

MORPHOLOGICAL TYPOLOGY: A HOLISTIC VIEW*

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Abstract

Morphological theories can be classified, into two different types: *Atomistic* and *Holistic*. Atomistic models see morphology as the study of internal structure of words constituted of smaller units like *root*, *stem*, *affix*, etc. The century-old categories of morphological typology: *isolating*, *agglutinative*, *flexional*, *polysynthetic*, etc. necessarily reflect the atomistic view of morphology. In the present article, we will try to illustrate how morphological typology can be done from the point of view of W(hole) W(ord) M(orphology), one of the holistic models of our time. WWM claims that words are ‘seamless wholes’ with no internal (non-phonological) hierarchical structure and that no morphological operation needs to involve units smaller than the word. According to this model any morphological relationship between two words of a language can be described by a W(ord) F(ormation) S(trategy) licensed by a set of semantically related pairs of words showing the same formal difference and categorical affiliation. Each WFS involves a particular morphological operation (e.g. Noun~Adjective, Verb, indicative~Verb, imperative), and at least one morphological mechanism (e.g. adjunction-deletion and segmental modification). An exhaustive list of the WFSs of a language classified in different mechanism and operation-types constitutes the morphological profile of that language. A comparative study of the morphological profiles of different languages and language families shows that languages are not equally rich in WFSs in all the mechanism-types and operation-types. We claim that WWM allows us to look at morphological typology from a different perspective, which could give a clearer view of the morphological diversity of human languages.

Key word: *Atomistic, Holistic, Typology, Strategy, Morphological operation, Morphological mechanism*

1. Introduction

Morphological theories can be classified, on an a priori basis, into two different types: *Atomistic* and *Holistic*. For atomistic models, morphology is understood as a matter of *divide and rule* – words must be divided into smaller units (*root*, *stem*, *affix*, etc.) in order to formulate rules that describe how these units are concatenated with each other. The century-old categories of morphological typology: *isolating*, *agglutinative*, *synthetic*, *analytic*, *polysynthetic*, etc. necessarily reflect the atomistic view of morphology. On the other hand, WWM (elaborated in Ford et al. 1997), one of the holistic models of our time, claims that words are ‘seamless wholes’ with no internal (non-phonological) hierarchical structure and that no morphological operation needs to involve units smaller than the word. One may ask, then, how this model accounts for typological variations– a question that we shall attempt to answer here in the light of Singh (1999).

This article is organized as follows: Section 2 provides a brief description of WWM; Section 3 describes the different morphological operations and morphological mechanisms that word formation processes usually involve; Section 4 presents the morphological profiles of two Indic

languages, Hindi and Bengali, in the light of WWM, going on to compare the two profiles; Section 6 points out some problems of the WWM typology; and the final section draws some conclusions to all that go before.

2. Whole Word Morphology

According to Singh (2006:578), “All that needs to be said about word structure in any language (of any type whatsoever) can and must be said by instantiations of the schema in (S1). These instantiations are referred to as Word Formation Strategies (WFSs) because, as generalizations drawn from known particular facts, they can be activated in the production and understanding of new words. WFSs must be formulated as generally as possible, but – and this is crucial – only as generally as the facts of the matter permit.

S1. $/X/_{\alpha} \leftrightarrow /X'/_{\beta}$ where

1. $/X/_{\alpha}$ and $/X'/_{\beta}$ are words and X and X' are abbreviations of the forms of classes of words belonging to categories α and β (with which specific words belonging to the right category can be unified or on to which they can be mapped)
2. ' represents (all the) form-related differences between $/X/$ and $/X'/_$ that fall outside of automatic phonology.
3. α and β are categories that may be represented as feature bundles.
4. The \leftrightarrow represents a bidirectional implication (if X then $/X'/_$, and if $/X'/_$, then X).
5. The interpretation of $/X/_{\alpha}$ is a semantic function of $/X'/_{\beta}$ and vice versa.
6. ' can be null iff $\alpha \neq \beta$.”

As Singh (2006:578) expresses it, WWM sees morphology, “not as a combinatorics of morphs or morphemes but as a system of generalized and abstract bidirectional correspondence among patterns instantiated by sets of whole words that exploit the same contrast.” Singh (2006:578) goes on to state that some advocates of WWM (e.g. Ford et al. 1997) take the ‘dissociative’ view of morphology and “postulate the existence of rules of interpretation associated with WFSs”, whereas others (e.g. Neuvel 2003) subscribe to the ‘associative’ view *à la* Corbin (1987) and require the said contrast to be “both formal and semantic.”

In the present article, we will adopt the dissociative view of morphology in the sense that each WFS has to be licensed by a set of semantically related pairs of words showing the same i) formal contrast and ii) categorical affiliation, but not necessarily the ‘same’ semantic contrast. For example, (1) instantiates a WFS of English because it is licensed by a set of semantically related word-pairs which manifest the same i) formal contrast: $X/X\lambda_{\iota}$ and iii) categorical affiliation: Noun/Adjective. An ad hoc rule of interpretation (e.g. ‘ $/X/_$ -like’) accompanies each WFS in the present article. The bidirectional arrow implies that a WFS can be activated both ways by using either of the pair-mates as the input.

