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The derivation of compound ordinal numerals: Implications for morphological theory

The derivation of compound ordinal numerals: Implications for morphological theory[1]

Gregory Stump

Abstract

In the domains of both inflection and derivation, there is evidence for both rules of exponence (which realize specific morphosyntactic properties or derivational categories through the introduction of specific morphological markings) and rules of composition (which determine how such rules of exponence apply in the definition of a compound's inflected forms or derivatives). A single, general rule of composition accounts for the definition of a wide range of derivatives from compound bases; nevertheless, ordinal derivation demonstrates the considerable extent to which rules of composition may vary across languages. Evidence from a diverse range of languages is used to motivate a typology of ordinal derivation whose distinct types embody different rules of composition.

1 Derivational marking in compounds

The expression of a derivational category C is customarily equated with the application of a word-formation rule relating a base B of the appropriate sort to a derivative D, whose form ordinarily differs from that of B in that it contains some formal mark of category C; for instance, the expression of the derivational category 'privative adjective' is equated with the application of a rule relating a noun B to an adjective B-*less*. (Hereafter, I shall refer to derivational rules of this sort, which introduce specific morphological markings (such as -*less*) as RULES OF DERIVATIONAL EXPONENCE.) In many cases, the expression of a derivational category C involves not only a rule R of derivational exponence, but also an additional rule specifying how R is involved in the expression of C when the base is a compound. In instances in which the compound is headed, this additional RULE OF COMPOSITION very often requires the application of R to the compound's head. That is, for any rule of derivational exponence *Deriv*, the application

of ***Deriv*** to a compound [X Y] headed by Y is very often determined by the rule of composition in (1):

(1)   Rule of composition for ***Deriv***: ***Deriv***([X Y])=[X ***Deriv***(Y)]

On first consideration, (1) might appear to be the ONLY rule of composition that is ever needed in the derivational domain; my purpose here is to challenge this assumption. In particular, I shall demonstrate that in deriving ordinal numerals from their cardinal counterparts, languages exploit a wide array of rules of composition, including but by no means limited to (1).

I first discuss rules of composition that are widely observable in the domains of inflection and nonordinal derivation (§2). I then discuss the derivation of ordinal numerals in a range of languages, including the rules of composition that are involved in this derivation (§3). The evidence that I discuss motivates a richly varied typology of ordinal formation and leads to the conclusion that in the derivational domain, rules of composition may assume a variety of different forms (§4).

2 Rules of composition in inflection and in nonordinal derivation

There is clear evidence for a distinction between rules of exponence and rules of composition both in the derivational domain and in the domain of inflection. Consider first the case of inflection. In the inflection of English, various lexically conditioned rules of inflectional exponence are involved in the definition of past-tense forms such as *lived*, *did*, *sang*, *ate*, and *spent*; on the other hand, a single rule of composition guarantees that headed compounds such as OUTLIVE, OVERDO, OUTSING, OVEREAT and OUTSPEND inflect for past tense on their head in the manner required by its lexical conditioning: *outlived*, *overdid*, *outsang*, *overate*, *outspent*. Stump (2001: 115) calls this rule of composition THE HEAD-APPLICATION PRINCIPLE and argues that it is a universal of inflectional morphology. According to this principle, the result of applying a rule ***Infl*** of inflectional exponence to a compound [X Y] headed by Y is the compound [X ***Infl***(Y)]. The only kind of situation in which the Head-Application Principle does not enter into the inflection of a compound [X Y] is one in which the rule defining the compound [X Y] stipulates that X and Y are both uninflected stems; in such cases, rules of inflectional exponence must treat [X Y] as an unanalyzed whole (Stump 2001: 114ff).

The rule of composition in (1) in many cases functions as the derivational counterpart of the Head-Application Principle. Thus, consider the formation of denominal occupation nouns in English. Given a noncompound disciplinary noun of the form X, one can represent the form of the corresponding occupational derivative as the result of applying a function ***OccupDeriv*** to X. The evaluation of ***OccupDeriv*** is lexically conditioned: where X=*physics*, ***OccupDeriv***(X)=*physicist* (in which *-ist* supplants the final *s* in *physics* and induces velar softening, however this is to be formulated); where X=*economics*, ***OccupDeriv***(X)=*economist* (in which *-ist* supplants the final *-ics* in *economics*); and where X=*linguistics*, ***OccupDeriv***(X)=*linguist* (from which the final *–ics* in *linguistics* is simply absent). This lexical conditioning is represented in (2).

(2) Lexical conditioning in the derivation of denominal occupation nouns in English

Disciplinary noun X	Occupational derivative *OccupDeriv*(X)		
	absence of *-s* addition of *-ist*	absence of *-ics* addition of *-ist*	absence of *-ics* no addition of *-ist*
physics	*physic-ist*		
economics		*econom-ist*	
linguistics			*linguist*

When the base of derivation is a compound disciplinary noun [X Y], the form of the occupational derivative is in general [X *OccupDeriv*(Y)], where *OccupDeriv*(Y) exhibits the lexical conditioning specifically associated with Y; for instance, the compound disciplinary nouns in (3a) have the occupational derivatives in (3b). This regularity in the formation of the occupational derivatives from compound bases may be attributed to the rule of composition in (1).

(3) Denominal occupation nouns (b) derived from compounds (a)
    a.   *high-energy physics*   b.   *high-energy physicist*

         home economics   *home economist*

         Romance linguistics   *Romance linguist*

This rule of composition is the cause of the 'bracketing paradoxes' observed by Spencer 1988: logically, *atomic scientist* has the structure [[atomic science] –ist], yet morphologically, as an effect of (1), it has the realization [atomic [scient-ist]]. Because of (1), it is fallacious to expect a derived lexeme's logical structure to be isomorphic to its morphological realization: the meaning of the lexeme ATOMIC SCIENTIST is related to the meaning of the lexeme ATOMIC SCIENCE, but this relation is not mediated by ATOMIC SCIENTIST's morphological realization as [atomic [scient-ist]].

    In the examples in (3), the rule of composition in (1) functions very much like the Head-Application Principle; just as the latter principle causes inflectional markings to be situated on the head of a compound, so (1) causes derivational marking to be situated on the head of each compound in (3a). But unlike the Head-Application Principle, the rule of composition in (1) doesn't invariably define a pattern of head marking. Consider, for instance, the derivation of diminutives from exocentric [V N] compounds in Spanish (Catalán 1995).

    Suppose first that given a noncompound Spanish noun X, the form of the corresponding diminutive derivative is the result of applying a function *Dimin* to X. On that assumption, the evaluation of *Dimin* must be conditioned both by X's gender and by its prosodic characteristics: where the derivational base X is masculine, *Dimin*(X) is also masculine and exhibits a diminutive marker from column M of (4); where X is feminine, *Dimin*(X) is also feminine and exhibits a diminutive marker from column F;

and the choice among the markers in rows (4a–c) depends on the derivational base's prosodic characteristics, as in (5).

