha-kaṇṭha* (*long-neck-ed*; cf., *level-head-ed*) be turned into *dīrgha-kaṇṭha-tva* (*long-neck-ed-ness*; cf., *level-head-ed-ness*).

Moreover, just as an adjective such as *kṛśaḥ* (*thin*) can function, as its English translation can, as a common noun, meaning the same thing as its English nominal counterpart, *the thin*, so too should an exocentric (*bahuvrīhi*) compound be liable to function as a common noun. And this too is true, as observed by Speijer (1886, §222, fn. 1) and as exemplified by following compound and its commentarial gloss.

(2.1) NBT 48.4
(vyutpanna-ṣaṅketasya)

(2.2) NBTP 49.1-2
vyutpannaḥ jñātaḥ saṅketāḥ yena saḥ
arisen known convention by whom he
One by whom the conventions of language are known
(*jñāta* (*known*) glosses *vyutpanna* (*arisen*).)

There is independent confirmation that homo-denotative exocentric (*sa-māna-adhikaraṇa-bahuvrīhi*) compounds are best treated as descriptive (*kar-madhāraya*) compounds to which a phonetically null, possessive, adjectival suffix (symbolized hence forth with 'B') is affixed. Sanskrit has a phonet-

ically overt, possessive, adjectival suffix *-ka* which is virtually synonymous with the phonetically null one just hypothesized. Though their distributions are somewhat different (A 5.4.151 ff.), nonetheless, they overlap to such an extent that commentators to a text in which an exocentric (*bahuvrīhi*) compound occurs frequently repeat the compound, adding the *-ka* suffix to signal the fact that the compound in question is to be construed, not as a descriptive (*karmadhāraya*) compound, but as an exocentric (*bahuvrīhi*) compound (Boose and Tubb 1981, ch. 5, sec. 15).

English too has homo-denotative exocentric compounds. By and large, they are marked by the adjectival, possessive suffix, *-ed*. These English compounds, exemplified by such compounds as *longlegged*, *literal-minded*, and *two-footed*, have a distribution narrower than that of its counterpart in Sanskrit — a fact which will be dilated on below.

Not every English homo-denotative exocentric compound has the *-ed* suffix. In particular, English homo-denotative exocentric compounds which serve as proper names or epithets seem to require a phonetically null counterpart to the *-ed* suffix.² Examples of proper names are particularly common in children’s stories. For example, in the children’s movie, *Land Before Time*, the two dinosaurs which are the main characters are named, *big foot* and *long neck*, instead of *big-footed* and *long-necked*. Examples of epithets are such compounds as *red-head*, *dim-wit*, *hard-back*, etc., to which there correspond *red-headed*, *dim-witted*, *hard-backed*, and so forth. (See Marchand 1969, ch. 2, sec. 18 for other examples.) Moreover, it seems that the *-ed* suffix and its phonetically null counterpart are in free variation in exocentric compounds which are initial constituents in larger compounds: *long-necked bottle plant* and *long neck bottle plant* both denote plants for bottles whose necks are long.

Another parallel between English and Sanskrit homo-denotative exocentric (*samāna-adhikaraṇa-bahuvrīhi*) compounds is the predication relation in the canonical paraphrase may be metaphorical, instead of literal. Thus, in the compounds *candra-mukha* (*moon-faced*), *sthūla-caraṇa* (*club-footed*), and *ayo-muṣṭi* (*iron-fisted*), a face (*mukha*) is likened unto a moon (*candra*), a foot (*caraṇa*) unto a club (*sthūla*), and a fist (*muṣṭi*) unto iron (*ayas*).

²It is interesting to note in this connection that the Sanskrit suffix *-ka*, used to mark phonetically a *bahuvrīhi* compound, is said by Pāṇini (A 5.4.155) to be prohibited from affixation to *bahuvrīhi* compounds which serve as names.

As noted by Di Sciullo and Williams (1987, p. 30), in English, constituents outside of a compound cannot be construed with constituents subordinate within a compound. This generalization is undoubtedly true of English compound formation, as illustrated by the contrast in the interpretability of the expressions in (3).

