

# ON THE ORDER OF DEMONSTRATIVE, NUMERAL, ADJECTIVE, AND NOUN

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This article reports on a typological study of the order of demonstrative, numeral, adjective, and noun, based on a sample of 576 languages. I propose a set of five surface principles which interact to predict the relative frequencies of the different orders of these four elements, whereby the more principles an order conforms to, the more frequent it will be. I provide evidence that the relative frequencies of the different orders can only be described and explained in terms of semantic notions of demonstrative, numeral, and adjective, independent of their syntactic realization, and not in terms of syntactic categories. I compare my approach to a generative account of the same phenomenon by Cinque (2005). I argue that my approach accounts for the relative frequencies of the different orders better than Cinque's in a number of respects.\*

*Keywords:* word order, noun phrases, Greenberg's universal 20, demonstratives, numerals, adjectives

**1. INTRODUCTION.** There are twenty-four logically possible orders of demonstrative, numeral, adjective, and noun (as there are for any four elements), such as the Dem-Num-Adj-N order of English, illustrated in 1.

(1) those three black horses

Dem Num Adj N

The goal of this article is to report on a study of the order of these four elements in a sample of 576 languages.<sup>1</sup> I present data on which of the twenty-four orders are attested in this sample and on the relative frequencies of the attested orders, and I propose a set of principles to account for the relative frequencies of the various orders.

The article is organized as follows. I first present the basic data on the frequency of each of the twenty-four orders in my sample and discuss the extent to which universal 20 of Greenberg 1963 accounts for the attested and nonattested orders (§2). In §3, I propose a set of five principles and show how they account for the relative frequencies of the different orders by demonstrating that the more principles a given order violates, the less frequent it is. I then present evidence in §4 that the relative frequencies of the three types of adnominal modifiers relative to the noun and relative to each other can only be explained if we interpret the notions of demonstrative, numeral, and adjective as semantic notions rather than as syntactic categories. In §5 I discuss possible explanations for the proposed five principles, and I compare my account to Cinque's (2005) account of the relative frequencies of the different orders (including which orders are attested and unattested) in §6. In §7, I discuss two papers that compare an early account of mine with Cinque's and one paper comparing the account in this article with Cinque's, and then briefly discuss proposals by Hawkins (1983) and Rijkhoff (2002, 2008) in §8 and

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<sup>1</sup> The sample of languages is a convenience sample, made up of those languages from my larger typological database (much of it represented in my chapters in Dryer & Haspelmath 2013) for which I have data on the order of these four elements and for which a single order is dominant. Additional information about the sample and other supplementary materials accompanying this article can be accessed online at <http://muse.jhu.edu/resolve/54>.

§9, respectively, that bear on the claims here. Finally, I discuss some experimental work by Jennifer Culbertson in collaboration with a number of other people that is directly relevant to the phenomena discussed in this article (§10).

**2. THE FREQUENCIES OF THE DIFFERENT ORDERS.** Universal 20 of Greenberg 1963, given in 2, claims that only twelve of the twenty-four logically possible orders of demonstrative, numeral, adjective, and noun are found among the languages of the world.

- (2) UNIVERSAL 20 (Greenberg 1963): When any or all of the items (demonstrative, numeral, and descriptive adjective) precede the noun, they are always in that order. If they follow, the order is either the same or its opposite.<sup>2</sup>

In Table 1 are listed the twenty-four logically possible orders of these four elements, followed by the number of languages of that type in my sample, where an asterisk indicates an order excluded by Greenberg's universal 20. I give in parentheses the abbreviations I use for the orders in the remainder of the article, the uppercase letters standing for the three modifiers, demonstratives (D), numerals (N), and adjectives (A), and the lowercase 'n' standing for the noun.

IF ALL THREE MODIFIERS PRECEDE THE NOUN		IF ALL THREE MODIFIERS FOLLOW THE NOUN	
Dem-Num-Adj-N (DNAn)	113	N-Adj-Num-Dem (nAND)	182
*Adj-Num-Dem-N (ANDn)	0	N-Dem-Num-Adj (nDNA)	8
*Dem-Adj-Num-N (DANn)	3	*N-Num-Adj-Dem (nNAD)	11
*Num-Dem-Adj-N (NDAn)	2	*N-Adj-Dem-Num (nADN)	36
*Num-Adj-Dem-N (NADn)	0	*N-Dem-Adj-Num (nDAN)	13
*Adj-Dem-Num-N (ADNn)	0	*N-Num-Dem-Adj (nNDA)	1
IF TWO OF THEM PRECEDE THE NOUN		IF TWO OF THEM FOLLOW THE NOUN	
Dem-Num-N-Adj (DNnA)	40	Adj-N-Num-Dem (AnND)	5
*Num-Dem-N-Adj (NDnA)	0	Adj-N-Dem-Num (AnDN)	5
Dem-Adj-N-Num (DANn)	12	Num-N-Adj-Dem (NnAD)	67
*Adj-Dem-N-Num (ADnN)	0	Num-N-Dem-Adj (NnDA)	5
Num-Adj-N-Dem (NAnD)	8	Dem-N-Adj-Num (DnAN)	53
*Adj-Num-N-Dem (ANnD)	0	Dem-N-Num-Adj (DnNA)	12

TABLE 1. Number of languages of each word-order type in my sample of 576 languages.

The data in Table 1 shows that six of the types excluded by Greenberg's universal 20 are in fact attested, although the existence of some of these types has been mentioned in the previous literature. For example, Hawkins (1983) cites instances of nADN and nDAN order, and Cinque (2005) cites instances of nNAD order. The first of these orders is illustrated in 3, from Akha, a Tibeto-Burman language spoken in Burma and China.<sup>3</sup>

<sup>2</sup> As noted by Hawkins (1983:118), there is an ambiguity in Greenberg's wording as to whether the 'they' in 'they are always in that order' refers to all three modifiers or just those that precede the noun. Consider a language where the demonstrative precedes the noun while the adjective and numeral both follow. Under the first interpretation of Greenberg's wording, the only possible order would be Dem-N-Num-Adj, not Dem-N-Adj-Num. Under the second interpretation, both Dem-N-Num-Adj and Dem-N-Adj-Num would be possible since if only one modifier precedes the noun, there is only one order among modifiers preceding the noun. But Greenberg's universal 20 under the first interpretation is clearly false: not only is Dem-N-Adj-Num one of the most common orders, as shown in Table 1, but it is also clearly more common than Dem-N-Num-Adj. Since Greenberg was presumably aware of Dem-N-Adj-Num languages, the second interpretation is apparently the one he intended.

<sup>3</sup> Abbreviations used in glosses throughout the article are as follows: ABS: absolutive, ATTR: attributive, CLF: classifier, CN: common noun, COMPL: completive, DAT: dative, DEF: definite, DEM: demonstrative, DIM: diminutive, DIR: directional, DUR: durative, EVTV: eventive, FAC: factual marker, GEN: genitive, GEND: gender agreement marker, IND: indicative, LA: locative applicative, LAT: lative case, LNK: linker, N.MRKR: noun

- (3) Akha (Hansson 2003:241)  
 tshóhà jòmý khó nji yà  
 person good those two CLF  
 N Adj Dem Num  
 ‘those two good persons’

The most significant way in which Greenberg’s universal 20 is inaccurate is that while his universal allows only two orders when all three modifiers follow the noun, not only are all six possibilities attested, but three orders that his universal excludes (nADN, nDAN, and nNAD) are also more frequent in my sample than one of the orders his universal allows (nDNA). Because of the existence of these orders, Hawkins (1983:119) proposes a revision to Greenberg’s universal 20:

When any or all of the modifiers (demonstrative, numeral, and descriptive adjective) precede the noun, they (i.e. those that do precede) are always found in that order. For those that follow, no predictions are made, though the most frequent order is the mirror-image of the order for preceding modifiers. In no case does the adjective precede the head when the demonstrative or numeral follow.

This asymmetry between prenominal and postnominal modifiers is reflected in my data: all eight orders excluded by Greenberg’s formulation that involve two or three modifiers preceding the noun (listed in Table 1) are either unattested or rare.

However, my sample does include two orders excluded by both Greenberg’s formulation and Hawkins’s restatement—two orders where all three modifiers precede the noun, but not using DNAn word order. One of these types, DANn, is represented by three languages in my data: Dhivehi (an Indic language) and two Nakh languages, Chechen and Ingush. This is illustrated in 4 for Dhivehi and in 5 for Ingush.

- (4) Dhivehi (Cain & Gair 2000:33; see also Gnanadesikan 2017:191, 194)  
 mi ra<sup>a</sup>gaļu tin fot  
 this good three book  
 Dem Adj Num N  
 ‘these three good books’
- (5) Ingush (Nichols 2011:446)  
 uq b-oaqqa-cha qea wazh-agh  
 this.OBL GEND-big-OBL three.OBL apple-LAT  
 Dem Adj Num N  
 ‘(about) these three big apples’

The second type in my sample where all three modifiers precede the noun but not in DNAn order is NDAn, represented by two languages, Waigali and Sierra Popoluca, discussed briefly in §6.

**3. FIVE PRINCIPLES GOVERNING THE RELATIVE FREQUENCIES OF THE DIFFERENT ORDERS.** In this section I propose five principles to account for the relative frequencies of the different orders. I propose that these principles interact in such a way that the more principles a given order conforms to, the more frequent it will be; the most common order conforms to all five principles, while orders conforming to only two are either rare or unattested, and orders conforming to only one principle are completely unattested. The approach is similar in spirit to Greenberg’s (1963) appeal to the interaction of dominance principles and harmony principles to explain the relative frequencies of different orders and to proposals by Tomlin (1986) of a set of principles to explain the

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marker, NC8: noun class 8 prefix, NOM: nominative, OBL: oblique, OPT: optative, PAUC: paucal, PL: plural, POSS: possessive, PPN: personal proper noun, PRF: perfect, PRS: present, PST: past, REL: relative, RES: resultative, SBJ: subject, SG: singular, SUBORD: subordinator, TRIPL: triplural, UV: undergoer voice.

relative frequencies of the six orders of subject, object, and verb. All five of the principles I appeal to have been previously proposed as independent principles.

The first two are principles that I call **ICONICITY PRINCIPLES**, which refer to the relative proximity of different modifiers to the noun when these modifiers occur on the same side of the noun. The first principle refers to the position of the demonstrative relative to the adjective and numeral, and the second refers to the position of the adjective relative to the numeral.

(6) Principles 1 and 2

- a. **ICONICITY PRINCIPLE 1:** The demonstrative tends to occur outside the adjective and numeral (i.e. further from the noun) when the demonstrative and the adjective or numeral (or both) occur on the same side of the noun.
- b. **ICONICITY PRINCIPLE 2:** The adjective tends to occur inside the numeral (i.e. closer to the noun) when they occur on the same side of the noun.

For example, languages that are nADN conform to iconicity principle 2, but not iconicity principle 1, since the demonstrative is closer to the noun than the numeral is.

The third principle is of a different nature. It is designed to capture the fact that exceptions to the two iconicity principles given above are much more common among modifiers following the noun than they are among modifiers preceding the noun.

- (7) **Principle 3: ASYMMETRY PRINCIPLE:** The iconicity principles apply more strongly to prenominal modifiers than they do to postnominal modifiers; exceptions to the iconicity principles will occur only with postnominal modifiers.

Any language conforming to both iconicity principles will automatically conform to the asymmetry principle. What this means is that a language that violates one of the iconicity principles will also violate the asymmetry principle if the violation involves prenominal modifiers but will conform to it if the violation involves postnominal modifiers.

The fourth principle is simply a principle favoring noun-adjective order over adjective-noun order.

- (8) **Principle 4: POSTNOMINAL ADJECTIVE PREFERENCE:** Noun-adjective order is preferred over adjective-noun order.

This preference is observed by Greenberg (1963:100) and is illustrated by the fact that in Dryer 2013a, N-Adj languages outnumber Adj-N languages 878 to 373.