(4)   Variant realizations of the Spanish diminutive suffix

	M	F
a.	*–ito*	*–ita*
b.	*–cito*	*–cita*
c.	*–ecito*	*–ecita*

(5)   Prosodic conditioning in the derivation of diminutives in Spanish

Base		Diminutive suffix (masc./fem.)			
Number of syllables	Final syllable	*-ito/-ita*[1]	*-cito/-cita*	*-ecito/-ecita*	Example
>2	open	*sombrero* 'sombrero' *principe* 'prince' *campana* 'bell'			*sombrerito* *principito* *campanita*
	ends in *n*		*corazón* 'heart' *canción* 'song'		*corazoncito* *cancioncita*
2	ends in *e, r, z*		*jefe* 'head, chief' *pintor* 'painter' *nariz* 'nose'		*jefecito* *pintorcito* *naricita*
	other	*mesa* 'table' *mano* 'hand' *paño* 'cloth' *pañal* 'diaper' *señal* 'sign'			*mesita* *manito* *pañito* *pañalito* *señalita*
1	closed			*pan* 'bread' *cruz* 'cross' *mes* 'month'	*panecito* *crucecita* *mesecito*
1. With elision of the base's final vowel.					

Now, Spanish has a class of exocentric compounds of the form [V N], e.g. *lava-platos* 'dishwasher' [wash-dishes]. Diminutives derived from such compounds are defined by the rule of composition in (1). The effect of (1) is to cause the realization of diminutive morphology in a diminutive deriving from an exocentric compound to be conditioned not by the prosody of the compound as a whole but by that of the compound's right-hand member (minus any plural morphology), as in the examples in (6). These cases are unlike that of *high-energy physicist*, since in these cases, the derivational marking is not situated on the compound's head; indeed, the compound has no head. Even so, *high-energy physicist* and *quitasolecito* are alike in that each derives from a compound C through the application of the relevant rule of derivational exponence to C's second member (whether or not this is C's head). Should this be seen as evidence that the rule of composition in (1) is a universal principle of derivation?

(6)   Exocentric compounds and their diminutives in Spanish

	Exocentric compound V-N$_2$	Diminutive
N$_2$ is a closed monosyllable	*quita-sol* 'parasol'	*quitasolecito*
	traga-luz 'skylight'	*tragalucecitas*
Minus its plural morphology, N$_2$ is disyllabic and ends in a vowel other than *e*	*apaga-velas* 'candle snuffer'	*apagavelitas*
	par-aguas 'umbrella'	*paraguitas*
	toca-discos 'record player'	*tocadisquitos*
	lava-platos 'dishwasher'	*lavaplatitos*
	abre-cartas 'letter opener'	*abrecartitas*
	tapa-bocas 'scarf/muffler'	*tapaboquitas*
	cuenta-gotas 'dropper'	*cuentagotitas*
Minus its plural morphology, N$_2$ is disyllabic and ends in *e*	*guarda-bosques* 'forest ranger'	*guardabosquecitos*
	para-choques 'bumper'	*parachoquecitos*
	porta-llaves 'keyring'	*portallavecitas*

One apparent kind of counterevidence to this hypothesis involves synthetic compounds such as *sheep-stealer*, *theater-goer*, and *evildoer*, in which the agentive suffix does not join with the verbal base in isolation: **stealer*, **goer*, **doer*. Such cases might, however, be brought into conformity with the hypothesis that (1) is invariably valid by appealing to the distinction between absolute and conjunct forms. An absolute form is used in isolation from any compounded formatives; a conjunct form is used in the presence of

compounded formatives. Many languages exhibit absolute/conjunct distinctions in their morphology (Stump 1995: 264–73; 2001: 119–26). In Sanskrit, for example, a verb's gerund has both an absolute form in *–tvā* (used in the absence of any compounded preverbs, e.g. *patitvā* 'having flown') and a conjunct form in *–ya* (used in the presence of one or more compounded preverbs, e.g. *ni-patya* 'having flown down'). Once a distinction is drawn between absolute and conjunct forms, one can say that in English, the agentive derivatives of the verbs *steal*, *go*, and *do* have conjunct forms but lack absolute forms; in this way, one can maintain that even derivatives such as *sheep-stealer* conform to (1).

This hypothesis, however, is dramatically disconfirmed by the evidence of ordinal derivation. A survey of ordinal derivation in over seventy languages reveals that when a compound cardinal numeral is the base of derivation, the expression of ordinal derivation is highly variable. Thus, suppose that each language with ordinal derivation has a function **Ord** such that where X is a cardinal numeral, **Ord**(X) is the ordinal counterpart of X; on that assumption, (1) does not suffice to define the form of ordinal derivatives for compound cardinal numerals. Indeed, as I now show, languages exhibit great diversity in the rules of composition that they employ for the evaluation of the function **Ord**.

3 Ordinal derivation

3.1 Some preliminaries

Before considering the formation of ordinal derivatives from compound cardinal numerals, it is important to note the large variety of ways in which natural languages form complex cardinal numerals. Some languages have no cardinal numeral morphology at all; an example is Andamanese, whose cardinal numeral system is reported to consist of the two lexical items in (7).

(7)   The cardinal numerals of Andamanese (according to Bloch, cited by Stampe 1976: 596)
      ūbatūl '1'   īkpōr '2 or more'

Most languages, however, have rich systems of cardinal numeral morphology, allowing larger numbers to be named through the systematic combination of numerals that name smaller numbers. The nature of such combinations varies widely across languages. For instance, Stampe (1976) cites the words for 'eighteen' in the languages in (8):

(8)   The cardinal numeral 'eighteen' in fifteen languages (cf. Stampe 1976: 594f)

Ono [Trans-New Guinea]	mete etke so keio mane so ḏitne karewe	hand 2 and foot whole and toe 3
Sora (a) [Austro-Asiatic; Munda]	mɨ-jeŋ yagi	1-foot 3

Welsh (a)	tri ar bym-theg	3 on 5–10
Classical Greek	ὀκτω-καί-δεκα	8-and-10
Spanish	diez y ocho	10 and 8
Nama [Khoisan]	[dìsi]-xhéisa-ca	[10]-8-and
German	acht-zehn	8–10
Vietnamese [Austro-Asiatic; Mon-Khmer]	mư ời-tám	10–8
Lithuanian	aštuna-lika	8-left
Ainu	tu-pesan-ishama-wan	2-from.[10]-and -both.[hands]
Latin	duo-de-vi-ginti	2-from-2–10
Finnish	kah-deksan toista	2-from.10 of. the.2nd.[10]
Sora (b)	miggəl-tuḍru	12–6
Breton	tri-ouec'h	3–6
Welsh (b)	deu-naw	2–9

These examples demonstrate at least three dimensions along which languages vary in the definition of their cardinal numerals. First, languages differ in the choice of their numeral base. Most of the cardinal numeral systems exemplified in (8) express 'eighteen' decimally (in base 10), but Sora (variety (b)) instead expresses it duodecimally (in base 12). The languages represented here also vary in the way in which arithmetic operations are evoked for the interpretation of complex cardinal numerals: most express the numeral 'eighteen' additively, but Breton and Welsh (b) express it multiplicatively, Ono expresses it through the use of both multiplication and addition, and Latin expresses it through the use of both multiplication and subtraction. Finally, the languages vary in the ways in which they express a particular arithmetic operation: Spanish, for example, expresses the additive operation in 10+8 through the use of an overt conjunction; Vietnamese expresses the additive operation in 10+8 purely by means of the ordering of its conjuncts, with the smaller addend following the larger one (in contrast to *tám mười* '80', literally '8 10'); and German expresses the additive operation in 8+10 through the use of the allomorph *zehn* (in contrast to *-zig*, which is instead used for the expression of the multiplicand as in numerals such as *achtzig* '80').

