3

Morphological Typology

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3.1 Introduction

Morphology is the study of shapes (Gk. μορφή 'form, shape', λόγος 'word, reason'). In linguistics, morphology is the study of how the forms of words may vary systematically to allow speakers to accomplish communicative work. One of the earliest topics linguists approached from a typological perspective was the ways in which languages characteristically form words from simpler meaningful elements. This area of investigation has come to be known as morphological typology.

In this chapter, I will first outline the history of morphological typology in linguistics. Following this, I will describe a method of identifying and describing the morphological typology of any language for the purposes of grammatical description (§3.3). In section 3.4, I describe how the indices of morphological typology interact with one another, and with the parameter of monosyllabicity, concentrating on some of the more unusual language types.

3.2 History

Until the middle of the twentieth century, linguists (or 'philologists' as they were often called in English) were mostly concerned with the genetic classification of languages and the reconstruction of earlier states of attested languages. This was mostly accomplished by comparing the vocabularies of living or documented extinct languages. However, there were some exceptions to this emphasis on vocabulary (or 'lexical') comparison in linguistics. In the early nineteenth century two brothers, August Wilhelm von Schlegel and Karl Wilhelm Friedrich von Schlegel, collaborated on a classification of languages based on 'internal structure' rather than simply shared vocabulary. This work was published by Karl Wilhelm

Friedrich von Schlegel in 1808. Though the Schlegels were still mostly interested in using their framework for determining genetic relationships, their work may be considered the first 'typological' approach to language comparison.

Key to the Schlegels' approach to a typology of languges are the various ways in which languages tend to form words from *roots* or basic forms. K. Schlegel (1808: 35–6) used an explicitly botanical metaphor for one type of language which he termed 'flexional' (*flexione*). In this language type, according to Schlegel, roots are like biological organisms which 'sprout' and give rise to stems, branches and leaves. By this he referred to morphological changes such as umlaut and apophony, as well as the lexical processes of suppletion and incorporation (see the contribution by Beck, Chapter 11 of this volume). For example, the forms *sing, sang, sung* and *song* in English represent 'flexion' because the forms develop from, or 'grow' out of a root (which may or may not occur independently in the contemporary language). While certain kinds of prefixation and suffixation (specifically those involving suppletive allomorphy) were included in K. Schlegel's characterization of flexion, languages in which umlaut, apophony and suppletion dominate the basic paradigms were considered to be qualitatively different from (and superior to) languages which employed mostly unvarying prefixes and suffixes, or unvarying monosyllabic roots to express important grammatical categories. In contrasting flexional languages with all others, Schlegel (1808: 51) states: 'In contrast [to flexional languages], in languages that have only affixes, roots are not actually fruitful seeds, but only a heap of atoms that every wind of chance may separate from each other or bring together.'[1]

For Schlegel, the existence of flexion in any two languages was prima facie evidence for a genetic relationship. On this basis, he concluded that Latin, Greek and German all 'descended from Sanskrit', an ancient and well-documented Indo-Aryan language that also displays the tendencies Schlegel recognized as flexional. All other languages of the world, according to Schlegel, lacked the creative 'internal' flowering tendency of roots and instead were constrained to express ideas in isolated monosyllables, or by means of invariant affixes attached 'externally' (and apparently randomly; see the quote above) to the base form. Schlegel took great pains to distinguish the internal germinal nature of flexional languages from the external nature of other language types, always with a clear value judgement in favour of flexional (i.e. Indo-European) languages. This work, though faulty in a number of respects, was central to the establishment of the Indo-European family of languages, principally by Bopp (1833–52).

Later in the nineteenth century, Wilhelm von Humboldt in a very important work (1836) distinguished four language types, though he named only three of them. The fourth, Chinese, he seemed to exclude

from the general typology: 'Apart from Chinese, which dispenses with all grammatical forms, we previously postulated in languages *three possible forms* for the attainment of sentence-making, the *inflectional*, the *agglutinating* and the *incorporative*' (1836, in Losonsky 1999: 216).

Though von Humboldt takes pains to distance himself from 'the uncongenial impression that I am singling out certain languages as the only legitimate ones' (Losonsky 1999: 217), in other places he clearly relates the presence of inflection, not only to the superiority of languages, but also to the 'energy of mental activity' of nations.