1. $/X/_N \leftrightarrow /X\lambda_{\iota}/_{Adj}$ ‘ $/X/_$ -like’
friend \leftrightarrow friendly; man \leftrightarrow manly

According to WWM, words have no internal (non-phonological) hierarchical structure. However, if a particular word is mapped onto some relevant WFS it can be analyzed into two

subcomponents, a *variable* (*friend/man*) and a *constant* ($/\lambda\iota/$). Subcomponents can be represented by any phonic element: single phoneme, meaningless sound cluster, words, and discontinuous or continuous segmental as well as supra-segmental means like stress and tone (variables, however, cannot be exclusively supra-segmental). For example, if the Hebrew word /hagdala/ ‘enlargement’ is mapped onto (2), the variable will be represented by the discontinuous sequence of consonants: /h/-/gd/-/l/, and the constant by the discontinuous sequence of vowels: /a/-/a/-/a/. Equally, if the Chinese word /ts^h□³⁵/ ‘a plough’ is mapped onto (3), the constant will be represented by the rising tone while the variable will be represented by the sequence of segments.

2. /CaCCaCa/_N ↔ /CiCCiC/_V ‘action of doing /CiCCiC/’
 /hagdala/ ‘enlargement’ ↔ /higdil/ ‘enlarge’;
 /haxtaba/ ‘dictation’ ↔ /hixtib/ ‘dictate’ (Data:Booij 2005:38)

3. /CV¹¹/_V ↔ /CV³⁵/_N ‘To do the action by using /CV³⁵/’
 /m□¹¹/ ‘to grind’ ↔ /m□³⁵/ ‘a grind’;
 /ts^h□¹¹/ ‘to plough’ ↔ /ts^h□³⁵/ ‘a plough’ (Data:Yu 2007:191)

Subcomponents should not be confused with word-parts like *stem* and *affix* because unlike the latter the former exist nowhere except in the word in question, and one is not even aware of them unless he maps the word onto the relevant WFS. Quite coincidentally, when a subcomponent is represented by a continuous sequence of phonemes, it can have phonic resemblance to word parts which some grammatical traditions would label as *morpheme*, *root*, *stem* or *affix*. As Singh (2004:191) expresses it, “The point is NOT that our variables do not ever correspond to what neo-Paninians call roots and stems– they do in a very large number of cases– but that we see that as synchronically irrelevant.”

3. Morphological operations and morphological mechanisms

3.1. Morphological operations

Each WFS involves some change in the (syntactic/morphological) category of the input. We may label these changes as *morphological operations*. For example, the morphological operation aimed at in (4) is ‘adverbialization’ or ‘adjectivization’, depending on the direction of the activation of the WFS.

4. /X/_{Adj} ↔ /XλI/_{Adv} ‘in a /X/ way’
 courageous ↔ courageously; angry ↔ angrily

The morphological operation aimed at in (5), a WFS of Bontok (a language spoken in the Philippines), is *nominalization* or *adjectivization* or *verbalization*.

5. /CX/_{N/Adj} ↔ /CumX/_{V, Prog, 3rd, Sing} ‘continuous action of becoming /X/’
 /fikas/ ‘strong’ ↔ /fumikas/ ‘he is becoming strong’
 /fusul/ ‘enemy’ ↔ /fumusul/ ‘he is becoming an enemy’
 (Data: Tserdanelis and Wong, 2004:172)

The operation aimed at (6), a WFS of Persian, is verbalization.

6. /Xμ/V, Past, Perf ↔ /μXμ/V, Past, Prog ‘doing progressively the action referred to in /Xm/’
/ραφταμ/ ‘I went’ ↔ /μραφταμ/ ‘I was going’
/Ξορδαμ/ ‘I slept’ ↔ /μΞορδαμ/ ‘I was sleeping’

The morphological operation aimed at in (7), a WFS of Hungarian, is either pluralization or ‘singularization’.

7. /X/N, Sing ↔ /XOK/N, Plu ‘Plural of /X/’
/□στ□λ/ ‘table’ ↔ /□στ□λοκ/ ‘tables’; /δοβ/ ‘drum’ ↔ /δοβοκ/ ‘drums’
(Data: Tserdanelis and Wong, 2004:179)

We can note that some WFSs change the syntactic category of their inputs (4-5) whereas some others change their morphological category (6-7). The WFSs that change the syntactic (and also morphological) category of the input (4-5) are *inter-categorical* and those like (6-7) which change only their morphological category are *intra-categorical*.