My objective here is to examine a further layer of diversification in the definition of languages' numeral systems, namely that of the formation of ordinal numerals (numerals that don't simply specify cardinality, but indicate a position in an ordered sequence). In particular, I shall develop a typological classification of the ways in which complex numerals such as those in (8) form their ordinals; in formal terms, this is a classification of the kinds of rules of composition that languages use in deriving ordinals from complex cardinals.[2]

Many languages have distinct cardinal and ordinal numerals, but not all do; for instance, there are no special ordinal numerals in the Peruvian language isolate Urarina (Olawsky 2006: 282), nor in the Chapacura–Wanham language Wari' of Brazil (Everett & Kern 1997: 349), nor in the Sino–Tibetan languages Qiang (LaPolla 2003: 64) and Dumi (van Driem 1993: 88). Many languages also distinguish ordinals from cardinals for certain numbers only. For instance, in the Babungo language (Niger–Congo; Cameroon), only 'one' has an ordinal counterpart (Schaub 1985: 240); in Lavukaleve (East Papuan), ordinals are distinguished from cardinals only for 'one' through 'ten', beyond which the cardinal numerals serve both cardinal and ordinal functions (Terrill 2003: 53); in Panamint (Uto–Aztecan), special ordinals exist only for 'one' through 'ten' and for multiples of ten (Dayley 1989: 161–7). Even so, a great many languages associate a distinct ordinal numeral with every one (or nearly) of their cardinal numerals; it is with those languages that I am concerned here.

3.2 External ordinal marking

Conceptually, the simplest way of forming the ordinal counterpart of a complex cardinal numeral *n* is by means of an operation applying to *n* as an unanalyzed whole. I shall refer to ordinal marking arising through such operations as EXTERNAL ordinal marking. The clearest cases of external ordinal marking are those involving a circumfix which straddles an entire cardinal numeral, however complex it may be. Thus, in Kanuri, ordinals are formed by attaching a circumfix to the corresponding cardinal; the circumfix consists of the prefix *kə́n–* and the suffix *-mi*, which join with both simplex and complex cardinals, as in (9).

(9) **Kanuri** [Nilo–Saharan] exhibits ordinal marking of the EXTERNAL CIRCUMFIXAL type

Cardinal:	tiló '1' 1	fíndi '20' 20	fíndin (lúkko) tilôn '21' 20 (&) 1
Ordinal:	kə́n-tiló-mi '1st' ORD-1-ORD	kə́n-fíndi-mi '20th' ORD-20-ORD	kə́n-fíndin (lúkko) tilôn-mi '21st' ORD-20 (&) 1-ORD
Sources:	Cyffer 2007: 1106–07; Hutchison 1981: 76–77, 202–03.		

Additional language of this type: Old Georgian [Kartvelian]; Fähnrich 1991: 154–55. Fähnrich mentions that alongside the external circumfixal pattern *me-oc-da-ert-ey* [ORD-20-&-1-ORD], the pattern *oc da me-ert-ey* [20-&-ORD-1-ORD] is also attested in Old Georgian; this pattern is comparable to a Modern Georgian pattern cited in (22a) below.

Thus, Kanuri doesn't need a rule of composition for the derivation of ordinals from complex cardinals; instead, all cardinals, complex or not, involve a single word-formation rule, as in (10).

(10) Definition of **Ord** in Kanuri: **Ord**(X) = *kə́n*-X-*mi*

3.3 Internal ordinal marking

Despite the conceptual simplicity of deriving ordinals from compound cardinals treated as unanalyzed wholes, a very common pattern of ordinal marking for compound cardinals involves the use of ordinal marking on one or more of the compound's individual constituents. I refer to this pattern of ordinal marking as INTERNAL marking.

There are numerous subtypes of internal ordinal marking. One extremely common subtype involves ordinal marking on exactly one constituent of the numeral compound, typically a peripheral constituent. Thus, in many languages, ordinal marking is situated on a numeral compound's right-peripheral constituent. In English, for example, the ordinal counterpart of the compound cardinal *twenty-one* is *twenty-first*, in which only the compound's final constituent exhibits ordinal marking. Similar examples are found in the other languages listed in (11).

(11) **English** exhibits ordinal marking of the INTERNAL RIGHT-PERIPHERAL type

Cardinal:	one	twenty	twenty-one
Ordinal:	first	twentieth	twenty-first

Additional languages of this type:		
Kurux	[Dravidian]	Hahn 1985: 87–90
West Greenlandic	[Eskimo-Aleut]	Fortescue 1984: 304–07.
Latvian	[IE; Baltic]	Fennell & Gelsen 1980: 159, 230, 357, 366, 377.
Lithuanian	[IE; Baltic]	Senn 1966: 212–18.
Afrikaans	[IE; Germanic]	Donaldson 1993: 420–24.
Dutch	[IE; Germanic]	Fehringer 1999: 58–60.
German	[IE; Germanic]	Hammond 1981: 167–72.
Norwegian	[IE; Germanic]	Strandskogen & Strandskogen 1986: 147–49.
Swedish	[IE; Germanic]	Holmes & Hinchliffe 2003: 196–206.
Bulgarian	[IE; Slavic]	Rå Hauge 1999: 76.
Lower Sorbian	[IE; Slavic]	Janaš 1976: 143–65.

Russian	[IE; Slavic]	Wade 1992: 193–218.
Serbian	[IE; Slavic]	Hammond 2005: 255–67.
Slovene	[IE; Slavic]	Herrity 2000: 126–37.
Ukrainian	[IE; Slavic]	Pugh & Press 1999: 189–98.
Modern Georgian (a)	[Kartvelian]	Aronson 1989: 147–48, 279–81; 1991: 263–65; Fähnrich 1987: 62–64.
Nenets	[Uralic]	Décsy 1966: 43.