- (3.1) ((man <eating) <shark)
 (3.2) *(eating <shark) of men

Interestingly, this generalization was presupposed as true of Sanskrit by Pāṇini. His treatment of compounds is to pair them with canonical phrasal paraphrases with which they share a common derivational ancestor; in addition to their semantic relation, they bear the syntactic relations of having the same heads and of having the same constituency. Hence, the constituency of compounds mirrors that of their canonical phrasal paraphrases. A condition on compound formation is that two elements cannot undergo compounding, the deletion of morphology from the subordinate element, unless the two elements form a constituent (A 2.1.4). A consequence of this is that inflected lexical items exterior to a compound are not construable with subordinate constituents within it. The applicability of this rule is illustrated both by Patañjali, in his *Mahābhāṣya*, or *Great Commentary*, on Pāṇini's *Aṣṭādhyāyī* (at A 2.1.1), and by Bharṭṛhari, in his work on the semantics of Sanskrit (VP 3.14.46), with the following example:

- (4.1) [_{NP₁} ((ṛddha <rāja) <puruṣaḥ)]
 rich king man
 servant of a rich king
 (4.2) * [_{NP₁} [_{AP₆} ṛddhasya] (rāja <puruṣaḥ)]
 of rich king-man
 servant of a rich king

Thus, the expression in (4.1) is acceptable, whereas the one in (4.2) is not, as signalled by the asterisk.

Though the generalization holds of English compounds, it does not of Sanskrit compounds. Counter-examples are furnished both by Patañjali (MBh on A 2.1.1) and by Bharṭṛhari (VP 3.14.47):

- (5.1) [_{NP₆} [_{NP₆} Devadattasya] guroḥ] kulam
of Devadatta of teacher family
- (5.2) (Devadatta- \leftarrow guru)- \leftarrow kulam
Devadatta-teacher-family
- (5.3) [_{NP₆} Devadattasya] (guru- \leftarrow kulam)
of Devadatta teacher-family
Devadatta's teacher's family

Indeed, compounds appearing in configurations such as that in (5.3) are given a special name by Sanskrit grammarians: they call them *a-samartha* compounds (i.e., non-constituent compounds). Moreover, these compounds are well attested in the classical literature. A study of over three-hundred sentences, chosen essentially at random from the Sanskrit corpus, reveals thirteen clear cases of non-constituent (*a-samartha*) compounds. (See Appendix I in Gillon 1993.) And a study of the first approximately five-hundred sentences of a single text reveals forty-three clear cases. (See Appendix II in Gillon 1993.)³

Thus, for example, in the best known play by the finest dramatist of Sanskrit literature, Kalidāsa's *Śakuntalā*, one finds precisely these configurations.

- (6) Ś 3.9.16 (= SG 3.1.6)
[_{NP₁} [_{NP₃} [_{NP₇} tasyām] (snigdha- \leftarrow dr̥ṣṭyā)]
on her fixed-gaze
(sūcita- \leftarrow abhilāṣaḥ)-B]
indicated-affection-ed
.. whose affection was indicated by his gaze being fixed on her

Here, the past passive participle, *sūcita* (*indicated*), which is a subordinate constituent within the exocentric (*bahuvrīhi*) compound *sūcita- \leftarrow abhilāṣaḥ* (**indicated-affectioned: whose affection was indicated*), is construed with the third, or instrumental, case noun phrase *tasyām snigdha- \leftarrow dr̥ṣṭyā* (*by his gaze being fixed on her*). Moreover, this noun phrase itself exhibits a non-constituent (*a-samartha*) compound, for the past passive participle, *snigdha*

³To put these frequencies in perspective, I should point out that non-constituent (*a-samartha*) compounds occurred more frequently in each corpus taken separately or jointly than either indirect questions or relative clauses.

(*fixed*) is found as a subordinate constituent in the compound *snigdha-dr̥ṣṭyā* (*by fixed-gaze: by his gaze being fixed*), yet it is construed with *tasyām* (*on her*), a seventh, or locative, case noun phrase, for which the verb *snih* (*to fix*) subcategorizes.

One person to attempt to meet the challenge presented by these compounds to Pāṇini's grammar of Sanskrit was Bhartṛhari, who suggested that non-constituent (*a-samartha*) compounds are limited to cases where the subordinate constituent in the compound expresses a relation. Bhartṛhari's insight is a deep one. The remainder of this paper is devoted to showing how this insight might be captured within constituency grammars and then applied to not only non-constituent compounds but also to exocentric ones. The main concept is that of an argument frame, or an enriched subcategorization frame.