3.2. Morphological mechanisms

A WFS is also based on some formal contrast between the input and the output, and this contrast is achieved through some formal means which we will call *morphological mechanism* or simply *mechanism*. There are five different mechanisms:

i) **Adjunction-deletion:** The morphological relationship between the noun *priest* and the noun *priesthood* can be achieved through (8) which involves the mechanism of adjunction-deletion of the sequence /ηYδ/. However, it is not necessary that the same segment undergoes deletion and adjunction. In (9), a Sanskrit WFS, the segment /ι/ is deleted, and /A/ is adjoined, but this deletion and adjunction takes place simultaneously in two different areas of the input or the output.

8. /X/N ↔ /XηYδ/N ‘quality of /X/’
priest ↔ priesthood; boy ↔ boyhood;

9. /Xτι/V, Pres, 3rd, Sing. ↔ /AXτ/V, Past, 3rd, Sing ‘Past of /Xτι/’
/δαδατ/ ‘he gives’ ↔ /Αδαδατ/ ‘he gave’; /βιβⁿετ/ ‘he fears’ ↔ /Αβιβⁿετ/ ‘he feared’
(Data: Chakraborty 2003:441-442)

ii) **Segmental modification:** In (10), a particular segment /Ω/ of the input is replaced by some other segment /Θ/ in the output.

10. /CaΩC/N, Sing ↔ /CaΘC/N, Plu ‘plural of /CaΩC/’
mouse ↔ mice; louse ↔ lice

iii) **Supra-segmental modification:** In (3) (repeated as (11)), if the input ends with a level tone, the output ends with a rising tone. In (12), on the other hand, the formal contrast is represented

by the place of accent: if the 2nd syllable (/ˈport/ or /ˈtest/) is accented rather than the 1st one (/ˈim/ or /ˈpro/), the input noun becomes a verb.

11. /CV¹¹/_V ↔ /CV³⁵/_N ‘To do the action by using /CV³⁵/’
/m[□]¹¹/ ‘to grind’ ↔ /m[□]³⁵/ ‘a grind’; /ts^h[□]¹¹/ ‘to plough’ ↔ /ts^h[□]³⁵/ ‘a plough’

12. /ˈσσ/_N ↔ /σˈσ/_V ‘Action of doing /ˈσσ/’
ˈimport ↔ imˈport; ˈprotest ↔ proˈtest

iv) **Substitution:** In (13), a WFS of Japanese, the sequence /ττε/ of the left-hand input is substituted by the single segment /υ/ in the output. This formal contrast can be described as follows: /Xα/ ↔ /Xβ/ which means that if α is attached to the variable /X/ then β can also be attached to it.

13. /Xττε/_{V, Gerund} ↔ /Xυ/_{V, Infinitive} ‘Infinitive form of /Xττε/’¹
tetsudatte ‘helping’ ↔ tetsudau ‘to help’; atte ‘meeting’ ↔ au ‘to meet’

v) **Identity:** In (14), no formal difference between the input and the output is visible, but identity is considered a mechanism, because it goes hand in hand with the categorical change.

14. /X/_{N, Sing} ↔ /X/_{V, Pres, Ind, 1st/2nd, Sing/Plu, 3rd Plu} ‘do /X/’
rhyme ↔ rhyme; fight ↔ fight

4. Typology à la WWM

Not all languages are equally rich in all types of morphological operations and neither do all of them involve all mechanisms to the same degree. In Sanskrit, the majority of WFSs involve adjunction-deletion, whereas only a few of them involve segmental modification or identity. On the other hand, in Arabic or Hebrew, a good number of WFSs involve segmental modification, and in English, many WFSs involve identity. However, both Arabic and English also involve a lot of adjunction-deletion. In Japanese, it seems, the majority of WFSs involve substitution. As languages differ regarding the use of morphological mechanisms and operations, it should be possible to classify them on the basis of the number of WFSs in each mechanism and operation type group. An exhaustive list of the WFSs of a language classified in different mechanism and operation-types would constitute the morphological profile of that language. For presenting a comparative typology, we must have in hand the morphological profile of the concerned languages.

4.1. Morphological profile of Hindi

The morphological profile of Hindi (presented in Singh and Agnihotri 1997, Singh 1999 and 2001) is based on a list of 270 WFSs. The distribution of these WFSs according to the type of morphological mechanism and morphological operation they involve is given in the following charts:

Distribution of WFSs of Hindi in each mechanism type			
Mechanism	Intra-categorical	Inter-categorical	Total
Identity	30	10	40
Suffixation ²	74	72	146
Suffixation + Segmental modification	15	05	20
Prefixation	26	10	36
Substitution	17	08	25
Segmental modification	03	-	03
Total	165	105	270