In these languages, a rule of composition of the type in (1) is responsible for the derivation of ordinals for complex cardinals. Thus, the **Ord** function has the following recursive definition in English:

(12) (Recursive) definition of **Ord** in English:

    a. Default rule of derivational exponence: **Ord**(X) = X-*(e)th* (where *e* appears after *i*)

    b. Rules of derivational exponence overriding (12a):

        Ord(*one*) = *first*

        Ord(*two*) = *second*

        Ord(*three*) = *third*

    c. Rule of composition overriding (12a): **Ord**([X Y]) = [X **Ord**(Y)]

Though I've characterized the ordinal marking in (11) as right-peripheral, there is an apparent alternative analysis: that of assuming that ordinal marking is always situated on the numeral denoting the smaller of two numbers. It is clear, though, that for the languages cited here, the simpler analysis is that ordinal marking is situated at a compound numeral's right periphery. Consider first English multiplicative compounds such as *two hundred*: these, too, exhibit right-peripheral ordinal marking (*two hundredth*), even though the multiplicand *hundred* denotes a larger number than the multiplier *two*. Moreover, the English teens are additive numerals in which the smaller addend precedes the larger, yet here too, ordinal morphology is situated at the right periphery, as in *seventeenth*. And finally, several Germanic and Slavic languages express '21' as 'one and twenty', with the smaller addend preceding; yet here again, the ordinal counterpart involves the ordinal form of the final addend rather than that of the smaller addend. These same languages express '101' as 'hundred (and) one', whose ordinal counterpart involves the ordinal form of 'one', as in English. (Norwegian has alternative forms for 'twenty-first', one similar to English, the other to German.)

    Internal ordinal marking is not always right-peripheral. Additive numerals in some languages are marked left-peripherally (on the larger of two addends), as for example in (13); see also the Breton evidence in §3.5.

(13) **Anywa** [Nilo-Saharan; Eastern Sudanic] exhibits ordinal marking of the INTERNAL LEFT-PERIPHERAL type in additive numerals

Cardinal:	ācíèl	āpáar	āpáar kúr cíèl	'11'
	'1'	'10'	10 & 1	
Ordinal:	dìkúɔŋ	pàaJ-gī	pàaJ-gī kúr cíèl	'11th'
	1.ORD	10-ORD	10-ORD & 1	
Source:	*Source:* Reh 1996: 286–88.			
Additional language of this type: Nobiin [Nilo-Saharan; Eastern Sudanic] Werner 1987: 108–11, 288.				

3.4 Extended internal ordinal marking

The examples of internal ordinal marking in (11) and (13) are SIMPLE in the sense that in each instance, only a single constituent carries ordinal marking in the ordinal form of a numeral compound. But some languages instead exhibit EXTENDED internal ordinal marking, in which two or more constituents of a numeral compound exhibit ordinal marking.

There are, in fact, three different subtypes of extended internal ordinal marking. The primary distinction is between extended internal ordinal marking which applies to operands of both multiplication and addition and marking which only applies to operands of addition (i.e. to addends). Consider first the Finnish example in (14). As this example shows, Finnish has extended internal ordinal marking, and the application of ordinal marking to a constituent is insensitive to whether that constituent serves as an operand of addition or multiplication. In Modern Greek, by contrast, only operands of addition are eligible for ordinal marking, as the example in (15) shows. Thus, extended internal ordinal marking may be OPERATION-INSENSITIVE (as in (14)) or OPERATION-SENSITIVE (as in (15)).

(14) **Finnish** [Uralic; Finnic] exhibits EXTENDED INTERNAL ordinal marking (OPERATION-INSENSITIVE):

Cardinal:	kolme-tuhatta sata-kolme-kymmentä–neljä 3-1000.PART.SG 100-3-10.PART.SG-4	'3134'
Ordinal:	kolmas-tuhannes sadas-kolmas-kymmenes–neljäs 3.ORD-1000.ORD 100.ORD-3.ORD-10.ORD-4.ORD	'3134th'

Sources: Sulkala & Karjalainen 1992: 344–7; Karlsson 1999: 129–35. Karlsson (1999: 134) notes that Finnish also allows long ordinal numerals in which only the final constituent carries ordinal marking, e.g. *kolmetuhatta satakolmekymmentäneljäs* '3134th'. Alongside *kahdes-kymmenes-ensimmäinen* [2.ORD-10.ORD-first] '21st' and *kahdes-kymmenes-toinen* [2.ORD-10.ORD-second] '22nd', *kahdes-kymmenes-yhdes* [2.ORD-10.ORD-1.ORD] '21st' and *kahdes-kymmenes-kahdes* [2.ORD-10.ORD-2.ORD] '22nd' are also possible; see (22b) below concerning these.

Additional language of this type: Vod [Uralic] Ariste 1968: 61–6.

(15) **Modern Greek** [IE; Hellenic] exhibits EXTENDED INTERNAL ordinal marking (OPERATION-SENSITIVE):

Cardinal:	*xília*	*tetrakósia*	*penínda*	*téssera*	'1,454'
	1000	4.100	5.10	4	
Ordinal:	*xiliostós*	*tetrakosiostós*	*pendikostós*	*tétartos*	'1,454th'
	1000.ORD	4.100.ORD	5.10.ORD	4.ORD	

Source: Joseph & Philippaki-Warburton 1987: 208.

Additional languages of this type:

Old Norse	[IE; Germanic]	Gordon 1957: 292–93.
Latin	[IE; Italic]	Wheelock 1963: 384–85
Portuguese	[IE; Italic]	Perini 2002: 106–11.
Spanish	[IE; Italic]	Butt & Benjamin 1988: 94–100.
Czech*	[IE; Slavic]	Naughton 2005: 116, 119. Naughton notes that in Czech, the numbers 21-99 are also expressible by means of additive compounds in which the lower constituent precedes, e.g. *jed(e)nadvacet* '21'; in the ordinal counterparts of these compounds, only the final addend carries ordinal marking, e.g. *jednadvacátý.*
Polish*	[IE; Slavic]	Swan 2002: 189–208; Bielec 1998: 240–56.

*For |X| < 100 (where |X| is the number denoted by numeral X); otherwise like English.

Among languages in which extended internal ordinal marking is operation-sensitive, there is a second distinction: in some such languages, the eligibility of an addend for ordinal marking may depend on how large a number it denotes. In Portuguese numeral compounds, all addends, no matter how large a number they denote, are eligible for ordinal marking; for example, the ordinal form of the numeral '1,566th' in (16) has ordinal marking on all of its addends. In Czech numeral compounds, by contrast, a nonfinal addend is eligible for ordinal marking only if it denotes a multiple of ten less than 100; for example, the ordinal form of the numeral '1,964th' in (17) has ordinal marking on its last two addends, but not on its first two. Thus, extended internal ordinal marking which is operation-sensitive may be UNLIMITED (as in Portuguese) or LIMITED (as in Czech).