Von Humboldt considered inflection to be distinct from 'agglutinative' processes such as regular prefixation and suffixation. Thus, English words such as *untie, review* and *countable* would be considered examples of agglutination, rather than inflection. On the other hand, *sing, sang, sung* and *song* would be examples of inflection. Incorporative processes, according to von Humboldt, involved compounding of base forms into words that may result in entire sentences being expressed in a single word. Among the few examples cited by von Humboldt is the following from 'the Mexican language' (Losonsky 1999: 130) – Classical Nahuatl as described in Zenteno (1753):[2]

(1)   a. ni-naca-qua   'I eat meat.'
          I-meat-eat
       b. ni-te-tla-maca   'I give somebody something.'
          I-somebody-something-give

What distinguishes this 'incorporative' structure from the kind of compounding evident in, for example, Greek, is that even when the object of the verb is expressed as an independent element, the verb must carry a pronominal element (the *-c* in example 2) to refer to it:

(2)   ni-**c**-qua in   nacatl.   'I eat it, the meat.'
       I-it-eat   the meat

Humboldt ascribes this tendency for whole sentences to be expressed in a single verb in rather disdainful terms, relating it to a characteristic 'way of thinking':

> To the Mexican way of thinking, the verb simply cannot be conceived without these qualifiers to complete it . . . The language betrays with the utmost clarity its intention of having these composite forms appear as a whole
> *(Humboldt 1836, in Losonsky 1999: 130).*

Humboldt then goes on to illustrate the incorporative tendency of Classical Nahuatl with the use of incorporated forms, rather than separate auxiliaries, to express tense and aspect.

Unfortunately, these early studies were fraught with inconsistencies and an obvious subtext in which 'inflectional' languages, such as Greek, Latin and German, were assumed to be superior to 'agglutinating' languages such as Turkish and Hungarian, 'incorporative' languages

such as Nahuatl and 'monosyllabic' languages such as Chinese. Note that Humboldt's assumption that the monosyllabic structure of Chinese excludes it from the general typology of languages could be used against the inflectional languages in comparison with Nahuatl. Certainly sentence-building processes in German, Greek and Latin are less incorporative, leaning more towards monosyllabicity, than Nahuatl. Thus from a purely linguistic point of view, Humboldt's inflectional languages occupy a middle position between incorporative languages and Chinese. This would hardly be logical if inflection were the culmination of an evolutionary process in which the other types were merely primitive stages. The presupposed superiority of inflectional languages was simply too powerful an attitude in the nineteenth century to be troubled by such inconsistencies.

It was not until 1921 that a linguist dared approach the topic of linguistic typology again. Sapir pointed out the logical inconsistencies while aggressively exposing the ethnocentrism of the earlier work as a reason why morphological typology did not enjoy much success:

> [This reason] is probably the most powerful deterrent of all to clear thinking. This is the evolutionary prejudice which instilled itself into the social sciences towards the middle of the last century and which is only now beginning to abate its tyrannical hold on our mind ... The vast majority of linguistic theorists themselves spoke languages of a certain type, of which the most fully developed varieties were the Latin and Greek that they had learned in their childhood. It was not difficult for them to be persuaded that these familiar languages represented the 'highest' development that speech had yet attained and that all other types were but steps on the way to this beloved 'inflective' type.
>
> *(Sapir [1921] 1939: 130–1)*

Sapir also pointed out other logical fallacies of the early approaches to morphological typology. First was the idea that languages can be characterized holistically and unambiguously in terms of their word and sentence-building processes. In fact, monosyllabicity, inflection, agglutination and fusion are all possible strategies for expressing any grammatical category. While a given language may accomplish more communicative work using certain of these strategies and downplaying others, there is no particular reason to expect one process to dominate or characterize an entire language. Second, the functions of some process may be very different in one language than in another. For example, prefixal agglutination occurs in Bantu languages and in Mon Khmer languages, yet Bantu prefixation expresses central and obligatory syntactic relations, while in Mon Khmer, prefixation tends to express 'optional' derivational categories. These two language families are very different in their morphological character, yet would cluster together in a morphological typology based strictly on superficial word-

building strategies, with no reference to the functions of those strategies.

