Inflection Classes and Economy

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1. Introduction

Inflection classes raise a number of basic questions of analysis. Which elements of a morphological system are assigned to inflection classes, and what types of principles govern class assignment? How are classes distinguished? Is there any bound on the number of possible classes within a given system? Why, in many languages, do these classes play no role in agreement or any other grammatical process?

Word and paradigm models offer one set of answers, based on traditional principles of classification that assign full wordforms to inflectional paradigms, and group paradigms into inflection classes. The Paradigm Economy Principle of Carstairs (1983) approaches the same questions from a morpheme-based perspective, and frames an answer in terms of constraints on the deployment of affixal resources within a system. A comparison of these alternatives suggests that generalizations over affixal exponents are derivative of patterns of interdependence involving whole words, and, hence, that there is ultimately no need for dedicated stem- or affix-based economy principles.

1.1. Word and Paradigm Economy

The grammatically significant part-whole relations within a word and paradigm (WP) model hold between a paradigm and its constituent wordforms, not between a word and its component morphs. A classical WP model

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thus begins by recognizing the word as "the smallest meaningful unit", and approaches the task of morphological analysis essentially as a "problem of classification" (Matthews (1991, 188f)). The inflected forms of a lexeme are classified according to the properties that they realize. Lexemes that inflect alike are assigned to a common conjugation or declension; i.e., inflection class. Each lexeme is represented by "a basic, unmodified or **leading form**", whose "special status is that all the other forms are modifications, or "inflections", of it" (Matthews (1991, 191)). These modifications are conventionally exhibited in the form of **exemplary paradigms**. Matching the leading form of a lexeme against its counterpart in an exemplary paradigm provides an analogical model for determining the inflected forms of the lexeme. Lieb (2003, 8) describes the deduction of a paradigm from a "designated form" (i.e., a leading form or *Kennform*), in the following terms:

> we start from a designated word form, and through a rule-governed procedure we obtain other word forms, and these word forms (including, since the Stoics, the designated form) ... constitute "the paradigm of y".

As Lieb (2003, 9) goes on to clarify, classical descriptions often "simply equate y with the (or a) designated form". Hence a classical WP model permits a highly transparent and economical description of inflection class systems. Each distinct inflection class is represented by an exemplary paradigm, and each non-exemplary member of a word class is represented by a leading form.

Analyzing an inflectional system into leading forms and exemplary paradigms also constrains the space of possible inflection classes in various ways. If a single leading form predicts the full paradigm of a lexeme, it follows that the number of different types of leading forms determines the number of classes. There cannot be more classes than there are types of leading forms, since this would mean that the forms in the "extra" exemplary paradigms are not predictable from any leading form. Conversely, there cannot be fewer classes than there are types of forms, since this would indicate that some properties used to distinguish types of leading forms were, in fact, of no predictive value.

The extremely tight notion of inflectional economy imposed by classical WP models derives ultimately from their assumption that the inflection of a lexeme can be predicted from its leading form. This assumption incorporates two related claims about the organization of inflection class systems. The

first is that a single form predicts the full paradigm — and thus determines the inflection class — of any (non-suppletive) lexeme. Systems in which this is true exhibit **lexical economy**, since each lexeme can be represented by a unique form. The second claim is that the class of each lexeme can be determined from the same form, e.g., by the nominative singular. Systems that satisfy this second condition are **lexically congruent**, in that one can identify the same leading form for all members of a word class. In a congruent inflectional system, leading forms are associated with a paradigm cell whose form variants serve, in effect, to index the inflection classes of a system.

The notions of lexical economy and congruence characterize the absolute limit of inflectional economy, in which each class is represented by a single exemplary paradigm and each lexeme by a unique form. Yet it is by no means obvious that all inflectional systems achieve this level of economy. In some systems, more than one "principal part" may be required to determine the inflectional paradigm of a lexeme. The Estonian declensional system, described in section 3, provides one example of such a system. Yet even in Estonian, one principal part often predicts another, so that a single form suffices to identify inflection class in two of the three major declensions. The highly economical structure of these declensions also illustrates how the economy of an inflectional system may derive from interdependent patterns of stem selection, rather than patterns of affixal exponence.