(16) **Portuguese** exhibits UNLIMITED extended internal ordinal marking (operation-sensitive):

Cardinal:	mil,	quinhentos	e	sessenta	e	seis	'1566'
	1000	500	&	60	&	6	
Ordinal:	milésimo	quingentésimo	sexagésimo		sexto		'1566th'
	1000.ORD	500.ORD	60.ORD		6.ORD		

(Perini 2002: 110)

(17) **Czech** exhibits LIMITED extended internal ordinal marking (operation-sensitive):

Cardinal:	tisíc	devět	set	šedesát	čtyři	'1964'
	1000	9	100	60	4	
Ordinal:	tisíc	devět	set	šedesátý	čtvrtý	'1964th'
	1000	9	100	60.ORD	4.ORD	

(Naughton 2005: 119)

In these languages, a rule of composition rather different from the English rule (12c) is responsible for the derivation of ordinals for complex cardinals. Thus, the *Ord* function has the following (partial) recursive definition in Finnish:

(18) (Partial recursive) definition of *Ord* in **Finnish**:

    a. Default rule of derivational exponence:

        $Ord(X) = X'\text{-}s$, where X′ is the inflectional stem of X

    b. Rules of derivational exponence overriding (18a):

       $Ord(yksi) = ensimmäinen$ ['first']

       $Ord(kaksi) = toinen$ ['second']

    c. Rule of composition overriding (18a): $Ord([X\ Y]) = [Ord(X)\ Ord(Y)]$

Similarly, the *Ord* function has (19) as its (partial) recursive definition in Modern Greek:

(19) (Partial recursive) definition of *Ord* in **Modern Greek**:

    a. Default rule of derivational exponence:

        $Ord(X) = X'\text{-}to\text{-}$, where X′ is X's combining form.

    b. Rules of derivational exponence overriding (19a):

       $Ord(enas) = prótos$ ['first']

       $Ord(δjó) = δéfteros$ ['second']

       . . .

    c. Rules of composition overriding (19a):

       Where $|X|$ is the number denoted by numeral X and
       $|[Y\ Z]| = |Y| + |Z|$,

       $Ord([Y\ Z]) = [Ord(Y)\ Ord(Z)]$;

       otherwise, $Ord([W\ X]) = [W\ Ord(X)]$

3.5 Two types of structure sensitivity

The Modern Greek rule of composition in (19a) is sensitive to the arithmetic operation involved in a compound numeral. Rules of composition in other languages exhibit other sorts of sensitivity. In Breton, for example, a numeral compound exhibits internal ordinal marking on the addend immediately preceding an overt mark of addition (*war* 'on', *ha* 'and'); otherwise it has right-peripheral marking. The examples in (20) illustrate. As the examples in (20a) show, there is a natural syntactic break in Breton numerals containing an overt mark of addition: when a phrase-internal (cardinal or ordinal) numeral modifies the head of a noun phrase, the modified head noun occupies this natural break; thus,

Breton ordinal marking is right-peripheral within the part of the numeral preceding this break. Various ways of formulating this generalization are imaginable; these are orthogonal to the issue under scrutiny here.

(20) **Breton** [IE; Celtic] exhibits internal ordinal marking on the addend immediately preceding an overt mark of addition (*war* 'on', *ha* 'and'); otherwise it has right-peripheral marking.

<table>
<tr><td>a.</td><td rowspan="2">*Cardinal:*</td><td></td><td>tri</td><td>c'hant</td><td>pemp</td><td>(devez)</td><td>ha</td><td>tri-ugent</td><td>'365 (days)'</td></tr>
<tr><td></td><td></td><td>3</td><td>100</td><td>5</td><td>(day)</td><td>&</td><td>3-20</td><td></td></tr>
<tr><td></td><td rowspan="2">*Ordinal:*</td><td>an</td><td>dri</td><td>c'hant</td><td>pemp-ved</td><td>devez</td><td>ha</td><td>tri-ugent</td><td>'the 365th day'</td></tr>
<tr><td></td><td>the</td><td>3</td><td>100</td><td>5-ORD</td><td>day</td><td>&</td><td>3-20</td><td></td></tr>
<tr><td>b.</td><td rowspan="2">*Cardinal:*</td><td colspan="2">pem-zeg</td><td colspan="7">'15'</td></tr>
<tr><td></td><td colspan="2">5-10</td><td colspan="7"></td></tr>
<tr><td></td><td rowspan="2">*Ordinal:*</td><td colspan="2">pem-zeg-ved</td><td colspan="7">'15th'</td></tr>
<tr><td></td><td colspan="2">5-10-ORD</td><td colspan="7"></td></tr>
<tr><td colspan="10">*Sources:* Kervella 1976: 263–8; Trépos 1968: 123–8.</td></tr>
<tr><td colspan="10">*Additional language of this type:*
Welsh   [IE; Celtic]   King 1993: 111–21; Williams 1980: 40.</td></tr>
</table>

The structure sensitivity in (20) involves the localization of ordinal marking among a numeral compound's conjuncts. Breton ordinals also exhibit a second, quite different type of structure sensitivity: a numeral may have one ordinal marking when it appears in isolation and a different ordinal marking when it appears as a member of a compound. In Breton, the cardinal *unan* '1' has the suppletive ordinal *kentañ* 'first' when used in isolation; but as part of an additive compound, the ordinal form of *unan* is the fully regular form *unanved*; by contrast, the cardinal *daou* '2' has a suppletive ordinal *eil* that is used both in isolation and as part of an additive compound (though there is some dialectal variation in this regard). Similar facts hold true in Welsh. The examples in (21a,b) illustrate. As these examples show, certain ordinals have separate absolute and conjunct forms. Similar absolute/conjunct alternations are of course familiar in other areas of morphology (Stump 1995: 264ff; 2001: 119ff); for instance, Latin has absolute *faciō* 'I do' but conjunct *-ficiō* (*perficiō* 'I accomplish', *adficiō* 'I affect', *efficiō* 'I perform'), French has absolute *dites* 'you say' but conjunct *-disez* (*contredisez* 'you contradict', *interdisez* 'you prohibit', *médisez* 'you speak ill of'), Sanskrit has absolute *nītvā* 'having led' but conjunct *-nīya* (*pariṇīya* 'having married', *abhinīya* 'having brought near', *avanīya* 'having led down into'), and so on.

(21) Languages with separate absolute and conjunct ordinals

a. **Breton** [IE; Celtic]

Cardinal:	unan		unan warn-ugent	'21'	daou	daou warn-ugent '22'
	1		1 on-20		2.MASC	2.MASC on-20
Ordinal:	absolute:	kentañ			eil	eil warn-ugent '22nd'
		1.ORD				
	conjunct:	unan-ved	unan-ved warn-ugent '21st'	2.ORD	2.ORD on-20
		1-ORD	1-ORD on-20		

Sources: Kervella 1976: 263–8; Trépos 1968: 123–8. Trépos also notes (p.127) the incidence of the patterns *eilved warn-ugent*, *daouved warn-ugent*, and *diouved warn-ugent* '22nd'.

b. **Welsh** [IE; Celtic]

Cardinal:	un		un ar hugain	'21'	dau	dau ar hugain '22'
	1		1 on 20		2.MASC	2.MASC on 20
Ordinal:	absolute:	cyntaf			ail	ail ar hugain '22nd'
		1.ORD				
	conjunct:	un-fed	un-fed ar hugain '21st'	2.ORD	2.ORD on 20
		1-ORD	1-ORD on 20		

Sources: King 1993: 111–21; Williams 1980: 40.