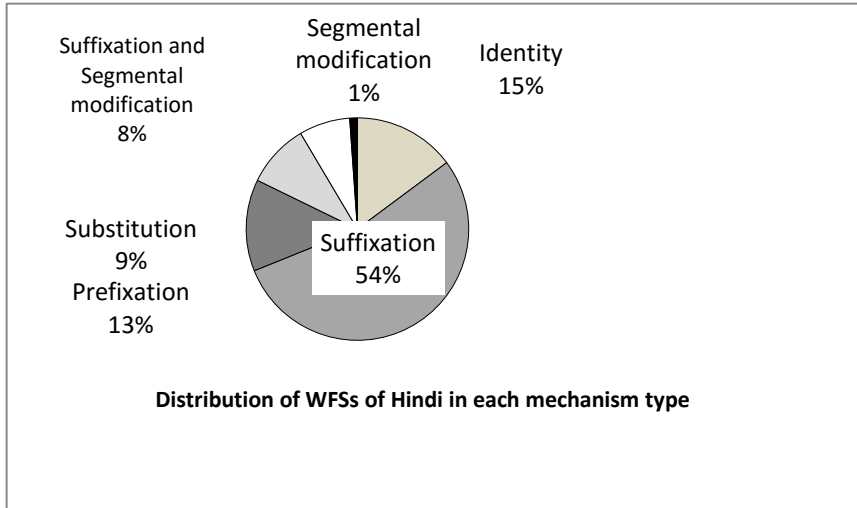
Intra-categorical distribution of WFSs of Hindi				
Mechanism	Noun-Noun	Verb-Verb	Adj-Adj	Total
Identity	07	22	01	30
Suffixation	46	26	02	74
Suffixation + Segmental modification	08	07	-	15
Prefixation	25	01	-	26
Substitution	13	01	03	17
Segmental modification	-	03	-	03
Total	99	59	06	165

Inter-categorical distribution of WFSs of Hindi							
Mechanism	Noun-Verb	Noun-Adj	Noun-Adv	Verb-Adj	Verb-Adv	Adj-Adv	Total
Identity	02	08	-	-	-	-	10
Suffixation	16	29	03	15	05	04	72
Suffixation + Segmental modification	-	03	-	02	-	-	05
Prefixation	-	06	04	-	-	-	10
Prefixation + Segmental modification	-	-	-	-	-	-	00
Substitution	-	04	01	02	-	01	08
Total	18	50	08	19	05	05	105

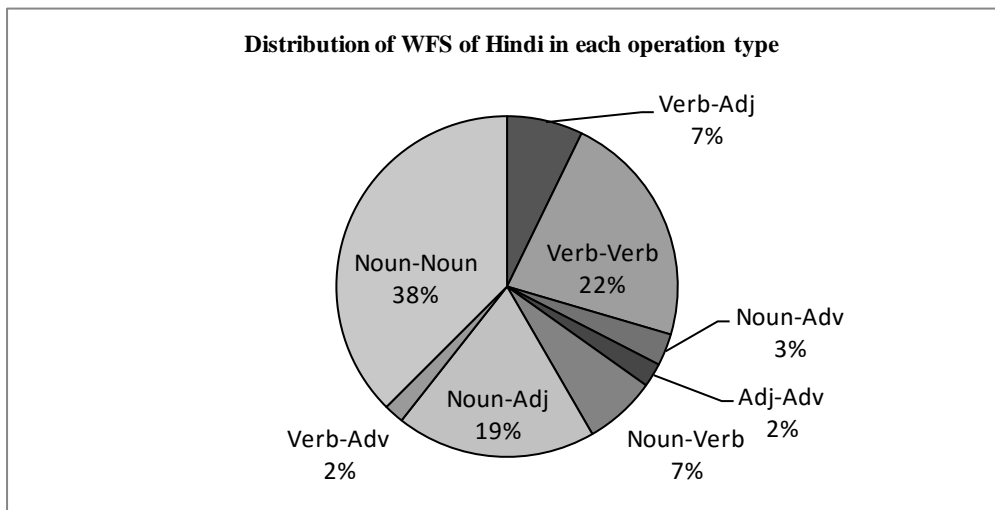
A comparative and analytical study of the above tables reveals the following characteristics of Hindi morphology:

a. Only 1% of the total number of WFSs involves segmental modification which rarely occurs as an independent mechanism. In most cases, segmental modification is accompanied by adjunction-deletion. More than two-thirds of the WFSs involving segmental modification belong to the intra-categorical group.