The description of Estonian declensions in section 3 also highlights the fact that WP models need not treat inflectional economy as an all or nothing affair. There is no reason to believe that speakers cannot store more than a single principal part for each regular lexeme, nor are there any grounds for supposing that a system with multiple principal parts is inherently unstable, or presents any particular difficulties for language acquisition or use. Hence, while any approach should be able to characterize systems with maximally efficient "storage strategies", this level of efficiency should surely not be regarded as a design property or teleological goal of morphological systems in general.

At the same time, it is significant that a minimally economical inflectional system defies description in terms of the exemplary paradigms and leading forms of a WP model. A system is minimally economical if the realization of each cell in a paradigm is independent of the realization of every other cell, so that no form within the paradigm is of any predictive value. A system of fully independent forms cannot be factored into exemplary paradigms and leading

forms, because no set of leading forms smaller than an entire paradigm will suffice to identify the inflection class of a lexeme. That is, in a minimally economical system, the distinction between exemplary paradigms and sets of leading forms collapses altogether, and the forms of every lexeme must be listed in full.

1.2. Affix and Paradigm Economy

Nothing prevents such pathologically uneconomical systems, if inflection classes serve merely to cross-reference separate inventories of stems and exponents. If the parts of an inflected wordform are associated solely by a common inflection class index of one sort or another, collections of fully independent exponents are in no way anomalous. Hence any model that disassembles wordforms into separate stem and affix entries admits a vast space of possible inflection classes. As Carstairs (1983) observes, although in somewhat different terms, the number of classes defined by an inventory of independent affixes corresponds to the product of the number of exponents in each paradigm cell. The clear challenge for a morpheme-based model is to exclude such uneconomical systems without placing an arbitrary numerical bound on the number of inflection classes in a language.

In a series of influential studies, Carstairs (1983; 1987) and Carstairs-McCarthy (1991; 1994) sets out to meet this challenge by imposing extrinsic constraints on the distribution of the affixal resources of an inflectional system. Carstairs (1983) introduces an affix-based version of lexical economy in the form of the Paradigm Economy Principle (PEP). The PEP correlates $\mathbb{C}$, the number of inflection classes in a morphological system with $\mathbb{A}$, the number of affixal exponents associated with the paradigm cell that exhibits the most affixal allomorphy. In a system where all relevant exponence is affixal, each leading form will be marked by a distinct affix, so that there will be exactly as many affixes as leading forms, and either the forms or the affixes can be used to index inflection classes. The No Blur Constraint (NBP) refines the distributional constraints on affixes by treating "inflection class membership as part of the meaning of an inflectional affix" (Carstairs (1994, 741)) and stipulating that at most one class-neutral affix can be associated with any paradigm cell.

Although there are parallels between affixal constraints and the economy conditions assumed within WP approaches, there are also important differ-

ences. Constraints on affixal distribution are purely extrinsic, and do not follow from any property of a morpheme-based model. Both the PEP and NBP also have an "all or nothing" character, in that there is no intrinsic notion of economy to fall back on if they are violated. Hence apparent violations of the PEP are overcome by consolidating paradigms into "macroparadigms", raising questions about the status of "paradigms" or "inflection classes". Affixal principles must also confront the problem of deciding which types of exponents should count as an "inflexion proper" (Carstairs (1983, 118)), and which types can be disregarded as "stem vowels" or as exponents of lexical properties that do not fall under the PEP or NBP. More fundamentally, affix-based principles are wholly irrelevant to any stem-based patterns of economy.

In short, Carstairs (1983, 127) identifies an important and, to a surprising degree, overlooked property of inflectional systems when he remarks that "there exists a real tendency ... towards keeping the total of paradigms for any word-class close to the logical minimum". Yet the need to invoke affixal constraints to capture this tendency is an artifact of abstracting exponents out of their classes and asking why they do not cooccur with exponents from other classes. A traditional response is that the choice of exponents in a paradigm is not free and independent, as suggested by lists of affixes. Rather, exponents are inextricably linked to paradigms and inflection classes, and it is the interdependence of forms in paradigm that ultimately determines the economy of an inflectional system.