In some systems, conjunct ordinals alternate optionally with their absolute counterparts. Thus, in Modern Georgian, the fully regular circumfixal form *me-ert-e* [ORD-1-ORD] '1st' optionally appears as a conjunct alternative to the suppletive ordinal *p'irveli* '1st'. In Finnish, *yksi* '1' and *kaksi* '2' each have two alternative ordinals: an absolute form (*ensimmäinen* and *toinen*) and a conjunct form (*yhdes* and *kahdes*). The absolute form is used in isolation; the conjunct form is used in multiplicative compounds; and in additive compounds either the absolute form or the conjunct form may be used. The Georgian and Finnish facts are schematized in (22).

(22) Languages with optional conjunct ordinals

a. **Modern Georgian** [Kartvelian]

Cardinal:	erti		oc-da-erti	'21'
	1		20-&-1	
Ordinal:	absolute:	p'irveli	oc-da-p'irveli	'21st'
		1.ORD	20-&-first	
	conjunct:	me-ert-e	oc-da-me-ert-e	'21st'
		ORD-1-ORD	20-&-ORD-1-ORD	

Sources: Aronson 1989: 147–48, 279–81; 1991: 263–65; Fähnrich 1987: 62–64; 1991: 154–55. The pattern *oc-da-me-ert-e* is attested in Old Georgian as *oc da me-ert-ey* '21st', alongside the external marking pattern of *me-oc-da-ert-ey*; cf. (9) above.

b. **Finnish** [Uralic]

Cardinal:	yksi		kaksi-kymmentä yksi		'21'
	1		2-10	1	
	kaksi		kaksi-kymmentä kaksi		'22'
	2		2-10	2	
Ordinal:	absolute:	ensimmäinen	kahdes-kymmenes-ensimmäinen	'21st'
		1.ORD	2.ORD-10.ORD-1.ORD	
		toinen	kahdes-kymmenes-toinen	'22nd'
		2.ORD	2.ORD-10.ORD-2.ORD	
	conjunct:	yhdes	kahdes-kymmenes-yhdes	'21st'
		1.ORD	2.ORD-10.ORD-1.ORD	
		kahdes	kahdes-kymmenes-kahdes	'22nd'
		2.ORD	2.ORD-10.ORD-2.ORD	

Sources: Sulkala & Karjalainen 1992: 344–7; Karlsson 1999: 129–35.

In view of the two sorts of structure sensitivity that Breton ordinals exhibit, the Breton definition of the *Ord* function in (23) is different from those of (12), (18), and (19). In this definition, the function *Ord*_{conjunct} applies to a cardinal numeral to yield the

corresponding conjunct ordinal; by default, $Ord_{\text{conjunct}}(X) = Ord(X)$ (as in (23a)), but this default is overridden when $X = unan$ 'one' (as in (23b)).

(23) (Partial recursive) definition of *Ord* in **Breton**:

    a.   Default rules of derivational exponence:

$$Ord(X) = X\text{-}ved$$
$$Ord_{\text{conjunct}}(X) = Ord(X)$$

    b.   Rules of derivational exponence overriding (23a):

$Ord(unan) = kentañ$	['first'; absolute]
$Ord_{\text{conjunct}}(unan) = unanved$	['first'; conjunct]
$Ord(daou) = eil$	['second']
$Ord(tri) = trede$	['third']
$Ord(pevar) = pevare$	['fourth']

    c.   Rules of composition overriding (23a):

$$Ord([X \text{ CONJ } Y]) = [Ord_{\text{conjunct}}(X) \text{ CONJ } Y]; \text{ otherwise,}$$
$$Ord([X \ Y]) = [X \ Ord(Y)]$$

3.6 Order sensitivity

In addition to operation sensitivity (§3.4) and structure sensitivity (§3.5), ordinal marking may exhibit sensitivity to the ordering of two addends. In Maltese (Afro–Asiatic; Semitic), ordinals are distinguished from cardinals in that they necessarily exhibit initial definiteness marking (*għoxrin* 'twenty', *l-għoxrin* 'twentieth'); low ordinals also exhibit different stems from their cardinal counterparts (*wieħed / waħda* 'one' [masc./fem.], *l-ewwel* 'first'). The ordinal form of an additive compound cardinal exhibits external ordinal marking (realized purely as initial definiteness marking: *wieħed u għoxrin* 'twenty-one', *il-wieħed u għoxrin* 'twenty-first') unless the smaller addend follows, in which case ordinality is realized as both initial definiteness marking and ordinal marking of the smaller addend: *mija u wieħed* 'one hundred one', *il-mija u l-ewwel* 'hundred and first'; *mija u wieħed u għoxrin* '121', *il-mija u l-wieħed u għoxrin* '121st' (Borg & Azzopardi-Alexander 1997: 266–71). Thus, in Maltese, the *Ord* function has (24) as its (partial) definition, where *Definite*(x) is the definiteness-marked form of X.

(24) (Partial recursive) definition of *Ord* in **Maltese**:

    a.   Default rule of derivational exponence: $Ord(X) = Definite(X)$

    b.   Rules of derivational exponence overriding (24a):

$Ord(wieħed) = Ord(waħda) = Definite(ewwel)$	['first']
$Ord(żewġ) = Definite(tieni)$	['second']
$Ord(tliet) = Definite(tielet)$	['third']

         . . .

    c.   Rule of composition overriding (24a):
             Where $|[Y\ Z]| = |Y| + |Z|$ and $|Y| > |Z|$, $Ord([Y\ Z]) =$
             Definite$([Y\ Ord(Z)])$

3.7 Interim summary

The facts discussed so far suggest the typology of ordinal marking in compound numerals in (25). The evidence motivating this typology entails a range of different rules of composition for the compound ordinals in these languages; these are summarized for six languages in (26).

(25) Types of ordinal marking in compound numerals

Language	External	Internal	Extended	Operation-sensitive	Limited	Periphery	Conjunct morphology
Kanuri	Yes	No	N/A	N/A	N/A	Circumfixal	No
English	No	Yes	No	N/A	N/A	Right	No
Anywa	No	Yes	No	N/A	N/A	Left	No
Finnish	No	Yes	Yes	No	No	N/A	Optional
Modern Greek	No	Yes	Yes	Yes	No	N/A	No
Portuguese	No	Yes	Yes	Yes	No	N/A	No
Czech	No	Yes	Yes	Yes	Yes	Right	No
Brythonic (Breton, Welsh)	No	Yes	No	N/A	N/A	On the addend immediately preceding an overt mark of addition; otherwise right	Yes
Modern Georgian	No	Yes	No	N/A	N/A	Right	Optional
Maltese	Yes, except that …	… ordinal marking appears on the smaller of two addends if it follows	No	N/A	N/A	Right if internal	No

(26) Rules of derivational exponence and composition for ordinal derivation in six
languages (where |X| is the number denoted by numeral X)