The last principle is one that favors orders in which all three modifiers occur on the same side of the noun. I consider this an instance of a more general principle whereby dependents of any head will occur on the same side of the head. I call this **INTRACATEGORIAL HARMONY** (in contrast to the notion of crosscategorical harmony proposed by Hawkins (1983), whereby dependents of different heads tend to occur on the same side of their head).

- (9) **Principle 5: INTRACATEGORIAL HARMONY:** The demonstrative, numeral, and adjective tend to all occur on the same side of the noun.

The approach I take here to explaining the relative frequencies of different orders of the three elements plus the noun relative to each other involves two stages. Rather than proposing principles that directly explain the relative frequencies, I employ an intermediate level of what I call **DESCRIPTIVE PRINCIPLES**, of which the five principles I have just proposed are instances. These principles are formulated in terms of grammatical notions and are in themselves explanatory only in a superficial sense. To fully explain the relative frequencies, one needs to provide explanations for the descriptive principles. The reason I employ this intermediate level is that it is possible to rigorously test such principles in the sense that one can test how well they account for the relative frequencies, whereas explanations for such principles tend to be more speculative and not

easy to test rigorously.<sup>4</sup> Furthermore, there can be competing hypotheses as to how to explain a given descriptive principle, and I take the question of how to explain these principles as a different enterprise from testing them. In some cases, the evidence for a descriptive principle may be strong but the explanation far from clear; this is the case, for example, with the asymmetry principle. I make some suggestions on how these five principles might be explained in §5 below.

The data in Table 2 below shows how well the five principles account for the relative frequencies of the different orders. Before we examine the table, it is necessary to describe the method employed in this article for computing these relative frequencies. The simplest approach would be to use the number of languages of each type. However, numbers of languages can be distorted by large genealogical groups and by languages in contact with each other (Dryer 2009). One approach that is superior to counting languages is to count genera containing languages of each type, where genera are genealogical groups comparable to the subfamilies of Indo-European.<sup>5</sup> This is the approach of Cysouw 2010 and Merlo 2015, discussed briefly in §7, which use data from a handout from an early version of the present article.

However, there is reason to believe that controlling for geography is as important as controlling for genealogy (Dryer 1989a, 2009, 2011, 2012, Cysouw 2013). It is not uncommon for neighboring families to share many typological features. For example, in my data on the order of numeral and noun, based on 1,446 languages, among pairs of languages that are in different families but within 1,000 km of each other, 74% share the same order of numeral and noun, while among pairs of languages in different families more than 1,000 km apart, only 48% share the same order of numeral and noun. When we consider analogous data for pairs of languages in the same family but in different genera, it turns out that among pairs of languages within 1,000 km of each other, 81% share the same order of numeral and noun, but among pairs of languages more than 1,000 km apart, only 68% share the same order of numeral and noun. In other words, pairs of languages in different families within 1,000 km of each other are more likely to share the same order of numeral and noun than pairs of languages in the same family (but in different genera) more than 1,000 km apart. Counting genera without considering geography does not give a reliable measure of the frequency of language types.<sup>6</sup>

The metric I use in this article considers both genealogy and geography. But how best to measure geography? The simplest way would be to measure the distance between two languages in terms of kilometers between them, as in the preceding paragraph. However, Cysouw, Dediu, and Moran (2012) argue that this is not ideal, since being 100 km apart in an area where the language density is low, like Siberia, is probably different from being 100 km apart in an area where the language density is high, like New Guinea, in that two languages 100 km apart in an area of low language density are more likely to resemble each other due to contact than two languages 100 km apart in an area

<sup>4</sup> See, however, discussion in §10 below of work by Culbertson, Smolensky, and Legendre (2012) and Culbertson and Adger (2014) arguing that there is experimental evidence of a cognitive preference for some of the generalizations expressed by my principles.

<sup>5</sup> As discussed in Dryer 1989a, the problem with counting languages is that where a given genus contains many languages of the same type, the language count is misleading. For example, my sample includes twenty-nine nAND languages in the Oceanic genus within Austronesian. Counting this genus once is a more accurate representation of the relative frequency of this type than counting twenty-nine languages separately.

<sup>6</sup> While the failure to control for geography is a problem for much quantitative work in typology, it is a particularly severe problem for Dunn, Greenhill, Levinson, and Gray's (2011) methodology. They employ methods developed in biology, where geography is largely irrelevant. As argued in Dryer 2011, 2012, it is possible to show that specific claims they make in reconstructing word order fail precisely because of their failure to consider the role of geography.

of high language density. They propose that the distance between two languages be measured by the number of languages between them. The measure used in this article for controlling for geography is based on this idea.

The method used here takes random samples of languages of a given type such that each pair of languages in the sample satisfies two criteria: (i) the two languages are not in the same genus, and (ii) there are at least ten languages between the two languages, where a language *X* is said to be between a language *Y* and a language *Z* if the distance between *X* and *Y* and the distance between *X* and *Z* are both less than the distance between *Y* and *Z*.<sup>7</sup> Languages are randomly added to each sample as long as they conform to these two criteria, until no additional languages can be added that conform to the criteria. I use the mean size of such samples over 10,000 trials as a measure of the frequency of that type. I refer to this metric below as the ADJUSTED FREQUENCY.

We now turn to Table 2. The second column lists the word-order types that are being examined. The third through seventh columns correspond to each of the five principles and identify which principle each order conforms to, where a blank means that the order conforms to that principle and an asterisk ('\*') means that it does not. The eighth column ('#\*s') shows the total number of asterisks in the preceding five columns and thus identifies how many principles that order violates. The ninth column ('#LGS') identifies the number of languages in my sample of that type, and the tenth column ('#GEN') the number of genera containing languages of that type. The last column gives the frequency of each type using the adjusted frequency metric described above.<sup>8</sup> The order in which the different types are listed in Table 2 is based on the adjusted frequency. If the adjusted frequency for two types is the same, the order is based on the number of genera. If the number of genera is the same, the order is based on the number of languages.

By inspecting the totals in the eighth column (labeled '#\*s'), which indicate how many principles each order does not conform to, one can see that with two exceptions (in boldface), the sequence is monotonic nondecreasing. Ignoring these two exceptions, there is one zero, then a series of 1s, then a series of 2s, then 3s, and then 4s. The first of these exceptions is DnNA (line 7), which violates two principles but is more common than two types that violate only one principle. The second exception is nNDA (line 18). This order violates two principles but is less common than three orders that violate three principles.

In the next section, I present evidence that the principles governing the order of these elements must involve semantic categories, not syntactic ones. In §5, I discuss possible explanations for the five principles.

<sup>7</sup> In computing the distance between two languages, I use the location of a point near the center of the area where a language is spoken as the location of that language. The choice of ten languages between in defining the metric is partly arbitrary. Using fewer languages between raises questions about whether geography has been adequately controlled for. Using more languages between tends to make the differences among the more frequent types (not just DNAn and nAND) similar due to a 'ceiling effect', since doing so decreases the possible number of languages of each type in a sample. In computing the number of languages between, I used only the 2,129 languages in my database rather than all languages.

<sup>8</sup> The adjusted frequencies in Table 2 were computed by taking a separate sample for each type. An alternative approach would be to take samples each of which contains languages of all types. The reason this alternative was not followed is that it measures the relative frequencies less accurately because of complications associated with controlling for genealogy, especially in overrepresenting the frequency of rarer types that occur in smaller genera compared to those that occur in larger genera. A disadvantage of the method used compared to this alternative method is that it does not represent the ratios between adjusted frequencies accurately because ceiling effects decrease the adjusted frequency of the more frequent types. However, since what is crucial for present purposes is the relative order of the types (rather than the ratios among frequencies), this disadvantage is less important.

									ADJUSTED	
		ICON1	ICON2	ASYM	HARMONY	N-ADJ	#*s	#LGS	#GEN	FREQ
1	nAND						0	182	85	44.17
2	DNAn					*	1	113	57	35.56
3	DnAN				*		1	53	40	29.95
4	DNnA				*		1	40	32	22.12
5	nADN	*					1	36	19	14.80
6	NnAD				*		1	67	27	14.54
7	<b>DnNA</b>		*		*		<b>2</b>	<b>12</b>	<b>10</b>	<b>9.75</b>
8	nDAN	*					1	13	11	9.00
9	nNAD		*				1	11	9	9.00
10	nDNA	*	*				2	8	6	5.67
11	DAnN				*	*	2	12	7	5.34
12	NAnD				*	*	2	8	5	4.00
13	AnND				*	*	2	5	3	3.00
14	NnDA	*			*		2	5	3	3.00
15	AnDN	*			*	*	3	5	3	2.50
16	DANn		*	*		*	3	3	2	2.00
17	NDAAn	*		*		*	3	2	2	2.00
18	<b>nNDA</b>	*	*				<b>2</b>	<b>1</b>	<b>1</b>	<b>1.00</b>
19	NADn	*		*		*	3	0	0	0
20	NDnA	*		*	*		3	0	0	0
21	ADnN	*		*	*	*	4	0	0	0
22	ADNn	*	*	*		*	4	0	0	0
23	ANDn	*	*	*		*	4	0	0	0
24	ANnD		*	*	*	*	4	0	0	0

TABLE 2. Frequencies of different orders and degree of conformity with my five principles.<sup>9</sup>

4. SYNTAX OR SEMANTICS? I have been using the terms *demonstrative*, *numeral*, and *adjective* as if it is clear what they denote. There are, however, two rather different ways to interpret these terms. The first is to consider them to be syntactic categories that are realized in all (or perhaps many) different languages. This interpretation is implicit in the proposals by Cinque (2005) to be discussed in §6 below. I argue in this section that syntactic categories are not relevant to either describing or explaining the relative frequencies of the different orders of these three elements and the noun. Rather, the relevant notions are semantic. As is illustrated in §4.1, the semantic notions of demonstrative, numeral, and adjective are realized by a wide variety of different syntactic constructions in different languages. I argue in this section that the crosslinguistic tendencies expressed by the principles I have proposed hold, to a large extent, regardless of what syntactic construction is employed in particular languages for representing these semantic notions.

An initial consideration arguing for this is that the data regarding the relative frequencies of the different orders is based on classifying languages according to the semantic categories. In other words, the data in this article and the data used by Greenberg (1963), which led him to propose his universal 20, as well as the data used by Hawkins (1983) and to a large extent that on which Cinque (2005) based his account, involves classifying languages according to the order of the SEMANTIC categories of demonstrative, numeral, adjective, and noun. In particular, the orders that are unattested or rare are unattested or rare regardless of the syntactic realization of these semantic categories. Similarly, the generalization that almost all languages conform to the iconicity principles for prenom-

<sup>9</sup> Key to Table 2: Icon1: iconicity principle 1, Icon2: iconicity principle 2, Asym: asymmetry principle, Harmony: intracategorical harmony, N-Adj: the postnominal adjective preference, #\*s: number of principles violated, #lgs: number of languages of given order, #gen: number of genera containing languages of given order.

inal modifiers holds regardless of the syntactic realization of these semantic categories. If the iconicity principles applied to only particular syntactic realizations of these semantic categories, then we would expect to find more instances of the rare or unattested orders involving other syntactic realizations of these semantic categories.

In §4.1, I summarize various ways in which semantic adjectives, numerals, and demonstratives are realized syntactically in different languages. In §4.2, I present evidence that the iconicity principles as they apply to semantic adjectives apply regardless of whether the semantic adjectives are verbs. More specifically, I provide evidence that even in languages in which semantic adjectives are verbs, they tend to occur inside the numeral or demonstrative (or both) when they occur on the same side of the noun as the numeral or demonstrative. In §4.3, I discuss evidence that numerals tend to occur outside adjectives and inside demonstratives, regardless of whether the language employs numeral classifiers. In §4.4, I argue that the postnominal adjective preference applies to semantic adjectives regardless of whether they are verbs. And in §4.5, I argue that intracategorical harmony is also based on semantic notions.