An argument frame has its classical quantificational logic. In elementary model theory, the set of predicates is partitioned into cells of the same degree, or adicity. The set of predicates are partitioned into the family of sets, one of which comprises all the one-place predicates, another all the two-place predicates, etc. This partitioning of the predicates has two effects. On the one hand, it helps to determine which string of symbols is a well-formed formula and which is not; on the other hand, it determines what kinds of values can be assigned to it. Thus, if one is told that P is a two place predicate and that a , b and c are terms, then one knows that Pab is a formula and that neither Pa nor $Pcba$ is. At the same time, one knows that P is to be assigned a set of ordered pairs in the model.

A similar effect can be achieved with a slight enrichment of subcategorization frames. Subcategorization frames were introduced into constituency grammar by Chomsky (1965 ch. 2.3.4; 2.4). They greatly simplified the constituency rules by having individual lexical items specify their complements. Subcategorization frames effectively formalized and generalized the lexicographical practice of distinguishing between transitive and intransitive verbs. Because the subcategorization frame of a word is silent about those constituents which are not its complements, the subcategorization frame of a verb does not specify that it has an argument corresponding to the subject of the clause in which it might occur. Argument frames will have this specification. As a result, argument frames will fulfill the same functions in constituency grammar which predicate adicity fulfills in classical quan-

tificational logic. It specifies the arguments associated with the word and it constrains the value assigned to it in a model to those relations with a corresponding arity, or degree of the relation. For example, a verb such as *to die*, which is intransitive, and thereby corresponding to a monadic predicate of classical quantification logic, takes only one argument and is assigned a unary relation (a subset of the model's domain), while a verb such as *to admire*, which is transitive, and thereby corresponding to a dyadic predicate, takes two arguments and is assigned a binary relation (a set of ordered pairs of members of the model's domain). Such a specification accounts for the contrasts in acceptability of the sentences given below.

- (7.1) Bill died.
- (7.2) *Bill died Fred.
- (8.1) *Mary admires.
- (8.2) Mary admires Bill.

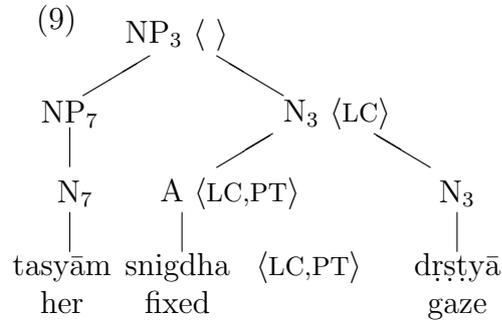
Moreover, just as each predicate of a given adicity is interpreted by a relation of a corresponding arity, so each relational word is interpreted by a relation of a corresponding arity. It is crucial that this correspondance be properly established. To see why, consider this example from model theory. Let R be a binary predicate and let a and b be individual constants. Let M be a model whose domain is $\{1, 2, 3\}$ and whose interpretation function i assigns 1 to a , 2 to b and the set of ordered pairs $\{\langle 1, 2 \rangle, \langle 2, 3 \rangle, \langle 3, 1 \rangle\}$ to R . The clause of the truth definition of an atomic formula guarantees the following: Rab is true if and only if $\langle i(a), i(b) \rangle \in i(R)$. It is crucial that the order of appearance of the individual constants a and b in the formula Rab be correlated with the ordered pair $\langle i(a), i(b) \rangle$, not with the ordered pair $\langle i(b), i(a) \rangle$. As the reader can easily verify, the ordered pair $\langle i(a), i(b) \rangle$ is a member of $i(R)$, but not the ordered pair $\langle i(b), i(a) \rangle$.

The situation in natural language is, of course, much more complex than the situation in logical notation. To begin with, a syntactic structure of even a simple clause is much more complex than that of an atomic formula, the formation of the latter being simply a matter of concatenation. In addition, many argument positions have associated with them values, called *valences* or *thematic roles*. Indeed, these valences are at the heart of Pāṇini's grammar, the *Aṣṭādhyāyī*, where they are known as *kāraka*, or *factors*. Typical valences include those recognized by Pāṇini: *agent*, *patient*, *beneficiary*, *source* and

location. Valences are confined to verbs and to nouns and adjectives derived from verbs. They are not associated with the arguments of underived relational nouns (for example, *friend*, *cousin*, *neighbor*, *colleague*) or with underived relational adjectives (for example, *equivalent*, *opposite*, *proud*, *domestic* and *local*). For the sake of simplifying the discussion, I shall avail myself of the terminology of valences to index the argument positions relevant to the exposition of the examples in the treatment below.