The body of the paper illustrates how a WP model captures the economy of inflectional systems and subsumes the effects of the PEP and NBP. Section 2 reviews notions of paradigm economy, and their application to patterns of affixal exponence. Section 3 presents an analysis of stem-based declensional economy in Estonian, and section 4 concludes with some general remarks about inflectional systems.

2. Paradigm Economy

The point of departure for Carstairs (1983) is the observation that the number of inflection classes in a morphological system never approaches the maximum that could, in principle, be defined from the inflectional exponents of the system. Even a small set of exponents defines an implausibly large number of classes, as one can see by considering the classes defined by the case exponents in (1).

(1) *Nominative and genitive exponents in Russian*

	SINGULAR	PLURAL
NOM	-Ø, -o, -a	-y, -a
GEN	-y, -a	-Ø, -ov, -ej

As Carstairs (1983) notes, the number of distinct paradigms defined by a set of exponents is the product of the number of exponents in each cell. In the present case, the ten exponents in (1)) define thirty-six ($3 \times 2 \times 3 \times 2$) potential paradigms.[1] The twelve distinct paradigms with a nominative singular in *-a* are listed in (2)); the remaining twenty-four have a nominative singular in *-o* or -Ø.

(2) *Independent paradigms containing nominative and genitive exponents*

		1	2	3	4	5	6	7	8	9	10	11	12
SG	NOM	-a											
	GEN	-y						-a					
PL	NOM	-y			-a			-y			-a		
	GEN	-Ø	-ov	-ej	-Ø	-ov	-ej	-Ø	-ov	-ej	-Ø	-ov	-ej

The most striking and unnatural feature of these paradigms is not their number, but the complete independence of their cells. For example, knowing that the nominative singular of a noun ends in *-a* in (2) implies nothing about any other nominative or genitive form. The same is true for the other exponents in (2). This is, of course, not at all how inflection classes tend to be organized. In Russian, knowing that the nominative singular of a noun ends in *-a* allows one to predict the other nominative and genitive exponents, along with the rest of the paradigm. Thus the feminine noun KOMNATA ('room') has the nominative singular *komnata*, the nominative plural *komnaty*, the genitive singular *komnaty* and the genitive plural *komnat*. Other forms are of less predictive value, and some — notably the dative, prepositional and instrumental plurals — are of no value at all.[2] Nevertheless, regular paradigms never consist entirely of non-predictive forms, of the sort schematized in (2).

[1] Adding allomorphs for the four other cases in Russian merely multiplies the number of classes further.

[2] In Russian, the dative, prepositional and instrumental plural endings are the same for all regular nouns and adjectives.

2.1. The Status of Inflection Classes

Interdependence of forms is, rather, a general property of inflectional paradigms, and it is doubtful whether any morphological system exhibiting the independence in (2) would even be described in terms of inflection classes. Yet Carstairs (1983) appears to have been the first to point out, if indirectly, that paradigms with fully independent forms are in no way anomalous if one takes a purely taxonomic view of inflection classes. That is, if inflection classes merely enumerate the distinctive patterns of declension and conjugation in a language, there is no principled reason why the forms within any given class should be interdependent. Although a taxonomic view of inflection classes is most strongly associated with morpheme-based models, a similar perspective underlies any approach that uses diacritic class features to cross-reference lexical entries with exponents or rules.

Within a morpheme-based approach, the independence of forms in a paradigm follows from the independence of their parts. In an "item and arrangement" (IA) model (Hockett (1954)), stems and exponents are both represented as lexical entries and associated by a relation of "selection".[3] Thus the singular paradigm of KOMNATA in (3)a is factored into the stem and exponent entries in (3)b.

(3) *IA analysis of the singular forms of* KOMNATA

a.

	SINGULAR FORMS
NOM	komnata
GEN	komnaty
ACC	komnatu
PREP	komnate
DAT	komnate
INST	komnatoj

b.