**4.1. SEMANTIC CATEGORIES AND SYNTACTIC CATEGORIES.** Consider first the notion of adjective. I am using the expression *semantic adjective* to denote words with a particular kind of meaning, namely, that of stative predicates which denote properties, regardless of their syntactic realization. We can distinguish a number of different ways in which semantic adjectives combine with nouns to express what English expresses with an adjective modifying the noun. One way is that employed by English: there is a distinct word class of adjectives that directly modify nouns (or, more accurately, occur as heads of adjective phrases that directly modify nouns). In many languages, however, semantic adjectives are grammatically verbs, and when they modify nouns, they are, strictly speaking, the verb in a relative clause that is modifying the noun, as in 10a from Ojibwa, where the structure is exactly the same as in the relative clause in 10b.

(10) Ojibwa (Rich Rhodes, p.c.)

- a. nini e-gnoozi-d  
man REL-tall-3SG  
'a tall man'
- b. nini e-ngamo-d  
man REL-sing-3SG  
'a man who is singing'

There are also languages in which semantic adjectives are grammatically verbs that occur in relative clauses, but the relative clause is not modifying the noun; rather, it is an internally headed relative clause, in which the noun (or noun phrase) is functioning as the subject of the semantic adjective, as in 11 from Ktunaxa (Kutenai). In this example, *ksahan patkiy* is an internally headed relative clause, in which *patkiy* is the subject of the verb *sahan* 'be bad', reflecting the general tendency for subjects to follow their verbs in Ktunaxa.<sup>10</sup>

(11) Ktunaxa

- hu wu·kat-i [k=sahan patkiy].  
1.SBJ see-IND [SUBORD=bad woman]  
'I saw the bad woman.'

Consider next numerals. In some languages numerals are clearly a distinct word class. In Irish, for example, numerals behave differently from adjectives, since they precede the noun, while adjectives follow it, as in 12.

<sup>10</sup> The Ktunaxa data in this article comes from my own field notes.

## (12) Irish (Nolan 2012:232)

dhá theach salach  
 two house dirty  
 Num N Adj  
 'two dirty houses'

In other languages, numerals behave much like adjectives and can be analyzed as a type of adjective, as in Swahili, where numerals take noun class prefixes, as in 13a, much like adjectives, illustrated in 13b.

## (13) Swahili (Ashton 1947:50, 47)

- a. vi-ti vi-wili  
 NC8(PL)-chair NC8(PL)-two  
 'two chairs'
- b. vi-ti vy-ema  
 NC8(PL)-chair NC8(PL)-good  
 'good chairs'

In other languages, numerals are verbs, and when modifying nouns they are really relative clauses. In 14a from Creek, for example, the word for 'two' occurs with verbal inflections; it occurs in a resultative perfective form, like the second verb in 14b, and is thus a relative clause, like both verbs in 14b.

## (14) Creek (Martin 2011:315, 392)

- a. honan-tá:ki hokkô:l-os  
 man-PL two:RES.PRF-DIM  
 'two men'
- b. asêy ifá wo'hk-í: a:-hôyl  
 that dog bark.EVTV-DUR DIR-stand:RES.PRF  
 'that dog standing over there barking'

In some languages in which numerals are verbs, they occur as the predicate in internally headed relative clauses, so that the noun (or noun phrase) is really the subject of the numeral verb, as in 15 from Ktunaxa, where *niçtahat* 'young man' is the subject of the verb *ʔas* 'two'; this is analogous to the internally headed relative clause with a semantic adjective as verb in 11 above.

- (15) hu wu-kat-i [ki=ʔas niçtahat].  
 1.SBJ see-IND [SUBORD=two young.man]  
 'I saw two young men.'

In still other languages, there is reason to analyze the numeral not as a modifier of the noun, but as the head of the construction, with the noun as a dependent of the numeral. This is the case in Rif Berber, illustrated in 16, where the structure consisting of numeral plus genitive marker plus NP in 16a is the same as the structure consisting of noun plus genitive marker plus NP in 16b.

## (16) Rif Berber (Kossmann 2000:160, 108)

- a. tlaʔa [n təwɾar]  
 three [GEN hill]  
 'three hills'
- b. axxam [n wəɾyaz]  
 house [GEN man]  
 'the man's house'

The construction in 16a is syntactically similar to partitive constructions in English (*three of the hills*) but lacks partitive meaning.

In other languages, numerals can or must combine with a numeral classifier. It seems likely that in at least some instances, either the classifier or the phrase consisting of numeral and classifier is head and the noun a dependent. For example, in 17 from Sre, a Mon-Khmer language, *bār nām* ‘two CLF’ (or perhaps just the classifier) may be the head, with the noun plus at least the adjective a complement of the classifier.

- (17) Sre (Manley 1972:157)  
       *bār nām sra? pa khay dō*  
       two CLF book new his this  
       Num N Adj Dem  
       ‘these two new books of his’

Whether classifier phrases are heads in most languages with numeral classifiers is not clear. But either way, the construction with numerals in such languages involves a different structure from what we find in languages without classifiers, where the numeral is simply modifying the noun.

Turning finally to demonstratives, there are again a number of different constructions that they occur in. I distinguish three types of languages in terms of how they treat demonstratives. First, in some languages (like English), demonstratives pattern with articles (and sometimes possessive words), in which case they can be analyzed as belonging to a category of determiners. Second, there are languages that have articles, but in which demonstratives appear in a different position in the noun phrase from definite articles and cooccur with articles. And third, there are languages that lack articles; whether one considers demonstratives in such languages to be determiners depends on one’s theoretical assumptions.<sup>11</sup>

**4.2. THE SEMANTIC BASIS OF THE ICONICITY PRINCIPLES AS THEY APPLY TO SEMANTIC ADJECTIVES.** One of the central claims of this article is that regardless of the construction used for demonstratives, numerals, and semantic adjectives, the generalizations governing the relative frequencies of different orders still apply. For example, regardless of the construction used, semantic adjectives tend to occur closer to the noun than numerals and demonstratives do when they occur on the same side of the noun. In this section, I provide evidence for this claim as it applies to semantic adjectives: I argue that these tend to occur inside numerals and demonstratives, regardless of whether they are verbs.

Cinque (2005, n. 2) suggests that in some languages that seem to be exceptions to his account (discussed in §6 below) of what orders are possible, in which adjectives appear outside numerals or even outside demonstratives, the so-called adjectives are really verbs and hence are really relative clauses.<sup>12</sup> He observes that relative clauses crosslinguistically tend to occur outside numerals and either inside or outside demonstratives, so that so-called adjectives that are really relative clauses should occur outside numerals. The problem is that there is considerable evidence that even in languages in which semantic adjectives are grammatically verbs, they still conform to the generalizations about the relative frequencies of the different orders. However, while I will show that this is largely correct, it is not the whole story: there do indeed seem to be some instances of less frequent orders that may reflect the particular syntactic structures in which the different semantic categories are realized.

<sup>11</sup> I did not include in this study languages in which the demonstratives are affixes on the noun, on the grounds that they are arguably inflectional morphology.

<sup>12</sup> Rijkhoff (2002:266–75, 2008:804) makes a similar proposal to explain some cases where adjectives occur outside demonstratives or numerals. The problems discussed here are equally well problems for Rijkhoff’s proposal. See §9 below.

If, as Cinque suggests, the principles governing the position of adjectives do not apply to languages in which semantic adjectives are verbs, then we would expect to find a number of such languages where the order (in terms of semantic categories) is DANn, ADNn, ANnD, or ADnN, since the semantic adjective in these orders is further from the noun than the numeral or demonstrative (or both). But only the first of these is attested, regardless of the syntactic realization of semantic adjectives. And among the languages of the one attested order among these four types, DANn, none is one in which semantic adjectives are verbs. In Dhivehi, for example, illustrated above in 4, semantic adjectives are not verbs: when used predicatively, as in 18, they lack the morphology that occurs on verbs.

(18) Dhivehi (Cain 2000:91)

mi fot ra<sup>n</sup>galu  
this book good  
'This book is good.'

Similarly, in Ingush, illustrated above in 5, it is clear that semantic adjectives are not verbs since they do not occur with verbal morphology and, when used predicatively, they occur with the copula verb, as in 19.

(19) Ingush (Nichols 2011:520)

Gettara dika d-y.  
very good GEND-be.PRS  
'That's wonderful.'

I am aware of no languages in which semantic adjectives are verbs where a prenominal semantic adjective can precede numerals or demonstratives.

Further support for the view that semantic adjectives that are verbs conform to the same principles governing the position of adjectives relative to demonstratives and numerals comes from evidence from a variety of languages. In Nias (data from the northern dialect; Lea Brown, p.c.), an Austronesian language spoken in Indonesia, both semantic adjectives and semantic numerals occur in relative clauses that follow the noun they modify (ignoring a distinct construction where the numeral precedes the noun, used when the NP is interpreted as indefinite). But adjective relative clauses occur inside the numeral relative clauses, while other relative clauses occur outside them. The grammaticality of 20a and ungrammaticality of 20b show that the verb *afusi* 'white', marked with a proclitic that occurs with relative clauses, must occur immediately after the noun, preceding a relative clause expressing a numeral.

(20) Nias (northern dialect; Lea Brown, p.c.)

- a. No u-bunu n-asu [s=afusi] [si=dua rozi].  
PST 1SG-kill ABS-dog [REL=white] [REL=two CLF]  
N Adj Num  
'I killed the two white dogs.'
- b. \*No u-bunu n-asu [si=dua rozi] [s=afusi].  
PST 1SG-kill ABS-dog [REL=two CLF] [REL=white]  
N Num Adj  
'I killed the two white dogs.'

But relative clauses based on nonstative verbs must occur outside relative clauses based on numerals, as the grammaticality of 21a and ungrammaticality of 21b show.

- (21) a. No u-bunu n-asu [si=dua rozi] [si=mörö].  
PST 1SG-kill ABS-dog [REL=two CLF] [REL=sleep].  
N Num Rel  
'I killed the two dogs that were sleeping.'

- 'I killed the two dogs that were sleeping.'

'those three black dogs [going around chasing cats]'

‘He is going to buy two big black pigs.’

'I saw the three female water buffaloes [caught by Mayaw].'

Hence relative clauses involving semantic adjectives in Amis behave differently from relative clauses containing other types of verbs in occurring closer to the noun than the numeral does.

The last case I discuss in detail is in some respects the strongest evidence that the determining factor is semantic rather than syntactic. In Chickasaw, a Muskogean language of the southeastern United States, both semantic adjectives and numerals occur as verbs and combine with nouns as verbs in internally headed relative clauses. In 25, for example, the noun *ofi* 'dog' is the subject of the verb *losa* 'be black' within one internally headed relative clause, while *ofi'losa* 'black dog' is the subject of the verb *tochchi'na* 'be three' within a second internally headed relative clause.

(25) Chickasaw (Pamela Munro, p.c.)

[[*Ofi' losa*]      *tochchi'na*] *yamm=at sa-lhiyoh-tok*.  
 dog be.black be.three      that=NOM 1SG.II-chase-PST  
 'Those three black dogs chased me.'

But despite the fact that neither *losa* 'be black' nor *tochchi'na* 'be three' is modifying the noun *ofi* 'dog', the preferred order of words is exactly that given in 25, with the semantic adjective occurring closest to the noun and the demonstrative occurring furthest from the noun, outside the two internally headed relative clauses. Despite the fact that the syntactic structure of 25 is radically different from more common structures in other languages, where the semantic adjective, numeral, and demonstrative are modifying the noun, these three elements follow the noun in the same order as that found in more common structures in other languages.