b. 15% of the total number of WFSs involves identity

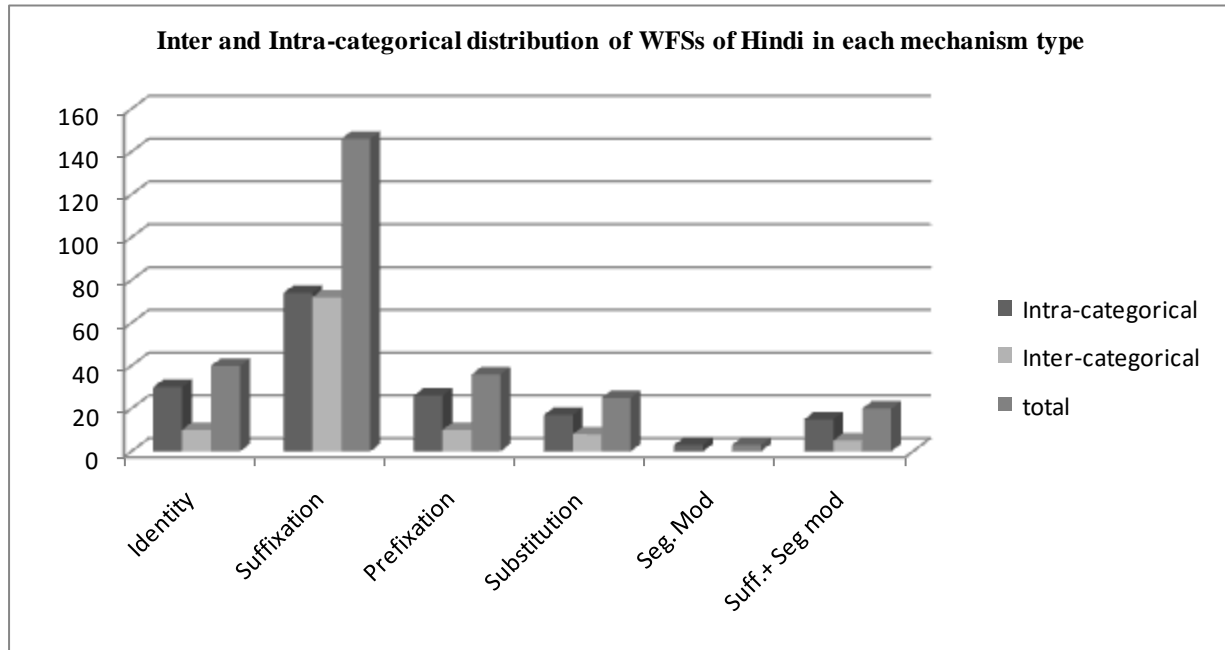


c. The majority of WFSs involve the mechanism of adjunction-deletion (75%) as compared to substitution (9%). About 80% of the total noun formation-WFSs involves adjunction-deletion. About 54% of the WFSs concerned with nouns involves suffixation.



d. 54% of the total number of WFSs involves suffixation whereas only 13% of them involves prefixation. Apparently, suffixation is the dominant morphological mechanism in Hindi word formation network.

e. There are more WFSs involved in intra-categorical operations (60%) as compared to inter-categorical ones (40%). The richest of the inter-categorical operation types is noun-adjective (19%), and among the intra-categorical ones, the noun-noun operation is the richest (38%).



f. A greater part of Hindi morphology (about 65% of the total number of WFSs) is concerned with the formation of nouns. Taking an overview, one can say that about 60% of the total intra- and over 76% of the total inter-categorical WFSs are involved in the formation of different types of nouns, and about 65% of the total number of WFSs is concerned with nouns. Among other categories, it is with adjectives that most of the nouns are formed: about 66% of the total number of inter-categorical noun-formation WFSs falls into the noun-adjective category.

4.2. Morphological profile of Bengali

The morphological profile of Bengali (presented in Bhattacharja 2007) is concretized in the following tables.

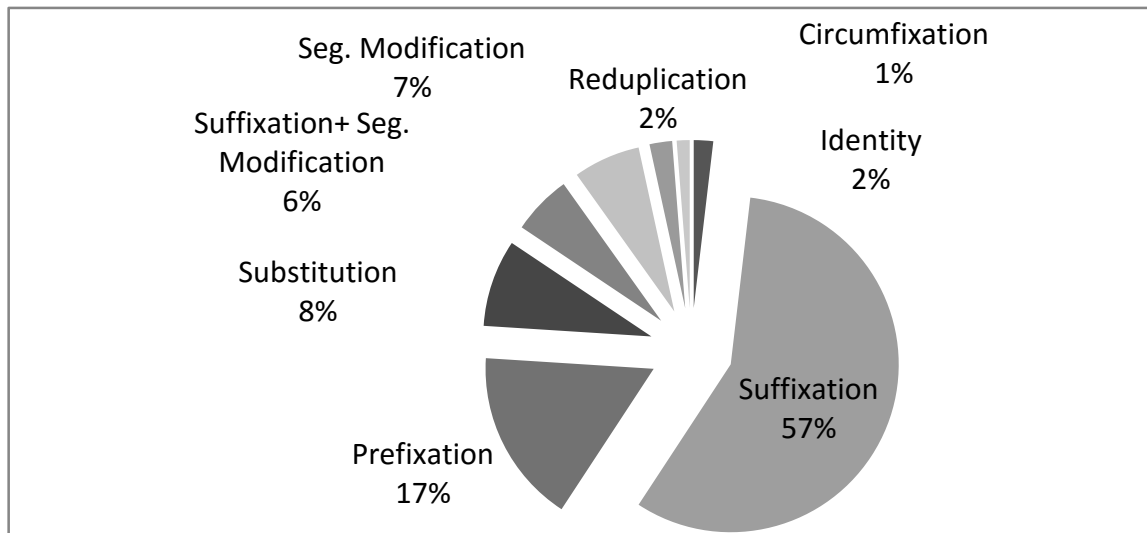
Distribution of WFSs of Bengali in each operation type			
Nature of operation	Number of WFSs		
Intracategorical			
Noun-Noun	488		
Singular-Plural	29		
Masc-Fem	23		
Case-Case	20		
Definite-Indefinite	06		
	Sub-total	566	
Verb-Verb	135		