STEM ENTRY	EXPONENT ENTRIES
⟨[2, N, FEM], *komnat*⟩	⟨[2, NOM, SG], *-a*⟩
	⟨[2, GEN, SG], *-y*⟩
	⟨[2, ACC, SG], *-u*⟩
	⟨[2, PREP, SG], *-e*⟩
	⟨[2, DAT, SG], *-e*⟩
	⟨[2, INST, SG], *-oj*⟩

Certain patterns of allomorph "selection" are conditioned by phonological properties of the stem. For example, the genitive exponent *-y* (IPA /ɨ/) is realized as [ɨ] following the "hard" unpalatalized consonant [t], but as [i] fol-

[3] Stems and exponents are equally independent in what Hockett (1954) calls an "item and process" (IP) model, though in this case the "entry" for an exponent may specify a process or operation, rather than a morph.

lowing a "soft" palatalized consonant, as in *nedeli*, the genitive singular of NEDELJA ('week'). However, the selection of the exponent set in (3)b is clearly not phonologically conditioned, as "hard stem" masculine and neuter nouns follow a different pattern. The selection of the exponents in (3)b also cannot be attributed to the fact that the stem is feminine in gender, given that masculine nouns in *-a*, such as MUŽČINA ('man') decline in the same way as KOMNATA. Hence the stem and exponent entries (3)b are linked by a common declensional class feature [2].

Now it happens that the gender and form of *komnat* together determine the class of KOMNATA, since hard stem feminines belong to the second declension in Russian. However, what is "predictable" in this case is merely the association of the class feature "[2]" with KOMNATA. The fact that class is predictable does not reduce the dependence on diacritic class features. Moreover, as Corbett (1983; 1991) argues at some length, inflection class is not in general predictable from gender in Slavic. For example, the class of MUŽČINA is not predictable from *mužčin*, since most hard stem masculines belong to the first declension. Consequently, MUŽČINA must be assigned "inherent" class features.

The basic problem with inflection class features is their generality: They permit arbitrary indexings of stems and exponent sets. By disassembling inflectional paradigms into inventories of "independent" stems and exponents, an IA analysis loses the information that KOMNATA has a nominative singular in *-a* and that nouns with a nominative singular in *-a* form their accusative singular in *-u*, etc. inflection class features restore the association between stems and exponent sets, but at the cost of expanding the space of potential classes. Given that class features are purely diacritic, there is nothing to prevent them from linking stems with the kinds of independent classes in (2). Hence the tendency towards economy noted by Carstairs (1983) remains wholly unexplained in an IA account.

It is perhaps surprising that the same issue arises for the "stem and paradigm" (SP) models of Anderson (1992), Aronoff (1994), and Stump (2001). These approaches differ from morpheme-based models in a number of important respects. All SP models associate grammatical properties with words, rather than with component morphs, and Stump (2001) also treats paradigms as basic components of a morphological system. Yet, like IA accounts, SP models retain stems as the basic unit of lexical storage, and use inflection class features to cross-reference stem entries with classes of real-

ization rules. The stem and exponents in (3)b thus correspond transparently to the stem and rules in (4).

(4) *SP analysis of the singular forms of* KOMNATA

STEM ENTRY	REALIZATION RULES
⟨[2, N, FEM], *komnat*⟩	⟨[2, NOM, SG], *Xa*⟩
	⟨[2, GEN, SG], *Xy*⟩
	⟨[2, ACC, SG], *Xu*⟩
	⟨[2, PREP, SG], *Xe*⟩
	⟨[2, DAT, SG], *Xe*⟩
	⟨[2, INST, SG], *Xoj*⟩

The rules in (4) are stated in the "realization pair" format of Aronoff (1994). The first element of each pair, e.g., [2, NOM, SG], expresses the properties that are spelled out by the rule. The second element, e.g., *Xa*, specifies how the properties are spelled out, in this case by suffixing *-a* to a stem "*X*". The class feature [2] is again associated with second declension nouns, and ensures that they are declined by the rules in (4). From the standpoint of inflectional economy, the cross-indexing of stems and rules in (4) is no different in principle from the indexing of stems and exponents in (3)b. Thus SP approaches again allow stems to be indexed to fully independent inflection classes.