Following Bhartrhari’s conjecture, I shall assume that non-constituent (*a-samartha*) compounds appear when the subordinate constituent in the compound has an argument which is construed with an inflected lexical item external to the compound. A survey of the cases mentioned above, as culled from the classical literature, shows that such is the case. Indeed, for the most part, the subordinate constituent is a deverbal noun or adjective, requiring an NP complement and often associating with it a particular valence.

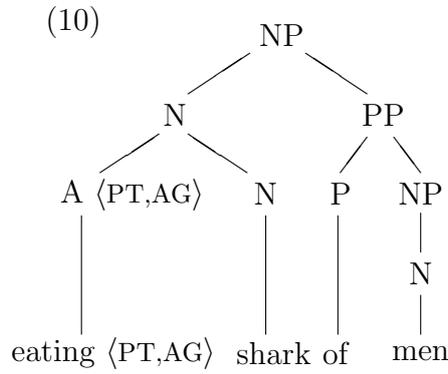
Let us consider the case of a non-constituent compound *snigdha-dṛṣṭyā*, cited above. Recall that it is preceded by the pronoun *tasyām*, which is construed with the word *snigdha*, itself subordinate to *dṛṣṭyā*. The past passive participle *snigdha* has two arguments, one of which must appear in the seventh case.



(where PT denotes *patient* and LC denotes *location*). The idea is that the argument frames are passed, as it were, up the tree. It is the *location* argument which is passed up to the top node of the tree for the compound.⁴

⁴This compound is also an exocentric compound. This aspect of the compound is not being addressed here.

This contrasts with the situation in English. Sanskrit, as we just saw, permits unsaturated arguments associated with a non-head to be transmitted to the mother node, while English prohibits non-heads from having unsaturated arguments. Thus, for example, an expression such as (3.2) is prohibited in English. The reason is that, although one of the arguments associated with *eating*, namely the one whose valence is *agent* is saturated by the noun *shark*, the other argument associated with *eating*, namely the one whose valence is *patient* is not.⁵



This treatment of non-constituent (*a-samartha*) compounds extends to exocentric (*bahuvrīhi*) compounds. Let us consider the following exocentric (*bahuvrīhi*) compounds in Sanskrit:

- (11.1) SK 830
 Compound: prāptātithiḥ grāmaḥ
 Analysis: (prāpta-←atithiḥ)-B grāmaḥ
 reached-guest-ed village
 Paraphrase [_{RC} atithayaḥ prāptāḥ yam]
 guest reached which
 saḥ prāptātithiḥ grāmaḥ
 that village
 the village which guests have reached

⁵Evidence that the argument with the valence of PATIENT is relevant comes from the acceptability of (3.1), namely *man-eating shark*.

(11.2) SK 830
 Compound: ūḍharathaḥ anaḍvān
 Analysis: (ūḍha-ṛathaḥ)-B anaḍvān
 drawn-cart-ed bull
 Paraphrase: [_{RC} rathaḥ ūḍhaḥ yena]
 cart drawn by which
 saḥ ūḍharathaḥ anaḍvān
 that bull
 the bull by which a cart is drawn

(11.3) SK 830
 Compound: upahr̥tapaśuḥ puruśaḥ
 Analysis: (upahr̥ta-ṛpaśuḥ)-B puruśaḥ
 offered-cattle-ed man
 Paraphrase: [_{RC} paśuḥ upahr̥taḥ yasmai]
 cattle offered to whom
 saḥ upahr̥ta-paśuḥ puruśaḥ
 that man
 the man to whom cattle is offered

(11.4) SK 830
 Compound: uddhr̥taudanā sthālī
 Analysis: (uddhr̥ta-ṛodanā)-B sthālī
 removed-rice vessel
 Paraphrase: [_{RC} odanaḥ uddhr̥taḥ yasyāḥ]
 rice removed from which
 sā uddhr̥taudanā sthālī
 that vessel
 the vessel from which rice has been removed