For these reasons (among others), Sapir goes on to elaborate his own morphological typology of languages based on functions as well as formal strategies. The functional index proposed by Sapir was a continuum between 'purely relational' concepts such as case and agreement on the one hand, and 'concrete' concepts such as *dog* or *collapse*, on the other. Intermediate between these extremes are 'concrete relational' concepts which contribute significantly to the meaning of a word but are not concerned with the relationships of the word to other words in the sentence. Nominalization, tense and aspect would be examples of concrete relational concepts. On the formal side, Sapir distinguished two indices, 'Technique' (fusional to agglutinative) and 'Synthesis' (analytic to polysynthetic). This formal distinction is clearly the basis for Comrie's ([1976] 1989) distinction between the index of fusion and index of synthesis, described and elaborated in section 3.3 below. Particular constructions can be characterized rather precisely according to where they fall on each of these three indices (Sapir [1921] 1939: 150–1). Applying these indices to whole languages, however, is a more complex matter. A language can only roughly be categorized according to which strategies it seems to favour, e.g. agglutination and flexion both exist in English (and many other languages), so whether English is considered flexional or agglutinative is a matter of degree. How much communicative work is accomplished via agglutination vs. flexion? Though Sapir did not come up with a definitive and objective morphological typology of languages, by conceptualizing morphological typology in terms of intersecting formal and functional parameters, all of which are in principle infinitely variable, Sapir provided a value-neutral framework for discussing morphological typology based on realistic and, in principle, measurable linguistic notions.

Joseph Greenberg, in an important but little-cited work (1954, reprinted in 1960), provides a detailed description of Sapir's typology and elaborates on it in an attempt to quantify the morphological typology of any language. In order to do this, Greenberg replaces Sapir's index of relation with four functional indices (derivational index, gross inflectional index, pure inflectional index and concordial index), and adds four formal indices (the compounding index, prefixal index, suffixal index and isolational index). Each index is defined as a ratio between the relative frequency of two elements (either formal devices or functions) over stretches of naturally occurring text. For example, the index of synthesis is calculated as the ratio of the number of morphemes to the number of words. If the ratio is 1:1 (one morpheme for each word), the language is at the isolating extreme of the index. The higher the proportion of morphemes to words, the

more synthetic the language is. The entire list of Greenberg's indices is presented in (3):

(3)   Synthesis: Morphemes per word (≥1)
      Agglutination: Agglutinative junctures to all morpheme junctures (≤1)
      Compounding: Roots per word (≥1)
      Derivation: Derivational morphemes per word (any number in principle)
      Gross inflection: Inflectional morphemes per word (any number in principle)
      Prefixing: Number of prefixes per word (any number in principle)
      Suffixing: Number of suffixes per word (any number in principle)
      Isolation: Expressions of grammatical relations by constituent order to all expressions of grammatical relations (≤1)
      Pure inflection: Expressions of grammatical relations by inflection to all expressions of grammatical relations (≤1)
      Concord: Expressions of grammatical relations by concordial inflectional morphology to all expressions of grammatical relations (≤1)

The result of calculating all the indices for any group of languages is a grid by which the morphological types of the languages can be precisely compared to one another. For example, Greenberg calculates the indices for eight languages and provides the table replicated here as Table 3.1 (1960: 193). Extrapolating from the individual indices, it is then possible,

Table 3.1 *Greenberg's (1954) calculations of ten typological parameters for eight languages*

	Sanskrit	Anglo-Saxon	Persian	English	Yakut	Swahili	Annamite	Eskimo
Synthesis	2.59	2.12	1.52	1.68	2.17	2.55	1.06	3.72
Agglutination	.09	.11	.34	.30	.51	.67	. . .	.03
Compounding	1.13	1.00	1.03	1.00	1.02	1.00	1.07	1.00
Derivation	.62	.20	.10	.15	.35	.07	.00	1.25
Gross inflection	.84	.90	.39	.53	.82	.80	.00	1.75
Prefixing	.16	.06	.01	.04	.00	1.16	.00	.00
Suffixing	1.18	1.03	.49	.64	1.15	.41	.00	2.72
Isolation	.16	.15	.52	.75	.29	.40	1.00	.02
Pure inflection	.46	.47	.29	.14	.59	.19	.00	.46
Concord	.38	.38	.19	.11	.12	.41	.00	.38

in principle, to assign any language to a particular "type" among those mentioned by Sapir ([1921] 1939).

The point of mentioning Greenberg's indices and including Table 3.1 is to emphasize that calculating the precise morphological type of a language in purely formal, objective terms is in fact possible. One may ask, therefore, why Greenberg's work is not cited more often in theoretical or descriptive accounts of individual languages. In my opinion, the reason involves a law of diminishing returns. While Greenberg's methodology is extremely precise, the benefit in terms of knowledge gained about a particular language is relatively small. As Greenberg himself states: 'We seek to establish typologies which involve characteristics of fundamental importance in language and which are useful for a variety of reasons' (1960: 179). In other words, a typology is useful insofar as it captures characteristics of 'fundamental importance', which correlate with other characteristics beyond simply the parameters of the typology itself. Precision is important in approaching the categorization of languages, but precision is not an end in itself. A precise delimitation of language types is of little value unless the types so delimited elucidate some fundamental property of languages that would otherwise be missed. As it turns out, the considerable time and ink necessary to calculate and publish the precise Greenbergian indices for a language has relatively little 'payoff' in terms of increased understanding of the language as a whole. For this reason, few linguists have followed up on Greenberg's methodologies and published exhaustive morphological typologies of individual languages.