The difficulties that IA and SP models face in constraining inflection classes derive from a common source, namely the fact that inflection class is not, in general, predictable from the stem entry of a lexeme. The stem entry in (3)b and (4) represents the morphosyntactic properties and morphotactic base shared by the inflected forms of KOMNATA. This entry contains just "inherent" (Chomsky (1965, 171)) category and gender properties, and the common stem form *komnat*. Yet a lexical representation that contains only these shared characteristics excludes precisely the properties that identify KOMNATA as a second declension noun. Hence the entry must be augmented by class features. But then there is no reason in principle why inflection classes should not simply provide a systematic enumeration of the forms of a morphological system, as Carstairs (1983) notes.

2.2. Affixal Economy

A traditional solution, outlined in section 2.3 below, is to reinstate words as the basic units of lexical storage. But Carstairs (1983) takes a different tack,

one which maintains independent entries for stems and exponents. Carstairs (1983, 127) proposes that a constraint on the distribution of inflectional exponents, which he calls the Paradigm Economy Principle (PEP), keeps "the actual paradigms" in a system "at or close to the minimum logically compatible with the inflectional resources" of the system.

An example will help to clarify the PEP, along with the notions of "paradigm" and "economy" that it incorporates. Russian nouns are standardly assigned to the three basic declension classes in (5). The first declension is usually divided into the masculine and neuter subclasses represented by ŽURNAL and SLOVO in (5). The second declension, as noted above, contains masculine and feminine nouns, but since they decline alike, this declension is not conventionally subdivided into gender classes. The third declension is represented by DVER′ in (5). Apart from the masculine noun PUT′ ('way') and ten neuter nouns in *-mja*, the third declension is exclusively feminine.[4]

(5) *Exemplary noun paradigms in Russian*

NUM	CASE	FIRST (MASC)	FIRST (NEUT)	SECOND	THIRD
SING	NOM	žurnal	slovo	komnata	dver´
	GEN	žurnala	slova	komnaty	dveri
	ACC	žurnal	slovo	komnatu	dver´
	PREP	žurnale	slove	komnate	dveri
	DAT	žurnalu	slovu	komnate	dveri
	INST	žurnalom	slovom	komnatoj	dverju
PLU	NOM	žurnaly	slova	komnaty	dveri
	GEN	žurnalov	slov	komnat	dverej
	ACC	žurnaly	slova	komnaty	dveri
	PREP	žurnalax	slovax	komnatax	dverjax
	DAT	žurnalam	slovam	komnatam	dverjam
	INST	žurnalami	slovami	komnatami	dverjami
GLOSS		'magazine'	'word'	'room'	'door'

[4]Nouns of the first and second declension exhibit additional variation, conditioned by whether their stems end in a "soft" (palatalized) or "hard" (unpalatalized) consonant, but this is not treated as a basis for further paradigmatic subdivisions. Outside of the second declension singular paradigm, accusative is a "virtual" case in Russian. The accusative forms of a noun are identical to the nominative forms in inanimate nouns, and identical to the genitive forms in animate nouns. However, this syncretism is again not traditionally regarded as constituting animate and inanimate sub-paradigms.

To determine whether Russian complies with the PEP, one first identifies the paradigm cell that exhibits the greatest affixal allomorphy. Stripping the exponents off the forms in (5) (and ignoring the mainly syncretic accusative exponents) yields the affixal case inventory in (6) below. Four cells in (6) have three allomorphs, three cells have two allomorphs, and three cells have just one. Since no cell has more than three allomorphs, the PEP allows at most three inflection classes. The question is, then, how many "actual paradigms" does Russian have? Some descriptions, e.g., Corbett (1983; 1991), assign first declension masculines and neuters to separate declensions, and thus recognize a total of four. However, as Carstairs (1983) notes, the traditional practice of consolidating classes that differ solely in gender into "macroparadigms" often brings a system into conformance with the PEP. In the present case, combining first declension masculines and neuters yields a total of three classes, which exactly matches the largest number of allomorphs in the cells in (6).