Similar evidence that semantic adjectives tend to occur closer to the noun than do relative clauses based on nonstative verbs is found in a variety of other languages. In Keo (Baird 2002:134, 186), Tuvaluan (Besnier 2000:139, 151), Lolovoli Northeast Ambae (Hyslop 2001:105, 231), and Kham (Watters 2002:111), semantic adjectives are verbs; but in all four languages, they occur closer to the noun than numerals do, while relative clauses based on nonstative verbs occur outside numerals. Similarly, in Shanghai Wu, semantic adjectives are marked the same way as relative clauses and occur inside demonstratives, while other relative clauses occur outside demonstratives (Zhu 2006:135). In Maybrat (Brown 1990, Dol 1999), a West Papuan language of Papua (the Indonesian part of New Guinea), semantic adjectives are clearly verbs, but they occur inside possessive phrases, while other relative clauses occur outside possessive phrases (Brown 1990:47). Similar facts are found in *Tukang Besi* (Donohue 1999:304), an Austronesian language spoken in Indonesia, where semantic adjectives precede possessive clitics, while eventive relative clauses follow such clitics. And in *Nahavaq*, an Oceanic language of Vanuatu, stative relative clauses occur inside possessive pronouns and the definite article, while eventive relative clauses tend to occur outside these words (Dimock 2009:115). Finally, in *Turkana* (Dimmendaal 1983:206), a Nilotic language spoken in Kenya, stative relative clauses occur inside numerals and demonstratives, while nonstative relative clauses occur outside. We find a repeated pattern in all of these languages, whereby semantic adjectives that are verbs occur closer to nouns than do relative clauses based on nonstative verbs. The apparent conclusion is that the principles governing the relative frequencies of different positions of semantic adjectives relative to other modifiers apply regardless of whether the semantic adjectives are verbs.

It would be a mistake, however, to claim that the particular syntactic properties of semantic adjectives never make a difference. Yapese, an Austronesian language of Mi-

cronesia, illustrated in 26, is an instance of an NnDA language. Example 26a illustrates the N-Dem-Adj order, while 26b illustrates Num-N order.

(26) Yapese (Jensen 1977:168, 156)

- a. rea kaaroo roog neey ni ba roowroow  
 SG car 1SG.POSS this REL be red  
 N Dem Adj  
 'this red car of mine'
- b. ruw ea kaaroo  
 two LNK car  
 Num N  
 'two cars'

But it is clear that the semantic adjective in 26a is formally a relative clause, since it occurs with the copula *ba* 'be'. Hence it is possible that its position outside the demonstrative is due, in part, to its being a relative clause.

A case somewhat similar to Yapese is presented by Slave, an Athapaskan language of northern Canada, as illustrated in 27.

(27) Slave (Rice 1989:1316)

- Michael hayi luge [tat'e i] [lek'a i] [welu i] wohsee.  
 Michael N.MRKR fish [three REL] [3.fat REL] [3.netted REL] 1SG.OPT.boil  
 N Num Adj  
 'I will boil the three fat fish that Michael netted.'

Slave is a DnNA language, with the semantic adjective outside the numeral. But in fact, both the semantic adjective and the numeral are in relative clauses, so it is not unreasonable to suggest that the fact that the semantic adjective is a relative clause is perhaps relevant to the fact that it occurs outside the numeral.

As discussed above and illustrated in 26, Yapese is an example of an NnDA language, where the semantic adjectives are syntactically relative clauses, so the fact that the semantic adjective occurs outside the demonstrative could be explained in terms of its being a relative clause. But this will not explain at least some other instances of NnDA languages. Cinque himself notes that Kilivila, an Austronesian language of Papua New Guinea, is a possible instance of an NnDA language, but suggests that, as appears to be the case in Yapese, the semantic adjective may really be a verb in a relative clause. But close examination of Kilivila shows that this is not the case. Semantic adjectives are not verbs in Kilivila; they do not occur with the subject affixes that occur on verbs. Compare the semantic adjective *nanakwa* 'fast' functioning as predicate in 28, without a subject prefix, with the verb *kaliseva* 'run off', which does occur with a subject prefix.

(28) Kilivila (Senft 1986:87)

- m-to-si-na su waga sena nanakwa taga ma-waga-si  
 this-human-PL-this 3PL.POSS canoe very fast but 1PL-canoes-PL  
 i-kaliseva-si.  
 3-run.off-PL  
 'Their canoes are very fast, but our canoes are outstanding.' (lit. 'they run off')

There are also languages that are DnNA, like Slave, but where the semantic adjective is not a relative clause. This is the case with Girawa, a Trans-New Guinea language. Ex-

ample 29 illustrates Girawa's N-Num-Adj order; the semantic adjective *mokup* 'black' lacks verbal inflection and is not a verb.

- (29) Girawa (Gasaway et al. 1992:48)  
 na-n en oirori mokup ra-u.  
 2SG-GEN dog two black be.at-3SG.PRS  
 'Your two black dogs are (there).'

The same is true for another DnNA language, Camus, a Nilotic language spoken in Kenya (Heine 1980:109). The general conclusion is that some instances in which semantic adjectives occur further from the noun than numerals or demonstratives do may be partially explained away on the grounds that they are relative clauses. But there are many other cases in which semantic adjectives that are not verbs occur further from nouns than numerals or demonstratives do, despite not being verbs.

That cases like Yapese and Slave are exceptional is made clear by examining the relationship between the position of semantic adjectives relative to numerals and demonstratives in a language and whether the semantic adjectives are verbs. Table 3 provides data on the relationship between the verbal status of semantic adjectives and whether they are closer to the noun than the numeral is when both occur on the same side of the noun.<sup>13</sup> In Tables 3 to 10, the columns labeled 'Frequency' (FREQ) are based on adjusted frequency, as explained in §3,<sup>14</sup> and the percentage figure in the right-hand column is based on the adjusted frequencies, rather than the raw language numbers. For example, the 90% on the first line of Table 3 is based on 27.90 as a percentage of the sum of 27.90 and 3.25.

Table 3 shows that semantic adjectives occur closer to the noun than numerals do, regardless of whether they are verbs. There is a small difference between languages in which semantic adjectives are verbs and languages in which they are not in that seman-

	Adj closer to noun than Num		Adj further from noun than Num		% closer
	#LGS	FREQ	#LGS	FREQ	
Adj is verb	53	27.90	7	3.25	90%
Adj is not verb	214	69.17	21	5.04	93%

TABLE 3. Relationship between whether semantic adjectives are verbs and whether they occur closer to the noun than numerals do when both occur on the same side of the noun.

<sup>13</sup> My classification of whether semantic adjectives are verbal in a given language is based on three criteria: (i) Does the semantic adjective occur with verbal morphology? (ii) Does the semantic adjective occur with nominal morphology? (iii) Does or can the semantic adjective occur with a copula when used predicatively? If the answer to the first question is 'yes' or the answer to neither of the other two questions is 'yes', then I classify the language as one where the semantic adjective is verbal. Languages that cannot be classified by these criteria include isolating languages with little or no inflectional morphology on either nouns or verbs and without a copula, languages where the above criteria yield contradictory results, and languages where some semantic adjectives are verbal while others are nonverbal.

<sup>14</sup> The adjusted frequencies in Tables 3 to 10 below are computed differently from those in Table 2 above. In computing the adjusted frequencies in Table 2, samples were constructed for each individual type. In computing those in Tables 3 to 10, in contrast, the samples include both types for each row. For example, the adjusted frequencies given on the first line of Table 3 are based on samples of languages where the semantic adjective is a verb and include both languages in which the adjective is closer to the noun than the numeral is and languages where it is the numeral that is closer to the noun. As explained in n. 8, the method used for Table 2 was chosen because the relative ordering was more important than the ratios between the frequencies of different types. However, for Tables 3 to 10, it is the ratios that are important, and constructing samples containing both types provides a more accurate estimate of the ratios.

tic adjectives that are verbs occur closer to the noun somewhat less often than semantic adjectives that are not (90% vs. 93%). This difference probably reflects languages like Slave (illustrated above in 27), showing that it is not semantics alone that determines the order of semantic adjectives relative to numerals. However, since the percentages are high for both types of languages, the implication is that it is determined primarily by semantics.

Table 4 gives analogous data for semantic adjectives and demonstratives.

	Adj closer to noun than Dem		Adj further from noun than Dem		% closer
	#LGS	FREQ	#LGS	FREQ	
Adj is verb	66	32.64	5	2.63	93%
Adj is not verb	217	67.32	20	6.92	91%

TABLE 4. Relationship between whether semantic adjectives are verbs and whether they occur closer to the noun than demonstratives do when both occur on the same side of the noun.

Again, we see that the preference for the semantic adjective to be closer to the noun than the demonstrative is approximately the same, regardless of whether the semantic adjective is a verb. We can conclude that the iconicity principles, as they apply to semantic adjectives, are primarily based on semantics.

**4.3. THE SEMANTIC BASIS OF THE ICONICITY PRINCIPLES AS THEY APPLY TO NUMERALS.** The evidence I have presented so far demonstrates that semantic adjectives tend to occur closer to nouns than numerals do, regardless of the syntactic construction used for semantic adjectives. I turn now to evidence that the iconicity principles apply to numerals regardless of the construction used. Some of the evidence presented in the last section is also relevant here. Much of that evidence showed that numerals occur outside semantic adjectives regardless of the construction used for semantic adjectives, but insofar as different constructions are used for numerals, that evidence is relevant here as well. In Nias, for example, numerals occur outside semantic adjectives (but inside relative clauses based on nonstative verbs) even though the numerals are themselves in relative clauses. Similarly, in Chickasaw, both semantic adjectives and numerals occur as verbs in internally headed relative clauses, but the numeral verbs occur further from the noun than do the verbs expressing semantic adjectives, and both are closer to the noun than demonstratives are. And in Kulina, an Arauan language spoken in Brazil (Dienst 2014), numerals are verbs, and when modifying nouns, they occur in relative clauses, but they still conform to iconicity principles in that they occur outside adjectives and inside demonstratives, when the demonstrative follows the noun (although demonstratives more commonly precede nouns in Kulina).

The primary evidence presented in this section argues that in languages with numeral classifiers, the combination of numeral and classifier tends to occur outside the semantic adjective but inside the demonstrative when they occur on the same side of the noun. In other words, the presence of classifiers does not significantly affect the position of numerals relative to semantic adjectives and demonstratives, even though in some such languages, the numeral plus classifier may not be modifying the noun but may itself (or just the classifier) be the head. For example, in Begak Ikaan, an Austronesian language spoken in New Guinea, numerals normally occur with classifiers, and the numeral plus classifier most frequently follows the noun, as do the adjective and demonstrative (Goudswaard 2005). But the numeral plus classifier occurs outside adjectives and inside demonstratives, as in 30.

## (30) Begak Idaan (Goudswaard 2005:272)

asu gayo tǝllu tassa' no  
 dog big three CLF yonder  
 'those three big dogs'

Tables 5 and 6 provide data on possible differences between languages with and without numeral classifiers with respect to the iconicity principles. Table 5 examines the difference between languages with and without these classifiers in terms of whether the numeral is closer to the noun than the demonstrative is when both occur on the same side of the noun.

	Num closer to noun than Dem		Num further from noun than Dem		% closer
	#LGS	FREQ	#LGS	FREQ	
Lg has numeral classifiers	78	31.45	10	1.67	95%
Lg lacks numeral classifiers	167	59.70	37	9.30	87%

TABLE 5. Relationship between whether a language has numeral classifiers and whether numerals occur closer to the noun than demonstratives do when both occur on the same side of the noun.

What Table 5 shows is that there is a preference for the numeral to occur closer to the noun than the demonstrative does, both in languages with and in those without numeral classifiers. But Table 5 also shows that this preference is actually stronger in languages with numeral classifiers (95% vs. 87%). If the preference for numerals to occur inside the demonstrative were based on syntactic categories, we would expect a difference to be in the opposite direction.

Table 6 gives analogous data for the relative order of semantic adjectives and numerals.

	Adj closer to noun than Num		Adj further from noun than Num		% closer
	#LGS	FREQ	#LGS	FREQ	
Lg has numeral classifiers	88	30.10	4	2.50	92%
Lg lacks numeral classifiers	176	60.69	19	6.27	91%

TABLE 6. Relationship between whether a language has numeral classifiers and whether semantic adjectives occur closer to the noun than numerals do when both occur on the same side of the noun.

Table 6 also shows little difference between languages with numeral classifiers and languages lacking them; in both types of languages, the semantic adjective shows a strong tendency to occur closer to the noun when it appears on the same side of the noun as the numeral.

The evidence in this and the preceding section shows that the principles governing the relative order of demonstrative, numeral, and adjective when they occur on the same side of the noun are primarily semantic, that the same tendencies occur regardless of the particular construction in which semantic adjectives and numerals occur. But what about the other principles I have proposed? In the next two sections, I consider the postnominal adjective preference and intracategorical harmony and ask whether these two are semantically based. I argue that in the former case it is, but that in the latter case, it is not clear. As far as the asymmetry principle is concerned, I have no basis for determining whether it is semantically based; it is possible that the iconicity principles are semantic but that the asymmetry principle is syntactic.