Rules of derivational exponence	Rules of composition
Kanuri: Ord(X) = *kə́n-X-mi*	
English Default: Ord(X) = X-*(e)th* Overrides: Ord(*one*) = *first* Ord(*two*) = *second* Ord(*three*) = *third*	Ord([X Y]) = [X Ord(Y)]

Finnish
 	
Defaults:
 	
    Ord(X) = X'-*s*, where X' is the inflectional stem of X
 	
    $Ord_{conjunct}$(X) = Ord(X)
 	
Overrides:
 	
    Ord(*yksi*)   = *ensimmäinen*   ['first'; absolute]
 	
    $Ord_{conjunct}$(*yksi*)   = *yhdes*   ['first'; conjunct]
 	
    Ord(*kaksi*)   = *toinen*   ['second'; absolute]
 	
    $Ord_{conjunct}$(*kaksi*)   = *kahdes*   ['second'; conjunct]
	Ord([X Y]) = [$Ord_{conjunct}$(X) $Ord_{conjunct}$(Y)]
	
	(where Y = *yksi* or *kaksi*, Ord([X Y]) is optionally [$Ord_{conjunct}$(X) Ord(Y)])

Modern Greek
 	
Default:
 	
    Ord(X) = X' -*to*-, where X' is X's combining form.
 	
Overrides:
 	
    Ord(*enas*) = *prótos*   ['first']
 	
    Ord(*δjó*) = *δéfteros*   ['second']
 	
    …
	Where |[Y Z]| = |Y| + |Z|,
	
	    Ord([Y Z]) = [Ord(Y) Ord(Z)];
	
	otherwise,
	
	    Ord([W X]) = [W Ord(X)]

Breton		
Defaults: $Ord(X) = X\text{-}ved$		
$\qquad Ord_{conjunct}(X) = Ord(X)$		
Overrides:		$Ord([X \text{ CONJ } Y]) = [Ord_{conjunct}(X) \text{ CONJ } Y]$
$\quad Ord(unan) = kenta\tilde{n}$	['first'; absolute]	$Ord([X\,Y]) = [X\ Ord(Y)]$
$\quad Ord_{conjunct}(unan) = unanved$	['first'; conjunct]	
$\quad Ord(daou) = eil$	['second']	
$\quad Ord(tri) = trede$	['third']	
$\quad Ord(pevar) = pevare$	['fourth']	
Maltese		
Default: $Ord(X) = Definite(X)$		
Overrides:		
$\quad Ord(wie\hbar ed) = Ord(wa\hbar da)$		Where $|[Y\,Z]| = |Y| + |Z|$ and $|Y| > |Z|$,
$\qquad\qquad = Definite(ewwel)$	['first']	$Ord([Y\,Z]) = Definite([Y\ Ord(Z)])$
$\quad Ord(\dot{z}ew\dot{g}) = Definite(tieni)$	['second']	
$\quad Ord(tliet) = Definite(tielet)$	['third']	
$\quad$…		

In the foregoing discussion, I have been assuming that compound numerals are morphological compounds and hence that rules of composition are morphological rules. Yet it is certainly possible that in some languages, compound numerals are generated in the syntax rather than in the morphology. For instance, the fact that the noun modified by a Breton cardinal or ordinal may be situated internally to the numeral (as in (20a)) and the fact that the parts of a Finnish complex numeral agree not only in ordinality but in number and case (Karttunen 2006) suggests that in these languages, compound numerals are generated syntactically. This is, however, an issue orthogonal to the need to postulate rules of composition; that is, whether one views a language's compound numerals as a product of morphology or of syntax, it is in any event necessary to postulate rules for the distribution of ordinal morphology with respect to a compound numeral's structure. Thus, if a compound cardinal numeral such as *twenty-one* is regarded as a syntactically complex expression of the form [$_{Card}$ Card Card], then the corresponding ordinal numeral must be seen as having the form [$_{Ord}$ Card Ord]; that is, compound ordinal numerals must be assumed to instantiate the recursive structure [$_{Ord}$ Card Ord], the syntactic equivalent of the rule of composition in (12c). In this way, each of the rules of composition in (26) can be given a syntactic characterization, as in (27).

(27) Ordinal composition in six languages (where |X| is the number denoted by numeral X)

Type	Syntactic conception of numeral composition	
Kanuri	Ord ／＼ ORD Card ORD	
English	Ord ／＼ Card Ord	
Finnish	Ord ／＼ Ord Ord	
Modern Greek	Multiplicative interpretation: Ord_2 ／＼ Card Ord_1	Additive interpretation: Ord_3 ／＼ Ord_1 Ord_2
Breton	Ord ／＼ Card Ord	Ord ／｜＼ Ord CONJ Card
Maltese	Ord_2 ／＼ Card Ord_1 where $\mid \text{Ord}_2 \mid = \mid \text{Card} \mid + \mid \text{Ord}_1 \mid$ and $\mid \text{Ord}_1 \mid < \mid \text{Card} \mid$	Ord ／＼ Card_1 Card_2 where $\mid \text{Ord} \mid = \mid \text{Card}_1 \mid + \mid \text{Card}_2 \mid$ and $\mid \text{Card}_1 \mid < \mid \text{Card}_2 \mid$

3.8 Ambiguous ordinal marking: External or internal?

In *twenty-first*, the incidence of suppletion in the ordinal marking of the numeral *one* makes it clear that the ordinal marking is, in these instances, internal. But in some languages, a single pattern of ordinal marking is exceptionlessly used for all numerals, including low numerals. In languages of this sort, ordinal marking may be ambiguous, being neither clearly external nor clearly internal. This ambiguity may arise with suffixal ordinal marking, as in (28), or prefixal marking, as in (29).

(28)   20-1-ORD: [20-1]-ORD   or   20-[1-ORD]   ?

(29)   ORD-20-1:   ORD-[20-1]   or   [ORD-20]-1   ?

The Uyghur evidence in (30) exemplifies the ambiguous suffixal type (28), which is either external or internal, right-peripheral; the Tagalog evidence in (31) exemplifies the ambiguous prefixal type (29), which is either external or internal, left-peripheral.

(30) **Uyghur** [Altaic, Turkic] exhibits ordinal marking of the AMBIGUOUS SUFFIXAL type

Cardinal:	bir '1'	yigirmä '20'	yigirmä bir '21'
	1	20	20 1
Ordinal:	bir-inči '1st'	yigirm-inči '20th'	yigirmä bir-inči '21st'
	1-ORD	20-ORD	20 1-ORD

Source: Hahn 1991: 594.

Additional languages of this type:

Bhojpuri	[IE; Indic]	Shukla 1981: 88.
Kwaami	[Afro-Asiatic; Chadic]	Leger 1994: 188–92. The form *kúmó kán múndînkì* '11th' confirmed by Rudolf Leger (p. c., June 2008).
K'abeena	[Afro-Asiatic; Cushitic]	Crass 2005: 207–18.
Amharic	[Afro-Asiatic; Semitic]	Leslau 1995: 251–65.
Turkish	[Altaic; Turkic]	Lewis 1967: 79–83.
Japanese	[Japanese]	Akiyama & Akiyama 1991: 172–74.
Beria	[Nilo-Saharan; Saharan]	Jakobi & Crass 2004.
Hunzib	[N. Caucasian; Daghestanian]	van den Berg 1995: 68–70.