Adjective-Adjective	52		
Non-Emphatic-Emphatic	02		
Pronoun-Pronoun	03		
Non-Inclusive-Inclusive	02		
Adverb-Adverb	02		
Numeral-Numeral	01		
	Sub-total	194	
		Sub-total	762
Intercategorical			
Noun-Adjective	343		
Noun-Adverb	36		
Adverb/Pronoun-Adjective	16		
Verb-Noun	13		
Adjective-Adverb	12		
Verb-Adjective	08		
Numeral/Quantifier- Pronoun/Adjective	05		
Verb-Adverb	04		
Numeral-Date Word	03		
Measure Word-Adjective	02		
Noun-Postposition	01		
Adverb-Postposition	01		
Adjective-Postposition	01		
Interjection-Noun	01		
Ordinal-adjective	01		
	Sub-total		447
Total			1209

Distribution of WFSs of Bengali in each mechanism type			
Type of mechanism		Number of WFSs	
Adjunction- Deletion	Suffixation	739	
	Prefixation	216	
	Circumfixation	10	
		Sub-total	965
Segmental modification	+ Suffixation	74	
	+ Circumfixation	03	
	+ Prefixation	06	
		Sub-total	83
		Sub-total	1048
Substitution	Suffixation	83	
	Segmental mod + Suffixation	15	
	Prefixation	06	
	Circumfixation	03	
	Segmental mod + Circumfixation	01	
		Sub-total	
Reduplication			28
Supra-Segmental modification			02
Identity			24
		Total	1209

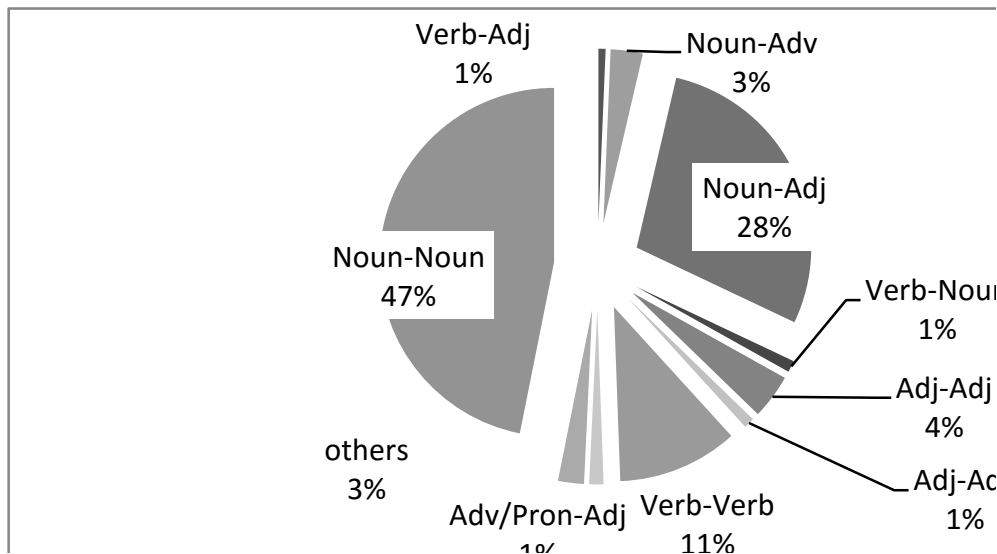
A comparative and analytical study of the above tables reveals the following characteristics of Bengali morphology:

a. There are more WFSs involved in intra-categorical operations (63%) as compared to inter-categorical ones (37%). The richest of the inter-categorical operation types is noun-adjective (28%). Among the intra-categorical ones, the noun-noun is the richest (46%).



b. More WFSs involve the mechanism of adjunction-deletion (80%), as compared to substitution (8%).

c. Reduplication and identity involve, each, about 2% of the total number of WFSs.



d. 57% of the total number of WFSs involves suffixation. Only 17% of them involves prefixation. Apparently, suffixation is the dominant morphological mechanism in Bengali word formation Network.