3.3 Morphological Typology and Descriptive Linguistics

While few descriptive linguists endeavour to employ Greenberg's methodology for calculating morphological typology exhaustively, modern linguistic grammars do typically include a section or chapter on morphological typology. Such descriptions are helpful to readers of grammars in developing an overall understanding of the structural 'personality' of a language. In this section, I will provide suggestions for how to analyse and present the morphological typology of a language for the purposes of a descriptive grammar that is insightful, and precise, yet reasonably limited in scope.

Of all the possible indices of morphological typology, Sapir's indices of technique and fusion are the most straightforward and unquestionably the most useful in characterizing the holistic morphological typology of a language. Comrie ([1976] 1989) renamed Sapir's index of technique, calling it the index of *synthesis*, while maintaining Sapir's terminology for the index of *fusion* (Greenberg's index of agglutination). As recognized by Sapir and Greenberg, synthesis and fusion are

properly applied to grammatical constructions, rather than whole languages. Nevertheless, languages do seem to 'favour' one or another end of each of these indices, though few, if any, adhere to any given typological classification in an absolute sense. From a communicational point of view, speakers seem to develop 'habits' of expressing grammatical meanings via syntax (isolating languages), agglutinative morphology or fusional morphology. Analysing or learning to speak a second language partly involves adjusting one's cognitive habit patterns to more closely approximate those of speakers of the second language in this regard. Therefore, looking carefully at the morphological typology of a language can be useful for grammar readers, grammar writers and second language learners.

3.3.1   The Index of Synthesis

The index of synthesis can be fairly quickly determined by counting the words and morphemes in a body of texts, and then dividing the number of morphemes by the number of words (Sapir's M/W ratio). Of course the larger the body of texts one has at one's disposal, the more precise the calculation will be. However, beyond about 500 words (my informal estimate), any increase in accuracy is likely to be of little significance. I would suggest using naturally occurring narrative, expository, procedural or exhortative texts, as opposed to conversation, the reason being that conversation tends to involve many interjections, fragments and false starts that will tend to skew results towards the isolating end of the index.

It is important at this point to consider what is meant by the term 'word'. As discussed in detail in Dixon and Aikhenvald (2002), there are at least two ways of identifying words in linguistic data. Leaving aside conventions of orthography and spelling for the moment, words may be identified on phonological or grammatical principles. For our purposes, a *phonological word* is any linguistic unit that may be pronounced in isolation. Words in this sense may be composed of other elements which may or may not be pronounceable in isolation. For example, the English form *walked* is a phonological word. It is composed of two morphemes, *walk* and *-ed*. The past tense morpheme in this example is not a word because it may not be pronounced coherently in English on its own. Furthermore, it undergoes certain morphophonemic changes depending on the root to which it attaches. On the other hand, the form *will walk* is composed of two phonological words because both parts can be interpreted independently of the other. Neither one is bound phonologically to the other.

Words may also be identified on grammatical grounds. Two forms are separate words if they can be reordered with respect to one

M/W = 1, <2	M/W ≥ 2, < 3	M/W ≥ 3
isolating	synthetic	polysynthetic

Figure 3.1 The index of synthesis (the number of morphemes per word)

another, and/or other syntactic pieces may be inserted between them. For example, the form *will jump* consists of two grammatical words because they may exchange positions and elements may be inserted between them: *Will she jump? She will definitely jump. She said she would jump and jump she will*. Sometimes phonological words and grammatical words are not the same. For example, the form *she'll* in *she'll jump* is one phonological word – the form spelled *-'ll* is a morphologically bound allomorph of the grammatical word *will*, though the two elements are still independent of one another syntactically – *she definitely'll dance* (see Bickel and Nichols 2005 for further elaboration of this idea). For the purposes of calculating the index of synthesis, we want to count grammatical words. Thus *she'll* would not be an instance of synthesis. Rather, it is treated as two words and two morphemes. Similarly, structures like *the dog*, though arguably one phonological word, would be considered two grammatical words.

At one extreme of the index of synthesis are isolating languages, namely those with an M/W ratio of 1. There is in principle no upper limit to the number of morphemes per word, though in practice languages with a synthesis index of two or more may be considered 'synthetic', and those with a synthesis index of three or more may be considered 'polysynthetic'. Figure 3.1 illustrates this continuum.