(31) In **Tagalog** [Austronesian, Malayo-Polynesian], ordinal marking is of the AMBIGUOUS PREFIXAL type:

Cardinal:	isá '1'	dalawampúʔ '20'	dalawampú-t-isá '21'
Ordinal:	ika-isá '1st'	ika-dalawampúʔ '20th'	ika-dalawampú-t-isá '21st'

Source: Llamzon 1976: 117f.

Additional languages of this type:

Malay	[Austronesian; Malayo-Polynesian]	Dodds 1977: 34, 65–66.
Pangasinan	[Austronesian; Malayo-Polynesian]	Benton 1971: 144–54.
Rapanui	[Austronesian; Malayo-Polynesian]	Du Feu 1996: 170–73.
Paiwan	[Austronesian; Paiwan]	Egli 1990: 149–53.

Moreover, the possibility of conjunct ordinal morphology brings even more languages into these ambiguous categories. Consider, for instance, the French evidence in (32). On first consideration, the fact that *vingt et un* 'twenty-one' has *vingt-et-unième* rather than **vingt-premier* as its ordinal suggests that French ordinal marking is external, in direct contrast to the internal, right-peripheral marking of English *twenty-first*. But if *premier/unième* are regarded as an absolute/conjunct pair comparable to Breton *kentañ/unanved* or Finnish *ensimmäinen/yhdes* or Modern Georgian *p'irveli/me-ert-e*, then *vingt-et-unième* can instead be seen as involving internal, right-peripheral marking. Similar facts hold true for ordinals in the other languages listed in (32). And analogously, the Berber evidence in (33) can be seen as involving either external ordinal marking or internal, left-peripheral ordinal marking.

(32) **French** [IE; Italic] exhibits ordinal marking of the AMBIGUOUS SUFFIXAL type (external marking or internal marking with SPECIAL CONJUNCT MORPHOLOGY)

Cardinal:	un (m.) '1' 1	vingt '20' 20	vingt et un (m.) '21' 20 & 1
Ordinal:	premier '1st' 1.ORD	vingtième '20th' 20.ORD	vingt-et-unième '21st' 20-&-1.ORD

Additional languages of this type:

Boraana Oromo	[Afro-Asiatic; Cushitic]	Stroomer 1995: 58–61.
Evenki	[Altaic; Tungus]	Nedjalkov 1997: 281–82.
Manchu	[Altaic; Tungus]	Gorelova 2002: 200–04.
Udihe	[Altaic; Tungus]	Nikolaeva & Tolskaya 2001: 417–24.
Manam	[Austronesian; M.-P.]	Lichtenberk 1983: 337–44.
Albanian	[IE; Albanian]	Buchholz & Fiedler 1987: 349–57.
Western Armenian	[IE; Armenian]	Sakayan 2000: 119–21.
Hindi	[IE; Indic]	McGregor 1995: 67–70.
Sanskrit	[IE; Indic]	Cardona 2007: 801–2; Whitney 1889: 177–85.
Persian	[IE; Iranian]	Boyle 1966: 28–29; Perry 2007: 990–92.
Italian	[IE; Italic]	Proudfoot & Cardo 1997: 112–18.
Romanian	[IE; Italic]	Daniliuc & Daniliuc 2000: 121–30; Gönczöl-Davies 2007: 78–82.
Basque	[Isolate]	Hualde & Ortiz de Urbina 2003: 126–29.
Korean	[Isolate]	Martin 1992: 174–79.
Chol	[Mayan]	Warkentin & Scott 1980: 107–10.
Bezhta	[N. Caucasian; Daghestanian]	Kibrik & Testelets 2004: 274–77.
Adamawa Fulani	[Niger-Congo; Atlantic]	Stennes 1967: 114–18.
Wolof	[Niger-Congo; Atlantic]	Ngom 2003: 45–49
Koromfe	[Niger-Congo; Volta-Congo]	Rennison 1997: 299–309.
Supyire	[Niger-Congo; Volta-Congo]	Carlson 1994: 167–71.
Koyra Chiini	[Nilo-Saharan; Songhai]	Heath 1999: 69–71, 74–76.
Hungarian	[Uralic; Ugric]	Rounds 2001: 241–43.

(33) **Berber** [Afro-Asiatic] exhibits ordinal marking of the AMBIGUOUS PREFIXAL type (external marking or internal marking with SPECIAL CONJUNCT MORPHOLOGY)

Cardinal:	yan (m.) '1'	mraw (m.) '10'	yan d mraw (m.) '11'
Ordinal:	amezwaru '1st'	wis mraw '10th'	wis yan d mraw '11th'
Source: Quitout 1997: 75–86.			

4 Conclusions

The evidence motivating the typology developed here demonstrates that the rules of composition involved in the derivation of ordinals from compound numerals are highly variable across languages; for this reason, the hypothesis that (1) is the sole rule of composition needed for a language's derivational morphology cannot be maintained.

(1) Rule of composition for **Deriv**: **Deriv**([X Y]) = [X **Deriv**(Y)]

The important theoretical conclusion highlighted by the ordinal evidence is that in formal terms, processes of derivation must be seen as having two components: rules of derivational exponence and rules of composition. Many derivational processes involve only a single, default rule of composition comparable to (1); and at least some derivational processes lack even this, insofar as they do not apply to compounds at all. But processes of ordinal derivation reveal a range of alternatives to the rule of composition in (1).

Ultimately, it is not surprising that ordinal derivation should exhibit such a diversity of rules of composition, since in most languages, compound numerals have a much greater type frequency among the bases of ordinal derivation than noncompound numerals. In English, for example, there are fewer than twenty monomorphemic numerals (e.g. *zero*, *one*, *two*, *three*, *four*, *five*, *six*, *seven*, *eight*, *nine*, *ten*, *eleven*, *twelve*, *hundred*, *thousand*, *million* and *googol*), all other numerals being compounds; thus, processes of ordinal derivation are different from most derivational processes in that, in terms of type frequency, they apply mainly to compounds. Moreover, the structure of cardinal numeral compounds varies widely across languages (as noted above in connection with the evidence in (8)); accordingly, it should come as no surprise that languages negotiate the formation of the corresponding ordinal compounds in a variety of ways.

Notes

1. Versions of this paper were presented at the University of Surrey (August 2009), at the conference on Universals and Typology in Word-Formation at P. J. Šafárik University, Košice, Slovakia (August 2009), and at the Linguistics Association of Great Britain Annual Meeting, University of Edinburgh (September 2009). Thanks to the audience members at all three

events for a number of helpful comments; thanks, too, to two anonymous referees for their suggestions.
2. For discussion of the varied ways in which languages form ordinal derivatives from simple cardinal numerals, see Stolz & Veselinova (2005).

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