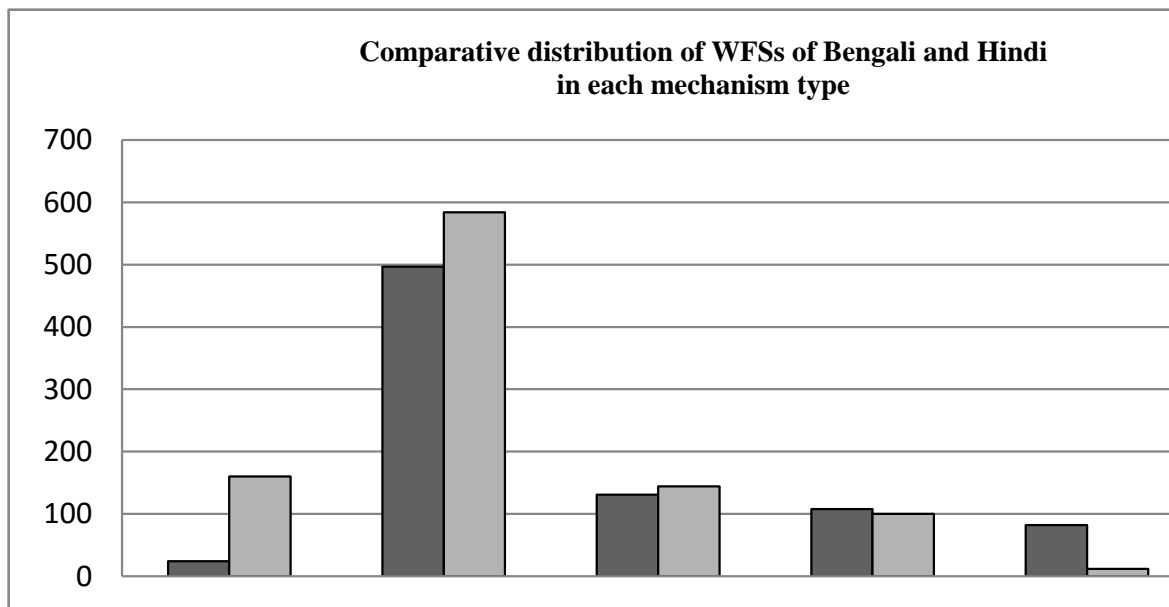
e. Only 7% of the total number of WFSs involves segmental modification. Segmental modification rarely occurs as an independent mechanism in Bengali, and in most cases, it accompanies adjunction-deletion. However, in a few WFSs, segmental modification also combines with substitution. Two-thirds of the WFSs involving segmental change belong to the inter-categorical group.

f. A greater part of the Bengali morphology is centered on noun formation. One can see that about 79% of the total number of WFSs is concerned with nouns. Within these, over 73% of the total intra- and 76% of the total inter-categorical WFSs are involved in the formation of different types of nouns. Among other categories, it is with the adjectives that most of the nouns are formed: 87% of the total number of inter-categorical noun-formation WFSs falls into the noun-adjective category.

4.3. A comparative study of the profile of Bengali and Hindi

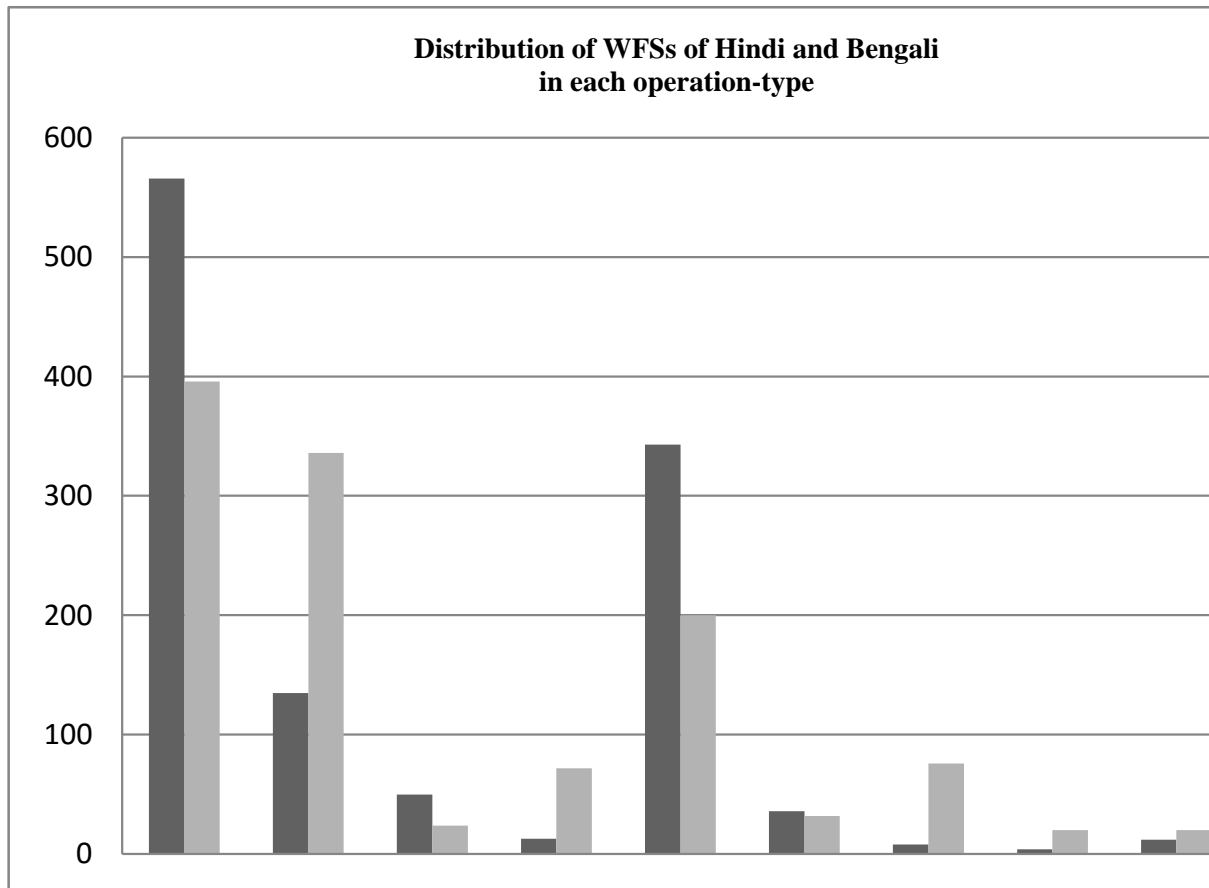
It is difficult to compare these two profiles, because the profile of Bengali is based on a comparatively more exhaustive data, containing about 1200 WFSs, whereas the profile of Hindi is based on about 300 WFSs. Moreover, unlike Bhattacharja (2007), Singh and Agnihotri (1997) does not include the so-called compounds. However, in order to equalize the number of WFSs of the two languages, the number of WFSs in each category of Hindi has been multiplied by four to make the numbers of WFSs available of the two languages comparable, to give a plausible contrastive picture of the morphological profile of the two languages.