(11.5) SK 830
 Compound: pītāmbaraḥ puruṣaḥ
 Analysis: (pīta-<ambaraḥ)-B puruṣaḥ
 yellow-garment-ed man
 Paraphrase: [_{RC} pītam ambaram yasya]
 yellow garment whose
 saḥ pītāmbaraḥ puruṣaḥ
 that man
 the man whose garments are yellow

In the paraphrase and translation of Sanskrit exocentric (*bahuvrīhi*) compounds, the relative pronoun of the paraphrasing relative clause may be construed with either the second constituent (11.5) or the first constituent (all other examples). Both of these constituents are subordinate within the structure of the exocentric *bahuvrīhi* compound. This is reflected in the canonical paraphrase, where the relative pronoun is construed with the subject of the relative clause (11.5) or with its predicate (all other examples). Indeed, as noted by Coulson (1976, p. 121), Sanskrit exocentric (*bahuvrīhi*) compounds are ambiguous between two readings: on one, the denotation of the lexical item modified by the exocentric compound is interpreted as the possessor of what is denoted by the final constituent of the compound; and on the other, it is interpreted as bearing a valence of any unsaturated argument associated with the initial constituent of the compound.

(12) Coulson 1976, p. 121
 Compound: dr̥ṣṭakaṣṭā strī
 Analysis: (dr̥ṣṭa-kaṣṭā)-B strī
 witnessed-misfortune-ed woman
 Reading 1: a woman whose misfortune has been witnessed
 (i.e., a woman whose misfortune people have witnessed)
 Reading 2: a woman by whom misfortune has been witnessed
 (i.e., a woman who has witnessed misfortune)

Moreover, an exocentric compound has available a reading corresponding to each of the unsaturated arguments associated with its initial constituent.

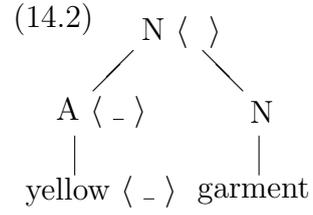
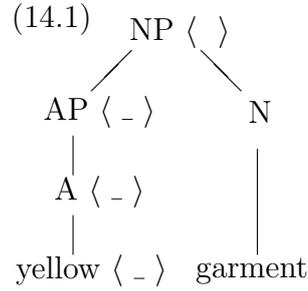
- (13) Coulson 1976, p. 121
 Compound: dattādarā rajñī
 Analysis: (datta-ādarā)-B rajñī
 given-respect-ed queen
 Reading 1: a queen by whom respect is given
 (i.e, a respectful queen)
 Reading 2: a queen to whom respect is given
 (i.e., a respected queen)

Here emerges the difference between English and Sanskrit exocentric compounds alluded to above. Notice that, of the six examples, only the fifth allows an acceptable English calque: **reached-guested*, **drawn-carted*, **offered-cattled* and **removed-vesseled* but *yellow-garmented*. At the same time, while an English exocentric compound is paraphrasable with a relative clause, yet the relative pronoun of the paraphrase, “whose”, is construed only with the subject of the relative clause, which corresponds to the final constituent of the compound paraphrased. Thus, *mean-spirited* is paraphrasable as *one whose spirit is mean*, *level-headed* as *one whose head is level*, and *long-legged* as *one whose legs are long*.

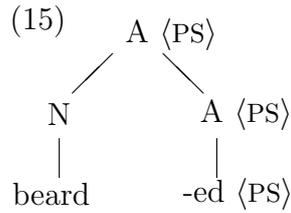
English and Sanskrit exocentric (*bahuvrīhi*) compounds differ as follows: the English adjectival suffix *-ed* does not permit the transmission of unsaturated arguments of an exocentric compound’s initial constituent; whereas the Sanskrit adjectival suffix B does permit the transmission of such arguments.

The foregoing differences between compounds in English and Sanskrit suggests the following hypothesis: the argument frame of initial constituents in lexical structure, in particular, in compound, percolate in Sanskrit but does not in English. This hypothesis accounts for two facts: first, that, in Sanskrit, unsaturated arguments associated with the initial constituent of an exocentric compound can be assigned to the lexical item the compound modifies, whereas in English they cannot be; second, that Sanskrit productively forms non-constituent (*a-samartha*) compounds whereas English does not. Let us see how this account works.