A strictly isolating language would be one in which every word in every construction consists of only one meaningful unit. Many Sinitic languages of Southeast Asia come close to this extreme. The following is an example from Mandarin:

(4) 他   沒   再   有   說   他   想   要   去   獵   鹿。
     tā   méi   zài   yǒu   shuō tā   xiǎng yào   qù   liè   lù
     3SG   NEG   again   EXIST   say   3SG   want   COMP   go   hunt   deer
     'He did not say again that he wanted to go hunt deer.'

Modern English, with a synthesis index of approximately 1.7, can be considered somewhat isolating or moderately synthetic. As acknowledged by Sapir ([1921] 1939), there are no strict dividing lines between isolating and synthetic, or synthetic and polysynthetic languages. However, one rule of thumb is that if entire sentences are often expressed in a single word, the language may be considered polysynthetic.

The Inuit-Aleut languages are good examples of highly polysynthetic languages. The following is an example of a polysynthetic structure in Central Yupik (thanks to Eliza Orr):

(5) Tuntu-ssur-qatar-ni-ksaite-ngqiggt-uq
     reindeer-hunt-FUT-say-NEG-again-3SG.IND
     'He had not yet said again that he was going to hunt reindeer.'

Such complex structures are not only possible in the Inuit languages, but also quite common, resulting in synthesis indices of well over 3. Furthermore, most of the morphological complexity in the Inuit languages, as in most polysynthetic languages, is in the verb word. In fact, nouns are used quite infrequently in natural texts, and when they do occur, they tend to have a synthesis index closer to 2.

3.3.2 The Index of Fusion

The index of fusion describes a continuum between highly *agglutinative* languages to highly *fusional* languages. A highly agglutinative language is one in which morpheme junctures tend to be clear, and there is no purely morphophonemic variation.[3] A highly fusional language (termed 'flectional' in the early work) is one in which morpheme junctures are difficult to determine. Word structure is characterized by a high degree of suppletive morphology, morphophonemic variation, as well as 'portmanteau' morphemes – individual morphemes that simultaneously participate in multiple grammatical paradigms.

The index of fusion may be calculated by dividing the number of fusional morpheme junctures (Fj) by the total number of morpheme junctures (J).[4] This index is a bit more difficult to calculate than the index of synthesis, mostly because of the many different ways that words may be formed in response to variation in grammatical categories (see the contribution by Beck, Chapter 11 of this volume). The existence of morphophonemic processes, autosegmental morphology, suppletion, apophony, umlaut, metathesis, non-concatenative morphology, subtractive morphology and portmanteau morphemes (described below) render the task much more difficult. For purposes of grammatical description, the following values may be used as a guide:

Fj/J = 0   Fj/J = 1

agglutinative   fusional
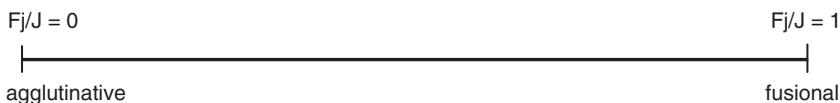
Figure 3.2 The index of fusion (the number of fusional junctures to all junctures)

(6)   Prefix: One juncture (±fusional)
      Suffix: One juncture (±fusional)
      Infix: Two junctures (±fusional)
      Circumfix/ambifix: Two junctures (±fusional)
      Metathesis: One juncture (±fusional)
      Reduplication: One juncture (±fusional)
      Compounding: One juncture (±fusional)
      Non-concatenation: One juncture (±fusional) per morpheme element
      Autosegmental morpheme: One fusional juncture
      Apophony: One fusional juncture
      Subtractive morphology: No junctures

For example, consider the English excerpt in (7a):

(7)   a. The company's great breakthrough came when they decided to buy trikes to sell their ice-cream around the streets in the 1920s.
     b. The company-'s great break-through came.PAST when they decid-ed to buy trike-s to sell their ice-cream around the street-s in the nine-teen twenty-s.

In (7b), agglutinative morpheme junctures are indicated by hyphens. Since the past tense of *come* is apophonic (regular stem change), it may be considered one fusional juncture, indicated by a dot. The genitive case, plural and major class past tense morpheme spelled -*ed* are agglutinative because the various pronunciations (allomorphs) involved are directly explainable on general phonological grounds.[5] Under this analysis, the index of fusion for this 22-word excerpt would be 1/9 or .11. Of course an excerpt of at least 500 words would be necessary to achieve anything like statistical reliability.