(6) *Regular case exponents in Russian*

CASE	SINGULAR	PLURAL
NOM	-Ø, -o, -a	-y, -a
GEN	-y, -a	-Ø, -ov, -ej
PREP	-e, -y	-ax
DAT	-u, -e, -y	-am
INST	-om, -oj, -u	-ami

On the face of it, Russian nouns provide a straightforward illustration of paradigm economy. The PEP plots $\mathbb{C}$, the number of distinct ways of inflecting a stem (i.e., the number of inflection classes) against $\mathbb{A}$, the number of ways of realizing the paradigm cell with the greatest affixal allomorphy. A language complies with the PEP if $\mathbb{C}$ is no greater than $\mathbb{A}$, which in practice means that $\mathbb{C} = \mathbb{A}$. Given the cells in (6), $\mathbb{A} = 3$; given a consolidated first declension, $\mathbb{C} = 3$. Thus $\mathbb{C} = \mathbb{A} = 3$.

Nevertheless, the manner in which Russian is brought into conformance with the PEP raises important questions about what constitutes "distinctness". First declension masculine and neuter nouns exhibit superficially different patterns in (5), as they have different endings in the nominative, and in the genitive plural. These classes are, however, regarded as "nondistinct", on the grounds that they differ in gender and share the remaining exponents

in common. Yet if one regards the variation between masculine and neuter paradigms in (5) as gender-related and hence "off-budget" for the purpose of determining $\mathbb{C}$, the difference between masculine and neuter **exponents** in (6) must likewise be regarded as the realization of gender, and hence not relevant for determining $\mathbb{A}$. One cannot maintain that paradigms are nondistinct because they differ in gender, and at the same time claim that the gender-differentiated exponents in those paradigms count as inflectionally distinct.

But then what are the nominative, and genitive plural exponents of the consolidated first declension, and how does one determine whether they are distinct from the exponents from the second and third declensions?[5] Irrespective of how these questions are resolved, the paradigms in (5) will remain in compliance with the PEP, since the dative and instrumental plural cells have three allomorphs in any case. The general point, however, is that one cannot establish an exponent inventory on the basis of unconsolidated paradigms and then determine class size on the basis of a consolidated system.

The use of macroparadigms to bring systems into conformance with the PEP also raises questions about the limits of this strategy. Combining first declension masculines and neuters into a macrodeclension is a relatively conservative proposal, which is widely assumed in descriptive grammars of Russian. But what principle prevents the consolidation of unrelated paradigms that are never grouped together? Precisely the same considerations that justified the consolidation of masculines and neuters in (5) would appear to apply to first declension masculines and third declension feminines. These declensions again differ in gender, and even have more plural forms in common than first declension masculines and neuters do. So what blocks a first-third macrodeclension? Or, for that matter, what prevents the consolidation of both masculines **and** neuters with third declension feminines? It might be possible to justify particular decisions in individual cases, but the fact that this is necessary at all just highlights the essentially case-by-case character of the PEP

[5]One could, for example, represent these exponents as {-Ø, *-o*}, {*-y, -a*}, and {-Ø, *-ov*}, and declare that each should count as "one allomorph" for the purpose of calculating $\mathbb{A}$. But is the first declension nominative plural {*-y, -a*} distinct from the exponent *-y*, which marks nominative plural in the second and third declensions? One answer would be "yes", on the grounds that one element of {*-y, -a*}, namely *-a*, is distinct from *-y*. Yet by allowing {*-y, -a*} to maintain the contrasts associated with each of its elements, this answer implicitly treats {*-y, -a*} as two exponents. Alternatively, {*-y, -a*} could be judged to be nondistinct from *-y*, on the grounds that not all of its elements contrast with *-y*. This answer reduces the nominative plural cell in (6) to one allomorph, and the nominative singular and genitive plural cells to two.

and its descendant conditions.