**4.4. THE SEMANTIC BASIS OF THE POSTNOMINAL ADJECTIVE PREFERENCE.** That the postnominal adjective preference is based on semantics is demonstrated by the fact that this preference is found whether or not semantic adjectives are verbs. Table 7 gives data

on the relationship between the order of semantic adjective and noun and whether semantic adjectives are verbs.

	N-Adj		Adj-N		% N-Adj
	#LGS	FREQ	#LGS	FREQ	
Adj is verb	120	44.39	37	15.38	74%
Adj is not verb	348	70.22	197	37.66	65%

TABLE 7. Relationship between whether semantic adjectives are verbs and the order of adjective and noun.

Table 7 shows that N-Adj order is somewhat more common in languages where the semantic adjective is a type of verb, with an adjusted frequency of 74% compared to 65% for languages where the semantic adjective is not a type of verb. While this difference does show that the syntactic category is relevant, the relatively small size of the difference implies that the postnominal adjective preference is largely true independently of the syntactic status of semantic adjectives.

**4.5. IS INTRACATEGORIAL HARMONY SEMANTIC?** The final question is whether intracategorical harmony applies to semantic categories or to syntactic categories. Is there a tendency for the demonstrative, numeral, and adjective to occur on the same side of the noun, regardless of their syntactic realization? With respect to different syntactic realizations of semantic adjectives, the question has no answer: the tendency for adjectives to occur on the same side of the noun as both demonstratives and numerals, regardless of whether semantic adjectives are verbs, tells us nothing since either way the semantic adjectives are modifying the noun.

Perhaps the most relevant data on this question involves numerals. The question is whether, in languages where the numeral combines with a classifier, the numeral tends to occur on the same side of the noun as the demonstrative and adjective. If it does, then this implies that intracategorical harmony is a semantic principle. If it does not, however, then this might reflect the fact that in many languages with numeral classifiers, the classifier phrase is not modifying the noun, but is the head while the noun is a dependent. If intracategorical harmony is a syntactic principle and if in many languages with numeral classifiers the classifier is the head rather than a modifier of the noun, then we would not expect numerals in such languages to exhibit a tendency to occur on the same side of the noun as demonstratives and adjectives. For example, Sre, a Mon-Khmer language illustrated in 17 above, places the numeral plus classifier before the noun while the adjective and demonstrative follow the noun, but if the classifier is the head, then the language is not an exception to intracategorical harmony.

In order to examine this, I compared languages with and without numeral classifiers, examining whether numerals occur on the same side of the noun as demonstratives and adjectives in these languages. Table 8 provides the relevant data for demonstratives.

	Num and Dem occur on same side of noun		Num and Dem occur on different sides of noun		% same side
	#LGS	FREQ	#LGS	FREQ	
Lg has numeral classifiers	129	31.35	75	14.70	68%
Lg lacks numeral classifiers	283	70.84	77	19.94	78%

TABLE 8. Relationship between whether the language has numeral classifiers and whether numeral and demonstrative occur on the same side of the noun.

Table 8 does show a difference between languages with and without numeral classifiers, in that the tendency for the numeral and demonstrative to occur on the same side

of the noun is stronger in languages without numeral classifiers (78% vs. 68%). This suggests that syntactic factors may play a role. However, the fact that there is a tendency for the numeral and demonstrative to occur on the same side of the noun, whether or not the language has numeral classifiers, suggests that it is the semantics which is the primary factor.

Table 9 gives analogous data for adjectives, showing that languages with and without numeral classifiers exhibit approximately the same tendency to occur on the same side of the noun as adjectives (75% for languages with numeral classifiers, 76% for languages without).

	Num and Adj occur on same side of noun		Num and Adj occur on different sides of noun		% same side
	#LGS	FREQ	#LGS	FREQ	
Lg has numeral classifiers	149	33.38	60	11.27	75%
Lg lacks numeral classifiers	296	71.88	77	22.11	76%

TABLE 9. Relationship between whether the language has numeral classifiers and whether numeral and adjective occur on the same side of the noun.

The fact that it is more common for the numeral to occur on the same side as the demonstrative and adjective, whether or not the language employs numeral classifiers, implies that the principle of intracategorical harmony is based primarily on the semantics of numerals, regardless of how they are realized syntactically.

## 5. EXPLAINING THE PRINCIPLES.

**5.1. INTRODUCTION.** As discussed above, my approach employs the notion of descriptive principles as an intermediate stage between the relative frequencies and the explanation for those relative frequencies. The primary goal of this article is to provide an account of the relative frequencies in terms of such descriptive principles, rather than to provide a full explanation for these frequencies, since I believe it is possible to provide stronger evidence for the descriptive principles than it is for the explanations. Ultimately, however, we need some explanations for those principles if we are to fully explain the relative frequencies. The brief remarks in this section toward this goal are considerably more speculative than the other sections of this article.

I do not offer any explanation for the asymmetry principle. It is not clear to me why the iconicity principles are stronger when the modifiers precede the noun.<sup>15</sup>

**5.2. THE ICONICITY PRINCIPLES.** I have referred to the first two principles as iconicity principles, presupposing that the explanation for them involves some notion of iconicity, broadly construed. The simplest explanation for these principles is in terms of explanations that have been offered for the relative ordering of multiple adjectives modifying nouns, where in English, for example, *a beautiful black horse* is more natural than *a black beautiful horse*. Various ideas have been suggested in the literature on this topic (Hetzron 1978, Givón 1990:470, Sproat & Shih 1991, Biber et al. 1999:599, Rijkhoff 2002, 2008, Wulff 2003, Scontras et al. 2017). Much of this work restricts attention to order among descriptive adjectives, but the issue here is whether this can be extended to demonstratives and numerals. One popular view (Givón 1990, Biber et al. 1999, though questioned by Wulff (2003) and Scontras and colleagues (2017)) is that adjectives denoting more inherent properties of the referent of the noun phrase tend to

<sup>15</sup> Whether Cinque's account (discussed below in §6) explains this is not clear. He achieves this result by assuming that the universal underlying order is one in which all modifiers precede the noun. Insofar as there are independent reasons in the framework he is working on for assuming this, his account could be seen as offering an explanation.

occur closer to the noun. In the case of *a beautiful black horse*, for example, the claim would be that its black color is a more inherent feature of the beautiful black horse than the fact that it is beautiful. This account requires some explanation for why more inherent features should be closer to the noun rather than the other way around. But the explanation for this appears to be that the noun itself denotes a more inherent property of the referent than the properties denoted by adjectives: it may not be easy to change the beauty or color of a horse, but it is certainly easier than changing the fact that it is a horse. By placing adjectives denoting more inherent properties closer to the noun, greater distance from the noun represents less inherent properties, where the noun is vacuously closer to itself and is the most inherent.

This account can be extended to cover demonstratives and numerals. If we consider the example of *those three black horses*, the fact that the horses occur in a set of three is normally a temporary property of the set of horses and quite clearly less inherent than most properties denoted by adjectives. And the demonstrative does not really denote a property of the horses at all; rather, it reflects the location of the horses relative to the speaker and directs the hearer's attention to them. In other words, numerals denote a temporary property of the referent, while demonstratives do not denote a property at all.<sup>16</sup>

An alternative account, but one that I think is to some extent a variation on the first one, more strongly appeals to iconicity.<sup>17</sup> Namely, one might try to explain the ordering in terms of the semantic types of the three adnominal words as functions from one semantic type to another, in the sense of Montague 1973 and Partee 1987, among others. For example, in terms of the notions of Keenan 2006, if we take nouns as denoting properties, then adjectives are best analyzed as functions from properties to properties, while demonstratives are best analyzed as functions from properties to generalized quantifiers. This would explain why demonstratives appear outside adjectives, since the semantic type of the output of applying an adjective to a noun is the same as the semantic type of the input to a demonstrative, but not vice versa. It is less clear, however, how to fit numerals into this picture. A common semantic analysis of numerals (for example, Keenan & Stavi 1986) is that they are like demonstratives in being a type of determiner. What I just said about demonstratives appearing outside adjectives would equally well explain why numerals appear outside adjectives. It is less clear, however, how one would account for the fact that demonstratives appear outside numerals, if both are functions from properties to generalized quantifiers. Most discussion of numerals in the semantics literature appears to assume their use in the absence of another determiner like a demonstrative, but various people treat the combination of demonstrative or other determiner with a numeral as itself a determiner, so that in *those three black dogs*, it is *those three* that is combining with *black dogs* rather than *those* combining with *three black dogs*. For example, Barwise and Cooper (1981:189) treat *the three* as a determiner, and Keenan and Stavi (1986:263) and Keenan (2006:302) do so similarly for *John's two or more* and *the ten*, respectively. Note that when numerals occur with another determiner like a demonstrative, their meaning is nonrestrictive: *those three dogs*

<sup>16</sup> The Cinque 2005 approach, discussed below in §6, also assumes something like the iconicity principles in the sense that it assumes that the underlying word order in all languages is one in which the demonstrative is further from the noun than the other two modifiers are while the adjective is closest to the noun, and the relative frequencies on his account depend to a large extent on the assumption that this is the underlying order. However, many of the movements that occur in Cinque's account result in structures that do not conform to iconicity principles, so his approach does not account for the fact that there is an overall preference for orders that conform to the iconicity principles.

<sup>17</sup> Culbertson and Adger (2014:5843) also propose both an account in terms of inherentness and the alternative account discussed in this paragraph as explanations for what I am calling the iconicity principles.

can be loosely paraphrased as *those dogs, which are three in number*, suggesting that the demonstrative is the real determiner and that the numeral is a modifier of the demonstrative, that is, a function from determiners to determiners. But if numerals are simply modifiers of the demonstrative, this provides no explanation of why numerals tend to occur inside demonstratives.

Note that one difference between this type of account and the one in terms of degree of inherentness arises with relative clauses. Semantically, relative clauses are like adjectives, mapping properties onto properties (Montague 1973:224). Unlike adjectives, however, relative clauses tend to occur further from the noun, outside numerals. But since a common type of relative clause involves an eventive predicate describing something that is true only transitorily of the referent of the noun phrase (compare *black* and *which is running away in the black dog which is running away*), an account in terms of inherentness does correctly predict that relative clauses involving eventive predicates are likely to occur further from the noun than adjectives do.

**5.3. INTRACATEGORIAL HARMONY.** The principle of intracategorial harmony claims that there is a tendency in languages for dependents of the noun to all occur on the same side of the noun. I assume that the explanation for this is simply that it reflects the fact that all dependents of the noun share precisely the property of being dependents of the noun. Whether this is due to shared syntax or shared semantics is not entirely clear, but the data in §4.5 suggests that it is semantic.

**5.4. THE POSTNOMINAL ADJECTIVE PREFERENCE.** The postnominal adjective preference appears to be the weakest of my five principles, in that the most frequent of the different orders that violate exactly one of my principles is the one that violates the postnominal adjective preference, namely DNAn (the order found in English).

Why might there be a general preference for semantic adjectives to follow the noun? I argue here that it reflects a combination of semantic factors and processing factors. One possible consideration is that the interpretation of an adjective is often dependent on the particular noun, while the interpretation of a noun is not in general dependent on the particular adjective. Or more specifically, with what Kamp and Partee (1995) call ‘subsective adjectives’, the meaning of the combination of the adjective and the noun is not simply the intersection of the set denoted by the adjective and the set denoted by the noun. For example, the meaning of *big mouse* is not the intersection of the set of big things and that of mice, since the interpretation of *big* here is relativized to the noun *mouse*. Since the most frequent adjectival meanings (cf. Dixon 1977) appear to be subsective (e.g. ‘big’, ‘small’, ‘good’, ‘bad’, ‘fast’, ‘slow’), it might be the case that adjectives follow the noun more often because their interpretation has to be delayed until after the noun. This issue will not arise if the noun precedes the adjective, since the interpretation of the noun does not normally depend on the particular adjective.