Portmanteau morphemes also pose a problem for calculating the index of fusion. For example, in Spanish the suffix -*ó* in a word like *habló* participates in five grammatical paradigms: mode (indicative), subject person (third person), subject number (singular), tense (past) and aspect (perfective). If any one of these categories changes, the entire suffix must change (see Table 3.2). There is no way to separate out which part of the suffix refers to mode, which part to subject reference and which part to tense or to aspect. However, because of the structure of the whole verbal system we see that these categories are distinguished morphologically in some forms; therefore we want to say that there are five morphemes 'fused' into that one -*ó* suffix. Even as the form *came* in English may be considered fusion of the root plus past tense, so -*ó* in Spanish may be considered an example of fusion of categories from five distinct paradigms, and so contains four fusional junctures and one agglutinative juncture between the root and suffix. In the form *habláramos* 'we were to speak' on the other hand, the suffix component -*ára* consistently expresses the past + subjunctive

Table 3.2 *Fusion in Spanish verbs*

		1st person	2nd person (fam.)	3rd person
Present	singular	hablo	hablas	habla
	plural	hablamos	hablais	hablan
Past	singular	hablé	hablaste	habló
Perfective	plural	hablamos	hablasteis	hablaron
Past	singular	hablaba	hablabas	hablaba
Imperfective	plural	hablábamos	hablabais	hablaban
Present	singular	hable	hables	hable
Subjunctive	plural	hablen	hableis	hablen
Past	singular	hablara	hablaras	hablara
Subjunctive	plural	habláramos	hablarais	hablaran

categories, while *-mos* consistently expresses reference to a first person + plural subject. Therefore we would say that there are two agglutinative junctures, one between the root and *-ára* and another between *-ára* and *-mos*. At the same time there is one fusional juncture represented in the suffix *-ára* and another fusional juncture within the suffix *-mos*.

In contrast, Turkish is a language for which each lexical meaning and grammatical category is, in general, expressed by its own morpheme, and the junctures between morphemes tend to be clear. Therefore, Turkish is a highly agglutinative language, as illustrated in this example:

(8) Yaramaz-laş-tırıl-a-mıy-abilen-ler-den-miş-siniz
     useless-act-like-E-NEG-able-PL-of-doubt-2.be
     'It seems that you are one of those who are incapable of being useless.'

The only possible case of fusion in this example are the meanings '2nd person' and 'be' that seem to be fused in the morpheme *-siniz*.

In addition to illustrating agglutination, example (8) illustrates a highly synthetic structure in Turkish. However, it would be inaccurate to characterize Turkish in general as being polysynthetic just on the basis of this example. This is because structures with this degree of complexity are quite unusual in natural discourse in Turkish. By the test mentioned above involving 500 words of naturally occurring text, the M/W index for Turkish is about 2.3, making it synthetic, but not polysynthetic. Of course, if one chooses a 500-word excerpt that contains even one such polysynthetic word, the index of synthesis may be skewed in the direction of polysynthesis. Such words, though interesting in their own way, may not accurately reflect the general morphological character of the language. For this reason, some linguists consider the notion of polysynthesis to be problematic (see Dixon 2010: 227–8 for a slightly different perspective on this issue). In any case, it is reasonable to exclude obviously outlying structures from consideration when calculating the overall morphological indices for a language.
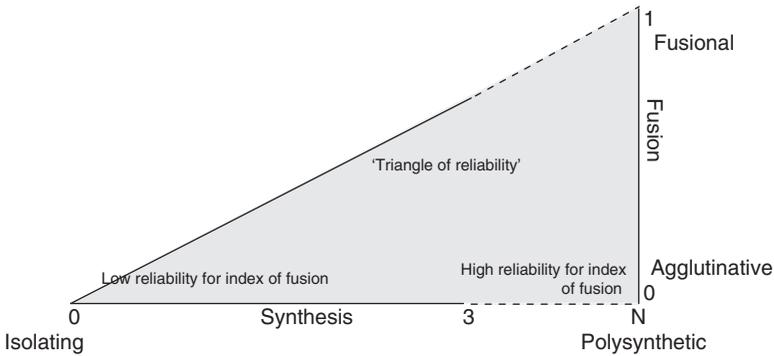
Figure 3.3 The interaction between the indices of synthesis and fusion

It is also reasonable to consider the genre of discourse that serves as one's sample. For example, the index of synthesis in a 500-word paragraph from an article in a medical journal in English would undoubtedly score much higher on the index of synthesis than an average secondary school essay. Therefore, it is advisable to seek excerpts that are unlikely to involve much complex technical vocabulary.