However, it is the way that "distinctness" is defined for "meanings" and "inflectional realizations" that has the most far-reaching consequences for the inflectional economy conditions investigated in Carstairs (1983; 1987) and Carstairs-McCarthy (1991; 1994). As noted above, nearly all stem-based accounts must use inflection class features to associate stems and exponents. Carstairs-McCarthy (1994, 741) makes a virtue of necessity, and suggests that "inflection class membership can count as part of the information content of an inflectional affix" under conditions that he goes on to specify. This claim effectively blurs the distinction between the properties that a form specifies and the characteristics that it, *qua* form, exhibits. An account that invokes inflection class "meanings" to account for inflectional economy thus sacrifices much of the intuitive plausibility of the original PEP. Yet it is important to recognize that this blurring of form and content does not derive from the search for inflectional economy conditions, but rather from the attempt to state these conditions in terms of morphemes. Inflection class "content" nicely illustrates the kinds of "meanings" that one ends up with by decomposing an inflectional system into inventories of "minimal meaningful units".

A morpheme-based perspective also underlies the characterization of "inflectional realization" in Carstairs (1983; 1987) and Carstairs-McCarthy (1991; 1994). Carstairs-McCarthy (1994, 739) states that "wordforms will be deemed inflectionally distinct if and only if they differ affixally", and suggests two considerations that support this "provisional, but not ... arbitrary decision". The first is that other morpheme-based accounts (including his own previous work) assumes "that there is an important difference between affixal and nonaffixal ... morphology". The force of this observation is weakened by a number of factors. To begin with, the fact that one has not changed position on an issue can hardly be regarded as evidence for the correctness of that position. One might also object that the distinction between affixal and nonaffixal exponence is forced on morpheme-based approaches, particularly IA accounts, which encounter familiar difficulties in describing nonaffixal patterns.

Quite apart from these kinds of issues, it is far from clear that the decision to "consider only affixal inflection" is parallel in the cases that Carstairs (1994, 739) cites. For example, Halle & Marantz (1993, 124ff) are able to disregard nonaffixal alternations because they tag every form that exhibits such an alternation with a proxy "zero" affix. This affix then triggers a "read-

justment rule" that effects the desired nonaffixal alternation. One's view of this type of analysis will tend to reflect more general views about structuralist morphophonemics and lexically restricted "rules". Carstairs-McCarthy (1994, 760f) acknowledges a problem that this use of zero affixes raises for his account, and thus argues against the Halle & Marantz (1993) analysis. But again, whatever one thinks about zero affixes in general, it is the use of zeros that permits Halle & Marantz (1993) to ignore nonaffixal patterns. By disregarding nonaffixal patterns and excluding their zero proxies, Carstairs-McCarthy (1994) eliminates entire verb classes that are distinguished by Halle & Marantz (1993).

One might wonder whether this sort of thing should matter. The answer is that it does, for reasons that relate to the second type of consideration that Carstairs-McCarthy (1994) raises. The decision to "consider only affixal inflection" permits a description of the English verb system that conforms to what Carstairs-McCarthy (1994, 742) terms in (7) the "No Blur Principle".

(7) *No Blur Principle* (Carstairs-McCarthy (1994, 742)):
Within any set of competing inflectional affixal realizations for the same paradigmatic cell, no more than one can fail to identify inflection class unambiguously.

Blur "avoidance" in the English verb system entails recognizing a verb class containing GIVE, because it has a past participle form in *-n*, while "ignor[ing] entirely the inflection class of verbs such as *sing*" on the grounds that they "display no overt affix for either the past or the passive participle" (Carstairs-McCarthy (1994, 760)). Further support for the exclusion of nonaffixal exponents comes, Carstairs-McCarthy (1994, 740) suggests, from the fact that "the 'affixes only' decision has the helpful practical consequence of usually yielding clearcut answers to questions about inflectional and paradigmatic distinctness", and that "some apparent breaches of paradigm economy dissolve when nonaffixal inflection is ignored" (p. 759). So, in short, restricting attention to affixes is useful, because affixal exponents can — at least usually — be isolated, and convenient, because it provides a basis for ignoring patterns that would otherwise violate economy principles.