The contrast between these two languages is reflected in the following charts.



It can be seen that suffixation is the dominant mechanism in both Hindi and Bengali. However, these two languages differ significantly in their use of identity and segmental modification. More WFSs involve identity in Hindi as compared to Bengali, whereas more WFSs involve segmental modification in Bengali as compared to Hindi. In this respect, Hindi is more like English, and Bengali is more like Sanskrit, to some extent. However, in both Hindi and Bengali, segmental modification rarely occurs as an independent mechanism.

One can see that while in both Hindi and Bengali a greater portion of the total number of WFSs is centered around noun formation, Bengali is richer in noun formation WFSs whereas Hindi is richer in verb formation ones. Bengali forms more adjectives from nouns while Hindi forms more adjectives from verbs. Again, in Bengali, more adjectives are formed from other adjectives, whereas in Hindi, more verbs are formed from nouns.



5. Problems with WWM typology

Let us now look at some drawbacks that prevail in WWM typology. The main problem is that some WFSs involve more than one mechanism, and, therefore, the same WFS can fall into different mechanism types. For example, (15), a French WFS involves two different mechanisms: i) Segmental modification (/κ/~σ/) and ii) Adjunction-Deletion of /ιτɛ/.

15. /Xκ/_{Adj} ↔ /Xσιτɛ/_N ‘quality of /Xκ/’
opaque /οπακ/ ‘opaque’ ↔ opacité /οπασιτɛ/ ‘opacity’

spécifique /σπεσιφικ/ ‘specific’ ↔ spécificité /σπεσιφισιτε/ ‘specificity’;

Another problem is that, strictly speaking, there is no difference between the different mechanisms. In fact, the only mechanism that exists is substitution. For example, in adjunction-deletion (8), α is represented by ‘zero’ (absence of segment) and β by [$\eta Y \delta$]; in segmental modification (10), / ω / represents α , and / φ / represents β ; in supra-segmental modification (11-12), the tone/stress/accent in the input represents α , and the one in the output represents β ; in identity (14), one category is replaced by another. The basic requirement of a WFS (unless it involves identity) is ['] (= formal contrast between the pair-mates) which is obtained by substituting a particular phonic entity (or its absence) by another.

6. Conclusion

In this article, we have shown how one can do morphological typology from the point of view of WWM. This typology shows in finer details the extent to which a particular language or language families make use of different mechanisms and operations. WWM allows one to analyze/organize morphological typology in a different way to give a different view of the morphological diversity of human languages.

Abbreviations:; 1st: 1st person, 2nd: 2nd person, 3rd: 3rd person, **Adj**: Adjective, **Adv**: Adverb, **N**: Noun, **Plu**: Plural, **Perf**: Perfective, **Pres**: Present, **Prog**: Progressive, **Sing**: Singular, **V**: Verb.

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Notes

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1. Although we have described Japanese verb forms in (13) as *gerund* and *infinitive*, they do not exactly correspond to the gerund and infinitive forms of European languages. In the traditional Japanese grammar, these two verb forms are known as *te*-form and *jisho* (‘dictionary’) form respectively. What is important is that the input and output of (13) have different meanings, and they also belong to different morphological categories.

2. We have subdivided adjunction-deletion into *suffixation* and *prefixation* exclusively for descriptive purposes. In the former, the constant appears on the right side of the variable, while in the latter, it

appears on the left. It should be clearly understood that they have nothing to do with atomistic processes of concatenating a *suffix* or a *prefix* with some *root* or *stem*. It is worth mentioning that in a good number of cases WWM mechanisms like suffixation and prefixation do not correspond to the process of suffixation and prefixation of atomistic models.

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