3.3.3   Interaction of Synthesis and Fusion

The index of synthesis is defined as the number of morphemes per word. Therefore, the more synthetic a language is, the greater the number of morpheme junctures in a given span of text. The more morpheme junctures one counts, the more reliable the calculated index of fusion is likely to be. In the extreme case of a highly isolating language, with no morpheme junctures at all, the index of fusion would always be 0/0, and hence irrelevant. If the language is mostly isolating, but does contain occasional morpheme junctures, an index of fusion may be calculated; however, it is not likely to be reliable unless many more than 500 words of text are considered, since the index of fusion depends on the number of junctures rather than the number of words. Thus, if synthesis and fusion are expressed as the axes of a two-dimensional graph, a 'triangle of reliability' may be described, as in Figure 3.3. Another way of expressing this idea is that the reliability of the index of fusion is proportional to the index of synthesis.

3.3.4   Synthesis and Monosyllabicity

In the nineteenth-century work on morphological typology, the notions of 'isolating language' and 'monosyllabic language' were treated as identical (see, e.g., von Humboldt 1836, in Losonsky 1999: 215). A monosyllabic language is one in which all words consist of one syllable, Chinese being the prime example for von Humboldt. However, it is

easily demonstrated that monosyllabicity and isolating typology do not necessarily coincide. A synthetic language may fuse many morphemes into a single syllable. We have seen this in the case of the Spanish monosyllabic suffix -*ó* which participates in up to five distinct paradigms. From this example, we might speculate as to whether languages exist in which entire sets of monosyllabic words may consist of paradigmatically regular variants. Such cases do exist, the best examples of which are in certain Western Nilotic languages.

Dinka, a Western Nilotic language spoken in South Sudan, is a largely monosyllabic language that exhibits three contrastive degrees of vowel length, three contrastive tones and two contrastive voice qualities. Andersen (1994) argues that morphologically complex monosyllabic verb forms in the Agar dialect of Dinka can be analysed in terms of variations in these features at different morphological 'strata'.

The system of inflection and derivation is understandably quite complex, but the general character of the system may be grasped by inspection of a complete paradigm for one transitive verb. The paradigm for the verb *tẹem* 'to cut' is given in Table 3.3. In these forms, vowel length is indicated by number of vowel characters: /v/ short, /vv/ medium and /vvv/ long. The lower diacritics indicate voice quality: creaky voice / ̰ /, and breathy voice / ̤ /. The upper diacritics indicate tone: high / ́ /, low / ̀ / and falling / ^ /. Diacritics are indicated once for each vowel, regardless of the number of vowel characters. The rows refer to the following categories: 'simple' form (present time reference) (0), Non-finite (NF), Non-topic Subject (NTS), First, Second and Third person subjects in the singular and plural, Passive (PASS) and Passive, Circumstantial Topic (PASS:CT). The columns refer to directional and valence categories. There is considerable homophony in this system, but Andersen argues convincingly that all of these categories are represented in the system and do form regular patterns for various classes of verb roots, depending on their underlying CV structure.

Table 3.3 *Synthesis and monosyllabicity in Dinka (from Andersen 1994: 29)*

	Simple	CF	CP	B	BAP	AP
			Transitive verb tẹem 'to cut'			
0	tẹ̀em	teẹ́em	teẹ̀em	tẹ́em	tẹ́em	tẹ̀m
NF	teẹ́em	tɛɛ́ɛm	tɛɛ̀ɛm	tɛ̣́ɛm	tɛ́ɛm	tẹ̀m
NTS	teẹ́em	teẹ́em	teẹ́em	tẹ́em	tẹ́em	tẹ́em
1sg	tɛɛ̀ɛm	tɛɛ́ɛm	tɛɛ̀ɛm	tẹ́em	tɛ́ɛm	tẹ̀ɛm
2sg	tẹ́em	tɛɛ́ɛm-ẹ́	teẹ̀em	tẹ̀em-ẹ́	tẹ̀ɛm-ẹ́	tẹ̀ɛm-ẹ́
3sg	teẹ̀em	teẹ́em	teẹ̀em	tẹ́em	tẹ́em	tẹ̀em
1pl	tẹ̀em-kụ́	teẹ́em-kụ̀	teẹ̀em-kụ́	tẹ́em-kụ̀	tẹ́em-kụ̀	tẹ́m-kụ̀
2pl	tɛ̀ɛm-kạ́	tɛɛ́ɛm-kạ̀	tɛɛ̀ɛm-kạ́	tɛ́ɛm-kạ̀	tɛ́ɛm-kạ̀	tạ́m-kạ̀
3pl	tẹ̀em-kẹ́	teẹ́em-kẹ̀	teẹ̀em-kẹ́	tẹ́em-kẹ̀	tẹ́em-kẹ̀	tẹ́m-kẹ̀
PASS	tẹ́em	teệem-è	teệem-è	tệem-è	tệem-è	tệem-è
PASS:CT	teệem-è	teệem-è	teệem-è	tệem-è	tệem-è	tệem-è