However, a more obvious explanation for the postnominal adjectival preference appeals to the similarity between adjectives and relative clauses. There is a very strong preference for relative clauses to follow nouns (Hawkins 1990:225); in Dryer 2013b, languages with N-Rel order outnumber languages with Rel-N order by 579 to 141. Thus in languages in which semantic adjectives are verbs and hence a type of relative clause, we would expect a strong tendency for such semantic adjectives to follow the noun. Since Hawkins (1990:255–56) argues that the preference for postnominal relative clauses is due to processing factors, this would provide an explanation for the postnominal adjectival preference for languages in which semantic adjectives are verbs.

It turns out, however, that even in languages in which semantic adjectives are not verbs, they exhibit a clear tendency to occur on the same side of the noun as relative clauses. Table 10 shows that among such languages, the adjective precedes the noun twice as often when the relative clause also precedes the noun (20.87 vs. 10.91 in terms of adjusted frequency) and follows the noun more than three times as often when the relative clause also follows the noun (58.14 vs. 15.99).<sup>18</sup>

	Adj-N		N-Adj	
	#LGS	FREQ	#LGS	FREQ
Rel-N	63	20.87	21	10.91
N-Rel	54	15.99	200	58.14

TABLE 10. Relationship between the order of semantic adjective and noun and the order of relative clause and noun in languages where semantic adjectives are not verbs.

The apparent explanation for this correlation is the semantic similarity between adjectives and relative clauses, as reflected by the fact that adnominal adjectives are frequently paraphraseable by relative clauses, as in English.<sup>19</sup> What this means is that a plausible explanation for the fact that semantic adjectives which are not verbs tend to follow the noun is that semantic adjectives are semantically similar to relative clauses and relative clauses exhibit a strong tendency to follow nouns due to processing factors.

**6. CINQUE'S ACCOUNT.** Cinque (2005) also proposes an account of the relative frequencies of the different orders of demonstrative, numeral, adjective, and noun. In this section, I discuss his account and show that my principles account for the relative frequencies of the different orders better than his approach. Furthermore, an additional goal of Cinque's proposal is to account for which orders are attested and which are not. However, four of the orders he claims are unattested are actually attested in my sample.

Because it would take too much space to discuss the details of Cinque's account, I summarize it only very briefly here. The core of his account is that the different orders are derived by movement from an underlying structure, which is Dem-Num-Adj-N for all languages. Different types of movements are unmarked, marked, or very marked, and many of the types require multiple movements, some of which may be marked, others unmarked. His theory claims that orders requiring only unmarked movements will be the most frequent, and that among orders requiring marked movements, those requiring very marked movements will be less frequent than those requiring movements that are merely marked but not very marked. A summary of these markedness principles (all of which are independently motivated by other phenomena discussed previously in the literature) is given in 31.

(31) Relative markedness of different types of movement in Cinque's account

- a. Unmarked: no movement at all
- b. Unmarked: movement of what he calls pied-piping of the *whose picture*-type, which amounts to movement of a constituent containing the N, where the N is on the left edge of the constituent that moves
- c. Marked: movement without pied-piping, that is, extraction of a constituent out of a larger constituent

<sup>18</sup> See n. 13 above for my criteria for determining whether a semantic adjective in a given language is verbal.

<sup>19</sup> This is also captured by the fact that in a formal theory like Montague 1973, both adjectives and relative clauses are functions from properties to properties, while demonstratives and numerals are not.

- d. Very marked (if even possible):<sup>20</sup> a special case of 31c, ‘subextraction’ of the N out of N+Adj within N+Adj+Num
- e. Very marked: movement of what he calls pied-piping of the *picture of who*-type, which amounts to movement of a constituent containing the N, where the N is not on the left edge of the constituent that moves
- f. Marked: partial movement: the constituent that moved could move further but does not
- g. Unmarked: total movement: the constituent that moved could not move any further than it has moved

I illustrate his approach briefly by discussing how DnAN order is derived. It involves two movements: first, movement of the N past the Adj, and then movement of the N+Adj combination past the Num, as shown in 32.

(32) Dem Num Adj N  $\rightarrow$  Dem Num N Adj  $\rightarrow$  Dem N Adj Num (DnAN)

Both of these movements are unmarked in his approach. The movement of the N past the Adj is a trivial instance of 31b: since only the N moves, it is automatically on the left edge of the constituent that moves. The second movement, that of the N+Adj past the Num, is also an instance of 31b, since the N is on the left edge of the constituent that moves. However, the overall derivation is marked since the movement of the N+Adj is partial: it could have moved past the Dem but did not. Note that if the N+Adj does move past the Dem, we get the order nADN, but this movement is marked for another reason: it is an instance of 31c since the N+Adj is moved out of the N+Adj+Num constituent. If the N+Adj moves along with the Num, then the movement is unmarked and we get the common nAND order, which involves only unmarked movements.

To see how Cinque’s account predicts the nonexistence of the orders he claims are unattested, consider NDAn. The only way this order could be derived is if the Num moves past the Dem by itself. But on Cinque’s account, all movements must include the N, so there is no way to derive the order NDAn. For the same reason, there is no way to get DANn, since there is no way for the Adj to move past the Num without the N moving with it. And there is no way to derive NnDA, because for the Num+N to move past the Dem, the Adj would have to come with them, since only constituents can move. The other orders that Cinque claims are unattested are underivable for similar reasons.

We can now turn to evaluating Cinque’s account in terms of the data presented above in Table 2. First, consider the existence of four orders that Cinque’s account predicts should be unattested. Because the existence of these orders has not been previously documented in the literature, I list in 33 the languages in my sample that are instances of each.

<sup>20</sup> Cinque questions whether this sort of movement, which he calls ‘subextraction’, should be allowed at all, suggesting that perhaps the apparent instances can be explained away. However, the type that requires this sort of movement, nDAN, is actually the eighth most frequent type in my sample.

(33) Orders predicted not to exist by Cinque (2005) and the languages with these orders in my sample

a. Num-N-Dem-Adj (NnDA)<sup>21</sup>

- Austro-Asiatic: KATUIC: Katu (Costello 1969:22)
- Austronesian: YAPESE: Yapese (Jensen 1977:168)
- Austronesian: OCEANIC: Kilivila (Senft 1986:105), Teop (Mosel & Spriggs 1992:42, 54, Mosel & Thiesen 2007:97), Drehu (Tryon 1967: 61)

b. Dem-Adj-Num-N (DANn)

- Indo-European: INDIC: Dhivehi (Cain & Gair 2000:33)
- Nakh-Daghestanian: NAKH: Chechen (Johanna Nichols, p.c.), Ingush (Nichols 2011:669)

c. Num-Dem-Adj-N (NDAn)

- Indo-European: NURISTANI: Waigali (Degener 1998:226–27)
- Mixe-Zoque: MIXE-ZOQUE: Sierra Popoluca (de Jong Boudreault 2009, p.c.)

d. N-Num-Dem-Adj (nNDA)

- Niger-Congo: BANTOID: Haya (Byarushengo 1977:13)

The most frequent of these four orders is NnDA (shown in 33a). Interestingly, this is the sole order that Greenberg's universal 20 permits but Cinque's account does not. The example in 34 illustrates this order in Kilivila.<sup>22</sup>

(34) Kilivila (Senft 1986:104)

na-lima vivila mi-na-si-na      na-manabweta mina Tauwema  
 CLF-five girls this-CLF-PL-this CLF-beautiful from Tauwema  
 Num N Dem Adj  
 'these five beautiful girls from Tauwema'

The second order attested in my sample that Cinque's account predicts should not exist is DANn. This order is unusual in that the adjective occurs outside the numeral and both precede the noun. Examples 4 and 5 earlier in this article illustrate this order for two of the three languages in my sample that exhibit this order, Dhivehi and Ingush.

The third order excluded by Cinque's account is NDAn, but there are two NDAn languages in my sample, namely Waigali (an Indo-European language in the Nuristani branch spoken in northeastern Afghanistan) and Sierra Popoluca (a Mixe-Zoque language of Mexico).<sup>23</sup> Example 35a illustrates Num-Dem-N order in Waigali, while 35b illustrates Dem-Adj-N order.

(35) Waigali (Degener 1998:227, 205)

- a. tre tē taw  
 three that place  
 'those three places'
- b. sa uma düštō brā  
 that 1SG.GEN old brother  
 'that older brother of mine'

<sup>21</sup> As discussed above in §4.2, however, the Yapese construction is one where the particular construction used for semantic adjectives (namely a relative clause) is one that might explain why the semantic adjective occurs outside the demonstrative.

<sup>22</sup> Cinque does acknowledge that Kilivila is an apparent instance of NnDA. I discuss his suggestion for explaining Kilivila away in §4.2 above.

<sup>23</sup> My database contains one other language, Terêna, that is not in the 576-language sample but that places both the numeral and demonstrative before the noun, with the numeral preceding the demonstrative. But the formula in Schultz 1969:66 does not specify an order for the demonstrative and adjective, so the language is not included in the sample. Schultz does not appear to cite any example illustrating Num-Dem-N order.

The second instance of an NDA language is Sierra Popoluca. Although it is clear from the description by de Jong Boudreault (2009) that the numeral precedes both the demonstrative and the adjective, it is not clear that the demonstrative precedes the adjective. However, de Jong Boudreault (p.c.) informs me that this is indeed the case. But what is unusual about Sierra Popoluca is that the numeral precedes the demonstrative, with both preceding the noun, as is illustrated in 36.

(36) Sierra Popoluca (de Jong Boudreault 2009:248)

ʔiku-kóm            tukuteen jeʔm pok  
3.ERG-fill.COMPL three    that gourd  
Num            Dem N

‘He filled the three gourds.’

The sole instance of an nNDA language is Haya, a Bantu language spoken in Tanzania, illustrated in 37.

(37) Haya (Byarushengo 1977:13)

enjú zange ibily’ êz’ ézi-lúŋgi  
house my two these NC-good  
N            Num Dem Adj

‘these two good houses of mine’

Let us turn now to the predictions of Cinque’s account regarding the relative frequencies of attested orders. Table 11 is similar to Table 2 above, but classifies the different orders in terms of Cinque’s account. The third column (‘marked options’) identifies which marked options are required to derive that order in terms of the types listed in 31 above.<sup>24</sup> The fourth column (‘#marked options’) shows the number of marked options; a ‘+’ here indicates that the order involves a movement that Cinque characterizes as very marked. An asterisk in this column means that Cinque’s account predicts that this order should not exist. The fifth column (‘#LGS (acc. to Cinque)’) gives Cinque’s informal characterization of how common that order is.<sup>25</sup> The last three columns are identical to the last three columns in Table 2, identifying the numbers of languages in my sample of that type, as well as the number of genera and the number of families containing languages of that type.<sup>26</sup>

There is little question that in general terms, Cinque’s account does an impressive job in predicting the relative frequencies of the different orders, correctly predicting the two that are the most frequent. Every order that is not attested in my sample, his account predicts should not exist. And although there are four orders attested in my sample that his theory predicts should not exist, all of these are relatively rare. However, there are

<sup>24</sup> There are apparent inconsistencies in what Cinque counts as partial movement. Cinque treats NAnD (line 12 in Table 11) as partial movement. This order is derived by a single movement, moving the Num+Adj+N together past the Dem, which is a very marked movement of type 31e. He treats it as involving partial movement in that the N itself could have moved further past the A and Num but does not (Guglielmo Cinque, p.c.). However, he does not treat AnND (line 13) and AnDN (line 15) as involving partial movement. But by the logic he applies to NAnD, it would seem that these should also involve partial movement, since in both of these, the Adj+N moves, but the N does not move by itself, when it could have. For this reason, I treat these as involving partial movement, which means that these two orders involve more marked options than Cinque claims. Doing so actually helps Cinque’s account, since these are both quite infrequent orders.

<sup>25</sup> Cinque does not provide information on the total number of languages in his sample.

<sup>26</sup> The annotation ‘1+/\*’ with type nDAN on line 8 represents Cinque’s characterization of this order either as one that involves an especially marked option or as one that should be ruled out altogether since it involves a type of extraction that no other order requires.