Each adjective has at least one argument which is saturated either by the noun it modifies or by the subject noun phrase of which it is predicated. This is illustrated below, for modification both within phrasal structure and within compound structure.

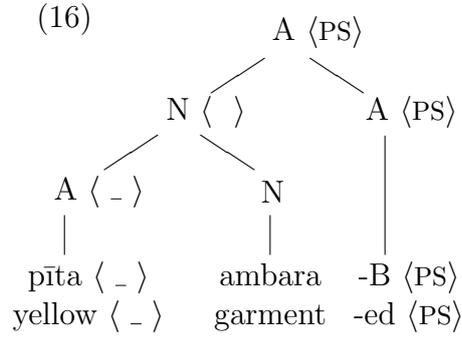


Now, both the *-ed* suffix in English and the *-B* suffix in Sanskrit create adjectives from nouns. This means that they create an argument. Associated with the resulting argument is the valence *possessor* (annotated PS). When the English suffix is applied to a simple noun like *beard*, one obtains the following:



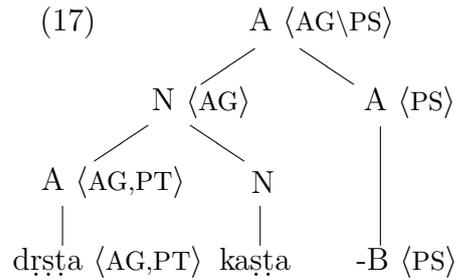
And when the resulting form modifies a word such as *man*, the resulting interpretation is *man who possesses a beard*. Combining what has been said so far, one obtains an analysis for both the Sanskrit compound in (11.5) and its English claque translation.

Moreover, the foregoing analysis shows precisely where Sanskrit and English differ. A morphologically complex English word accepts unsaturated arguments associated only with its head. Whereas, a morphologically complex Sanskrit word accepts the unsaturated arguments either of its head or of its head's sister. When an exocentric compound has no unsaturated argument other than the one associated with its possessive suffix, then its English and Sanskrit versions are equally acceptable.

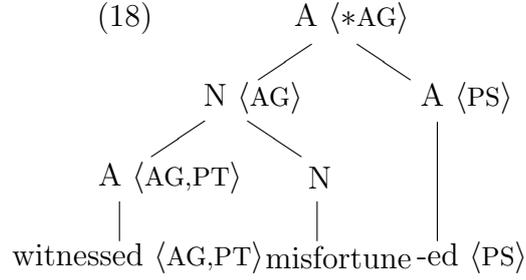


In this example, the argument associated with *yellow* (*pīta*) is saturated by *garment* (*ambara*), and so the complex word *yellow garment* (*pītāmbara*) has no unsaturated argument. The suffixation of *-ed* (*-B*) to *yellow garment* (*pītāmbara*) creates an unsaturated argument with an associated valence, namely that of possessor (PS).

The situation is otherwise when the left-hand constituent of an exocentric compound has an unsaturated argument. Sanskrit permits unsaturated arguments associated with either a head and a non-head to be transmitted to the mother node; and, depending on which unsaturated argument is transmitted, the compound receives one or another interpretation. Thus, in the compound in (12) the unsaturated argument associated with the entire compound may have associated with it either the value AG or the value PS (annotated below as $\langle \text{AG} \setminus \text{PS} \rangle$).



In contrast, English prohibits any unsaturated arguments from being associated with a non-head, with the consequence that the English counterparts to (9) are ungrammatical (annotated below as $\langle * \rangle$).



3 Conclusion

Above, we examined two kinds of compounds in Classical Sanskrit, non-constituent (*a-samartha*) compounds and exocentric (*bahuvrīhi*) compounds. The former compounds were considered problematic by the Indian grammatical tradition for Pāṇini's grammar, the *Aṣṭādhyāyī*. An insight due to Bharṭṛhari shows how they can be satisfactorily analyzed. This insight was recast using the notion of an argument frame, a generalization of subcategorization frame. A bonus of this solution is that it provides insight into well-known properties of the exocentric compounds of Classical Sanskrit, properties which exocentric compounds in English do not have.

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