As can be seen in Table 3.3, most of these morphological categories are expressed autosegmentally by voice quality (phonation type), vowel length or tone. Even the suffixal component that appears in many of the forms is accompanied by an autosegmental component in the root. Therefore each instance of each of these categories in discourse would count as a fusional juncture, in addition to the agglutinative juncture that occurs in the forms that contain suffixes. If my understanding of this system is correct, the only form that contains no junctures is the simple, uninflected form (the upper-left cell, unshaded in Table 3.3). The lightly shaded cells represent one fusional juncture; medium shading represents two fusional junctures and the darkly shaded cells (the last five cells in the bottom row) contain three fusional junctures each. Although calculations have not been done on naturally occurring texts in Dinka, one can see that the index of fusion would probably be quite high – on the order of 4/5 or about .8. This is in spite of the fact that Dinka is 'to a large extent a monosyllabic language' (Andersen 1994: 1). Thus we might characterize Dinka as a synthetic, fusional, largely monosyllabic language.

3.4   Conclusion

In summary, the ways in which languages characteristically form words from smaller meaningful pieces was the first typological parameter to be investigated by linguists. Though early works were strongly influenced by nineteenth-century Euro/American attitudes towards race and evolution, the field has matured and continues to provide valuable insights into how speakers use their languages to accomplish communicative work. Modern linguistic grammars regularly include a section on morphological typology. Knowing something about the morphological typology of a language can help a fieldworker or second language learner develop a sense of the general 'character' of a language, as well as provide meaningful bases for comparing languages.

Two indices for calculating the morphological typology of a language are presented, based on the work of Sapir ([1921] 1939), Greenberg (1954) and Comrie ([1976] 1989). These are the index of synthesis and the index of fusion. The index of synthesis refers to the average number of morphemes per word (M/W) in texts in a language, while the index of fusion refers to the number of fusional morpheme junctures to the total number of morpheme junctures (Fj/J). Though these indices are logically independent of one another, in practice, the index of fusion can be reliably calculated only for languages that are at least somewhat synthetic (M/W ratio >1). Since strictly isolating languages (M/W=1) contain no morpheme junctures, an index of fusion cannot be calculated for such a language.

It has also been shown that the index of synthesis is logically and empirically distinct from the notion of monosyllabicity. That is, languages may fuse many morphemes into single syllables and as a consequence exhibit both synthetic and monosyllabic morphological characteristics.

Notes

1. In Sprachen hingegen, die statt der flexion nur affixa haben, sind die Wurzeln nicht eigentlich das; klein fruchtbarer Same, sondern nur wie ein haufen Atome, die jeder Wind des Zufalls leicht aus einander trieben oder zusammenführen kann.
2. All examples cited in this paper are presented in a current standard format for linguistic examples. In many cases this differs from their presentation in the original sources. The orthography, as well as morpheme and word boundaries (if any) are not changed, but the convention of glossing morphemes in an interlinear manner is added, based on information provided in the original.
3. Here I refer to the traditional distinction between morphophonemic and regular phonemic variation. Morphophonemic variation is allomorphic variation that applies only to certain morphemes, or only when morpheme boundaries are crossed, whereas regular phonemic variation is allomorphy that occurs throughout the language, irrespective of morpheme boundaries. For example, the variation between {s} and {-z} for the regular plural suffix in English is phonemic, since there is a general constraint against [z] after voiceless sounds.
4. Note that this is different from Greenberg's index of agglutination, which counts the number of agglutinative junctures compared to the total number of morpheme junctures. The figures are complementary and can easily be translated from one to the other, e.g. an index of agglutination of 7/8 would translate directly to an index of fusion of 1/8.
5. This is similar to the case of Turkish in which the vowel qualities of suffixes varies according to a general vowel harmony rule that operates over an entire phonological word. Similarly, the allomorphic variation of the major class inflectional suffixes in English is consistent with general syllable structure constraints (e.g. [z] never follows a voiceless sound).

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