		CINQUE			MY DATA		
		MARKED OPTIONS	#MARKED OPTIONS	#LGS (acc. to Cinque)	#LGS (my sample)	# GENERA	ADJUSTED FREQ
1	nAND	none	0	very many	182	85	44.17
2	DNAn	none	0	very many	113	57	35.56
3	DnAN	27f	1	many	53	40	29.95
4	DNnA	27f	1	many	40	32	22.12
5	nADN	27c	1	few	36	19	14.80
6	<b>NnAD</b>	<b>27e, 27f</b>	<b>2+</b>	<b>few</b>	67	27	14.54
7	<b>DnNA</b>	<b>27c, 27f</b>	<b>2</b>	<b>very few</b>	<b>12</b>	<b>10</b>	9.75
8	<b>nDAN</b>	<b>27d</b>	<b>1+/*</b>	<b>very few</b>	13	11	9.00
9	nNAD	27c	1	few	11	9	9.00
10	nDNA	27c	1	few	8	6	5.67
11	DAnN	27e, 27f	2+	very few	12	7	5.34
12	NAnD	27e, 27f	2	very few	8	5	4.00
13	AnND	27e, 27f	2+	very few	5	3	3.00
14	NnDA	*	*	none	5	3	3.00
15	AnDN	27c, 27e, 27f	3+	very few	5	3	2.50
16	DANn	*	*	none	3	2	2.00
17	NDAn	*	*	none	2	2	2.00
18	nNDA	*	*	none	1	1	1.00
19	NADn	*	*	none	0	0	0
20	NDnA	*	*	none	0	0	0
21	ADnN	*	*	none	0	0	0
22	ADNn	*	*	none	0	0	0
23	ANDn	*	*	none	0	0	0
24	ANnD	*	*	none	0	0	0

TABLE 11. Comparing Cinque's predicted frequencies with actual frequencies in my sample.

three orders that are considerably more common than predicted by his account: NnAD (line 6 of Table 11), DnNA (line 7), and nDAN (line 8).

The most serious inaccuracy is NnAD (line 6 of Table 11): this order is the sixth most frequent order in terms of adjusted frequency and the third most frequent in terms of total languages (only the two dominant orders, DNAn and its mirror image nAND, have more languages). It is considerably more frequent than two of the orders that involve a single marked option on his account, but it involves two marked options, one of them highly marked (pied-piping of the *picture of who*-type). The example in 17 above from Sre illustrates this order. It is possible that one source of the failure of Cinque's account to predict the high frequency of NnAD languages is in not distinguishing languages in which the numeral (or numeral plus classifier) is the head from those in which it is a dependent of the noun, and a revision that distinguished these types might more accurately predict the relative frequency of NnAD languages.<sup>27</sup> My account, by contrast, does predict that this order should be common, without making such a distinction, since this order violates only intracategorical harmony and this principle appears to be weaker than the iconicity principles. The evidence presented in §4.5 above shows only a relatively small difference between languages with and without numeral classifiers as far as their occurring on the same side of the noun as adjectives or demonstratives is concerned, suggesting that the distinction is not important in explaining the frequency of NnAD languages.

<sup>27</sup> Cinque 2006 suggests, however, that all languages employ numeral classifiers, but that in many languages these classifiers are not pronounced.

The second order that is more frequent than Cinque's account predicts is DnNA (line 7 of Table 11). The example in 38 illustrates this order in Bayso, a Cushitic language spoken in Ethiopia.

(38) Bayso (Hayward 1979:118)

hĩni idaa-jaa seed-o o-jinji emet-en.  
 this.PL.SBJ sheep-PAUC three-SBJ PAUC-big come-PRF.3PL  
 Dem N Num Adj

'These three big sheep came.'

The third order that is more frequent than predicted by Cinque's account is nDAN (line 8 of Table 11). I illustrate this type in 39 from Noon, a Niger-Congo language spoken in Senegal.

(39) Noon (Soukka 2000:129)

enoh-cii cii ci-yaanaaw-cii ci-daankah-cii  
 COW-DEF DEM ATTR-white-DEF ATTR-ten-DEF  
 N Dem Adj Num

'these ten white cows'

Although this order violates only one marked option on Cinque's account, it requires a type of extraction that none of the other orders requires and that he describes as especially marked. In fact, he suggests that the order might be impossible, with apparent instances explained away. But this order is in fact the eighth most frequent in my sample, with thirteen such languages (in eleven different genera).

One final problem with Cinque's approach, I have already addressed in §4 above: his approach is formulated in terms of syntactic categories, but the evidence I presented shows that whatever principles govern the relative frequencies of the different orders, they are based largely on semantic categories, not syntactic ones.<sup>28</sup>

**7. OTHER COMPARISONS OF MY ACCOUNT WITH CINQUE'S.** Both Cysouw (2010) and Merlo (2015) evaluate competing hypotheses for accounting for the relative frequencies of the different word orders, using data from the handout for Dryer 2006. Both argue that the set of principles proposed in Dryer 2006 do not account for the relative frequencies significantly better than proposals by Cysouw himself or the proposal in Cinque 2005, and in some respects fare worse. However, the sample used in Dryer 2006 is much smaller than the sample used in this article, and the principles are not the same as those used here. Furthermore, the conclusions drawn there are based only on numbers of genera, without consideration of the geographical factors incorporated into the measure of adjusted frequency used here.

These issues are partly addressed in Futrell, Levy, & Dryer 2017, which discusses problems with Merlo's approach and applies Cysouw's method to a comparison of the principles proposed in this article and those proposed by Cinque and by Cysouw, using the expanded data here and using both the measure of adjusted frequency and number of genera.<sup>29</sup> The basic conclusion is that when using the measure of adjusted frequency, my

<sup>28</sup> Abels and Neeleman (2012) provide arguments for a generative account that is alternative to the Cinque 2005 account, one that does not assume that all languages are underlyingly DNAn. Because their focus is on the distinction between attested and unattested orders and because they acknowledge that there is no difference between their account and Cinque's in terms of the relative frequencies of attested orders, I do not discuss their alternative here.

<sup>29</sup> Futrell et al. 2017 is based on the data in an earlier draft of this article, so the adjusted frequencies cited there are slightly different from those in this article.

proposal and Cinque's do about equally well (although Cinque's does marginally better) and both do better than Cysouw's, while when using number of genera, my proposal fares better than both Cinque's and Cysouw's. Because of the problems with Merlo's approach discussed by Futrell and colleagues, I ignore her approach further here.

There are a number of reasons why I am not overly concerned that my principles do not fare better than Cinque's in the Futrell et al. 2017 results. The first reason is that the evidence above shows that while Cinque's account does do fairly well in predicting the relative frequencies, my principles account better than his for the relative rankings: three of the eight most frequent orders are ones that Cinque's account predicts should be infrequent, including one that he suggests might not even be possible. A second reason is that the arguments in §4 that the principles governing the relative frequencies of the types must be based on semantic categories rather than syntactic ones means that there is a deep problem with an approach like Cinque's that is based on syntactic categories, regardless of how well it predicts the relative frequencies. A third reason is that these approaches conclude that although there are four attested orders that Cinque's account predicts should not exist, these approaches imply that Cinque's account is relatively successful in predicting their low frequency. However, the prediction that these orders should not exist is fundamental to his account, since he argues that there is no way to derive these orders without violating basic principles of movement.

A fourth reason why I am not overly concerned by the fact that the Futrell et al. results do not show my approach faring better than Cinque's is that approaches like the one used in their study (and those of Cysouw and of Merlo) cannot capture the relative markedness of different types of movement assumed by Cinque. Rather, these approaches determine the relative weights of different principles on the basis of a best fit to the data. This is not a problem applied to my approach and Cysouw's, but it does not accurately represent Cinque's. The relative markedness of different types of movement is an integral part of Cinque's proposal, since his assumptions about this are based, not on the data to be explained, but on independently motivated principles. The issue can be illustrated by the status of nDAN, which on Cinque's account requires a type of 'subextraction' that Cinque suggests might even be impossible. I argue above that the fact that this order is actually the eighth most frequent is an argument against Cinque's account. However, methods like that in Futrell et al. 2017 do not treat the high frequency of this order as a problem for Cinque, since the principles that this order violates are assigned a weight based on the observed frequency. Since this order is the only one involving this type of movement, the Futrell et al. method assigns this movement a weight implying that Cinque's account accurately predicts this order's frequency. Similarly, on Cinque's account, movement of N without pied-piping is marked, while pied-piping of the *picture of who*-type is very marked, but the weights determined by Futrell et al. treat the former as worse than the latter.

A final consideration is that the Futrell et al. results show that the primary source of my proposal's not faring better than Cinque's lies in the relative frequencies of the two most common orders, DNAn and nAND. In Cinque's approach, these are the only two orders that involve no marked options, so his approach correctly predicts that these should be of comparable frequency. On my approach, in contrast, DNAn violates one principle while nAND violates none, yet nAND is only slightly more common. Since the one principle that DNAn violates is the postnominal adjective preference, one might ask whether we need it. After all, if we were to abandon this principle, DNAn would be like nAND in violating no principle. However, it is clear from other orders that the postnominal adjective preference is well motivated. To illustrate this, Table 12 organizes the

twenty-four logically possible orders into two columns, with N-Adj orders on the left and Adj-N orders on the right, where each Adj-N order on the right-hand side is the mirror image of the N-Adj order immediately to its left, the numbers being the adjusted frequencies given in Tables 2 and 11.

N-Adj		Adj-N	
nAND	44.17	DNA <sub>n</sub>	35.56
DnAN	29.95	NAnD	4.00
DNnA	22.12	AnND	3.00
nADN	14.80	NDA <sub>n</sub>	2.00
NnAD	14.54	DAnN	5.34
DnNA	9.75	ANnD	0
nNAD	9.00	DAN <sub>n</sub>	2.00
nDAN	9.00	NAD <sub>n</sub>	0
nDNA	5.67	AND <sub>n</sub>	0
NnDA	3.00	ADnN	0
nNDA	1.00	ADN <sub>n</sub>	0
<b>NDnA</b>	<b>0</b>	<b>AnDN</b>	<b>2.50</b>

TABLE 12. Mirror-image pairs illustrating the postnominal adjective preference.

Except for the last line in Table 12, each of the N-Adj orders in the left-hand column is not only more frequent than the mirror-image Adj-N order in the right-hand column, but in most cases is also considerably more frequent. Hence we have good evidence for including the postnominal adjective preference as a principle, despite the fact that nAND is only slightly more common than DNA<sub>n</sub>. But the high frequency of DNA<sub>n</sub> can be explained by appealing to the fact that due to the asymmetry principle, languages that place all three modifiers before the noun will almost always be DNA<sub>n</sub>, but those that place all three modifiers after the noun will often employ orders other than nAND, since such orders will be consistent with the asymmetry principle although they violate one of the iconicity principles.

An assumption underlying this argument is that the order of modifiers with respect to the noun has a primacy compared to the order of modifiers with respect to each other when they occur on the same side of the noun. In other words, speaking metaphorically, it is as if languages first choose the order of modifiers with respect to the noun, and then only secondarily choose the order among modifiers. The basis for the assumption that the order of modifiers with respect to the noun is more basic than the order of modifiers with respect to each other is that noun phrases containing a noun and one modifier are far more frequent in usage than noun phrases containing a noun plus two modifiers. This is related to the fact that in most languages, it is either obligatory or most common for noun phrases to at least contain a noun. Crucially, methods like those used by Futrell and colleagues, Cysouw, and Merlo treat the order among modifiers on a par with the order of modifiers with respect to the noun and thus cannot incorporate the reason why, I claim, DNA<sub>n</sub> is almost as common as nAND, despite violating one principle while nAND violates none.

Futrell et al. 2017 does find that my proposal fares better than Cinque's if one applies the method to numbers of genera rather than adjusted frequency. However, I do not consider this result important since simply counting numbers of genera fails to consider the role of geography, as discussed above.

**8. HAWKINS'S HEAVINESS SERIALIZATION PRINCIPLE.** A number of proposals by Hawkins (1983, 1994, 2004, 2014) bear on the issues addressed in this article. I restrict attention here to a heaviness serialization principle that Hawkins (1983:90) proposes to

account for various generalizations involving the order of different modifiers of nouns relative to the noun, by which heavier modifiers are more likely than lighter modifiers to follow the noun. What is relevant to this article is his appeal to this principle to explain what I call the postnominal adjective preference, or why adjectives follow the noun more often than demonstratives or numerals do. He argues that adjectives follow nouns more often because they are heavier than demonstratives and numerals. More specifically, he argues that adjectives are heavier in the following sense (Hawkins 1983:90):

The morphological structure of descriptive adjectives typically comprises syllabically longer morphemes and more compounding of bound and free morphemes than that of demonstrative determiners; and in both of these respects descriptive adjectives are either greater than or equal to numerals.

There are a number of ways in which I find this explanation unconvincing. First, even if it is true that adjectives tend to be longer than demonstratives and numerals, it is not clear that this difference is strong enough to explain the fact that adjectives follow nouns more often than demonstratives or numerals do. Second, it is probably the case that only less frequent adjectives contain more syllables than demonstratives; it appears to be the case that in many languages, the most frequent adjectives tend to be monosyllabic. And third, it is not clear that adjectives tend to be longer than numerals; in fact, higher numerals in many languages tend to be longer than even low-frequency adjectives. The notion of heaviness plays a major role in Hawkins's later work, but it involves number of words, not number of syllables or number of morphemes; his appeal to heaviness in this later work is more persuasive.<sup>30</sup>

**9. RIJKHOFF'S PROPOSALS.** It is not possible to do justice here to proposals by Rijkhoff (2002, 2008) because of their complexity, but at least some brief discussion is warranted. Rijkhoff proposes an iconicity principle that is similar to the combined effects of my two iconicity principles as an explanation for the tendency for adjectives to occur closest to the noun, and demonstratives furthest out. His proposal differs in two crucial respects from mine. First, he claims that there are no clear exceptions to iconicity, that it is an essentially exceptionless principle. Second, he restricts his claim to cases where the adjective and numeral are 'simplex', excluding cases where these are expressed by phrases like relative clauses, where the words in question are nouns or verbs, or where they are in an appositional relationship to the noun.

There are a couple of problems with his proposal. First, and most seriously, the evidence presented in this article that the relevant categories of adjective and numeral are semantic is evidence that iconicity applies not just to what Rijkhoff treats as simplex but to the very cases that he excludes. In that sense his claims are too weak. Second, he excludes cases where apposition is concerned, but offers very little evidence that the apparent exceptions he is excluding involve apposition. For example, he suggests that the adjective and demonstrative in Nasioi are in apposition to the noun on the grounds that these can occur as independent referring expressions without a noun. But by that logic, the demonstrative and numeral in English should count as appositional, since they too can occur as independent referring expressions (*I want that*, *I want three*). My sample contains ninety-six languages that violate at least one of my iconicity principles, and it is very unclear for the majority of these on what basis they would be excluded. In that respect, his claim appears to be too strong. Even if one were to accept Rijkhoff's generous

<sup>30</sup> Hawkins (1983:117–27) also discusses Greenberg's universal 20 (given above in 2). He observes the tendency for languages to conform to the generalizations expressed by my two iconicity principles, but his discussion is not conclusive.

criteria for excluding languages on the grounds that they involve apposition, my prediction is that many languages that conform to iconicity principles would also be excluded, so his approach would fail to predict that what he treats as appositional structures also conform to iconicity. Both Cinque and Rijkhoff try to explain away exceptions without asking whether some of the cases that conform to their claims would be excluded for the same reasons the exceptions are explained away.

**10. RESEARCH BY CULBERTSON WITH OTHERS.** Culbertson, Smolensky, and Legendre (2012) and Culbertson and Adger (2014) use an experimental approach based on artificial language learning that they argue provides evidence for a number of generalizations directly relevant to this article. I discuss the latter article first.

Culbertson and Adger (2014) use this paradigm of artificial language learning to provide evidence that what I have characterized as the iconicity principles are cognitively real. Subjects learned an artificial language in which modifiers of nouns follow the noun. The subjects were exposed to examples involving a single modifier following the noun, and the test condition required subjects to produce examples with two modifiers. Their results showed that subjects more often produced noun phrases in which the order of the two modifiers conformed to what I call the iconicity principles, even though their order is the reverse of what we find in English. For example, having learned that the artificial language was N-Adj and N-Num, subjects more often produced N-Adj-Num than N-Num-Adj order. The tendency to use the order corresponding to the iconicity principles was particularly strong for N-Adj-Dem, presumably reflecting the fact that these are the most different in terms of iconicity principles. While their results are clearly consistent overall with the typological data in this article, there is one way in which they do not conform exactly to the typological patterns. Culbertson and Adger's results would lead us to expect noniconic orders involving adjective and numeral to be as common as noniconic orders involving numeral and demonstrative, but the data here shows the latter to be almost twice as common.

Culbertson, Smolensky, and Legendre's 2012 experiment tested preferences relating to Greenberg's universal 18, given in 40.

- (40) UNIVERSAL 18 (Greenberg 1963): When the descriptive adjective precedes the noun, the demonstrative and the numeral, with overwhelmingly more than chance frequency, do likewise.

This universal predicts that languages in which the adjective precedes the noun but in which either the demonstrative or numeral or both follow the noun will be relatively uncommon. This prediction is borne out by the data in this article. The four orders attested in my sample that do not conform to Greenberg's universal 18 are DAnN (line 11 of Table 2), NAnD (line 12), AnND (line 13), and AnDN (line 15). These are all less frequent than the corresponding orders with the adjective following the noun, DnAN (line 3 of Table 2), NnAD (line 6), nAND (line 1), and nADN (line 5), respectively. My approach captures Greenberg's universal 18 in that orders that do not conform will all violate at least two of my principles, namely intracategorical harmony and the postnominal adjective preference.

Culbertson, Smolensky, and Legendre's 2012 experiment focuses on the order of adjective and noun and of numeral and noun.<sup>31</sup> They conclude that their results support

<sup>31</sup> Unlike the experiment in Culbertson & Adger 2014, subjects were exposed to both orders of Adj and N and both orders of Num and N in the artificial language, but different experimental conditions varied according to the frequencies of the various orders.

what they assume to be the relative frequencies of the four possible orders given in 41, where the first two types are harmonic types (with adjective and numeral on the same side of the noun).

(41) {Adj-N&Num-N, N-Adj&N-Num} > N-Adj&Num-N > Adj-N&N-Num

There are two questions here: (i) Why do their subjects exhibit a preference for N-Adj&N-Num order over N-Adj&Num-N order? (ii) And why do their subjects exhibit a preference for N-Adj&Num-N order over Adj-N&N-Num order? The authors claim that these differences reflect cognitive factors underlying the relative frequencies of these types among the languages of the world. In terms of the principles proposed in this article, the first preference reflects intracategorical harmony, while the second reflects the postnominal adjective preference.

The authors argue that their results cannot be attributed to a bias toward English word order. However, this is far from clear. The authors assume that the preference for N-Adj&N-Num over N-Adj&Num-N cannot be attributed to such a bias on the grounds that N-Adj&N-Num differs more from English word order than N-Adj&N-Num in that, contrary to English order, the numeral follows the noun (while with N-Adj&N-Num, both numeral and adjective follow the noun). However, there is another sense in which N-Adj&N-Num is more similar to English word order in that it shares with English the fact that the adjective and numeral occur on the same side of the noun. In other words, it is possible that subjects consider numerals to be a kind of adjective and thus view N-Adj&N-Num order as differing from English only in that adjectives follow the noun, but see N-Adj&Num-N as differing more from English in that it distinguishes two types of adjectives in terms of the position relative to the noun.

Culbertson and colleagues also argue that the preference for N-Adj&Num-N over Adj-N&N-Num in their experiments cannot be attributed to a bias toward English word order because both differ from English in that one modifier follows the noun. They consider and reject one possible explanation for this preference, the fact that N-Adj order is at least possible in English while N-Num is not. The authors offer a number of arguments against this possibility. One of their arguments is that while N-Adj order is possible in English, it is rare and is restricted to stage-level predicates, while the adjectives in the experiments were individual-level predicates. However, there is a sense in which N-Adj order is not uncommon in English: while phrases of the form *a man tall* are generally not possible, those of the form *a man who is/was tall* are quite natural. Noun phrases of this sort, where the adjective is in a relative clause, are not instances of N-Adj order syntactically, but they are semantically equivalent to N-Adj order, and it may be that the possibility of semantic N-Adj order in English underlies the fact that their subjects had less difficulty with N-Adj&Num-N compared to Adj-N&N-Num order. Note that Greenberg's universal 18 is just as strong among languages where the semantic adjectives are grammatically verbs as it is among languages where the semantic adjectives are not verbs, as shown by Table 13.

	Adj is verb			Adj is not verb	
	Num-N	N-Num		Num-N	N-Num
Adj-N	12.21	0.95	Adj-N	32.16	4.60
N-Adj	15.74	28.06	N-Adj	15.61	51.53

TABLE 13. Adjusted frequencies bearing on Greenberg's universal 18, distinguishing languages where semantic adjectives are verbs and languages where they are not verbs.

Table 13 shows that Adj-N&N-Num order is the least frequent of the four orders, both among languages in which semantic adjectives are verbs and among those in

which semantic adjectives are not verbs, but especially among the former. This evidence, plus that cited above for the semantic basis for both the postnominal adjective preference and intracategorical harmony, the two principles of mine that underlie Greenberg's universal 18, argue that the cognitive factors underlying this universal are based on semantic categories rather than syntactic categories. This suggests that phrases of the form *a man who is/was tall* count as instances of N-Adj order, so there is a sense in which English allows N-Adj&Num-N order but not Adj-N&N-Num order. We therefore cannot exclude the possibility that the Culbertson et al. 2012 results are due to biases toward English word order.

In order to factor out the influence of native-speaker language, it would be necessary to perform a similar experiment with speakers of other languages. Japanese would be a particularly useful language to use for this purpose since, although it resembles English in that the dominant position for both adjectives and numerals is before the noun, it differs in that (semantic) adjectives always precede the noun while numerals can follow the noun (Kim 1995). If the Culbertson et al. experimental result truly reflects a cognitive bias against Adj-N&N-Num order, we should expect results for Japanese that are similar to those found for English. If the preference for N-Adj&Num-N over Adj-N&N-Num in their data is actually due to the influence of English along the lines I have suggested, we would expect the opposite preference for the Japanese speakers.

**11. CONCLUSION.** This article had four goals. The first of these has been to present data from a large sample of languages on the relative frequencies of different orders of demonstrative, numeral, adjective, and noun, including the identification of which orders are attested as dominant. In some respects, I consider this the primary goal, since this data provides a basis for testing any proposals for accounting for the orders of these four elements that may arise in the future. The second goal has been to propose a set of descriptive principles that account for the relative frequencies. While I have made some suggestions regarding the deeper explanation for these descriptive principles, these suggestions remain very tentative and this has not been a primary goal of this article. The third goal has been to argue that to a large extent, the principles underlying the order of these elements crosslinguistically are semantic, not syntactic. The fourth goal has been to demonstrate inadequacies in previous proposals by others, especially Cinque 2005.

Following Greenberg 1963 and Cinque 2005, I have restricted attention in this article to the position of only three modifiers of nouns, namely demonstratives, numerals, and adjectives. Ultimately, we need a more general theory of the order of noun modifiers, including not only these three, but also other types of modifiers, including articles (which exhibit different tendencies from demonstratives in terms of their position relative to the noun; Dryer 1992), relative clauses, possessors, plural words (Dryer 1989b), quantifiers meaning 'all' (which occur outside demonstratives more often than numerals do, as in English *all those people*), and various sorts of interrogative modifiers (corresponding to English *which*, *what sort of*, *how many*, *whose*). The extent to which the theory for the three modifiers discussed here extends to other modifiers is ultimately a further consideration in choosing between different approaches.

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