These sorts of considerations cannot be regarded as serious support for an "affixes only" policy. At best they provide a rationale for provisional assumptions that are vindicated by the results they yield. But what is the purpose of an analysis that gerrymanders English verbs into five classes by just ignor-

ing other patterns? One might want to draw a principled distinction between open and closed classes, and disregard the SING pattern as frozen, as it surely is (Clahsen (1999)). Yet the same criterion would exclude GIVE, and, besides, productivity plays no role in any affixal economy principle.

The apparent capriciousness of excluding SING clarifies the import of the "affixes only" decision. This methodological choice completely severs the connection between inflectional allomorphy and inflection classes. A system may have indefinitely many classes, provided that they are not affixally distinct. In language families, such as Germanic, in which productive inflection is almost exclusively affixal, this decision merely restricts the scope of the PEP or the "No Blur Principle" to a subclass of inflectional patterns. In other families, such as Balto-Finnic, in which productive stem alternations distinguish inflectional patterns, the emphasis on affixation renders these principles almost wholly irrelevant. It may be possible to give "economical" descriptions of such systems, but these descriptions will have almost nothing to say about the number, type or structure of inflection classes.

This may seem surprising, but it is fully consistent with the formulation of the PEP and subsequent economy principles. These principles do not, as is sometimes supposed, constrain the number of inflection classes in a system. What they constrain, rather, is the distribution of inflectional affixes:

> Paradigm economy provides at least a partial answer to a question ... about how, in any inflected language, the inflexional resources available in some word-class or part of speech are distributed among members of that word-class (Carstairs (1983, 161)).

In short, economy principles rehabilitate the notion of a "paradigm", but only in a supporting role. Paradigms are not the "complex whole" (Matthews (1991, 204)) of WP models, but serve merely as a domain over which one can state generalizations or constraints governing the distribution of affixes.

2.3. Lexical Economy

From a traditional perspective, the need to constrain the distribution of "the inflectional resources available in some word-class" is an artifact of a method. The "availability" of inflectional resources is the result of dissecting inflected forms into independent stems and exponents. Once these elements have been

assigned to separate entries, the analyst faces the problem of reconstituting the original system. The markers of inflection class have usually been removed from stems, so that class features or other diacritic properties are needed to re-index stems and exponents. But the generality of the indexing mechanism makes it seem that the system is not fully exploiting the resources at its disposal. So economy principles are introduced to confine exponents to their own inflection classes.

The critical step in this process is the decision to treat stems and exponents as independent units. This is precisely the step that a WP model does not take, as Matthews (1991, 204) points out:

> In the ancient model the primary insight is not that words can be split into roots and formatives, but that they can be located in paradigms. They are not wholes composed of simple parts, but are themselves the parts within a complex whole.

That is, the inflected forms in a morphological system are not broken down into inventories of "free" stems and "bound" exponents. Words are, rather, assigned to paradigms, which are in turn organized into inflection classes. There is no need to restrict the distribution of inflectional exponents, since these elements have no independent status. One can investigate the conditions under which patterns of exponence in one class come to be extended, but this is a diachronic, not a synchronic question.

The claim that inflected wordforms are listed as wholes in the lexicon does not, of course, entail that all inflected words must be listed. In principle, it would suffice to list a single exemplary paradigm for each inflection class, together with leading forms for each of the lexemes of that class. In a WP model, an exemplary paradigm functions simultaneously as "data" and "program". While representing the forms of a particular lexeme, the paradigm also exhibits the inflectional patterns characteristic of its class, and thus provides an analogical base for the inflection of other lexemes of that class.

For example, the paradigm for KOMNATA in (8) provides a model for the inflection of GAZETA ('newspaper'). Matching the nominative singular leading form *gazeta* against its counterpart *komnata* establishes a correspondence that determines each of the remaining entries of GAZETA. These derived entries will preserve the "inherent" properties of the leading form: the lexeme index GAZETA, mnemonically represented by the citation form in small capitals (Matthews (1991, 26)), and the category and gender properties associated with the lexeme. The inflectional properties and form of these entries

will likewise exhibit the same correspondence as the cells of the exemplary paradigm.

(8) *Traditional WP analysis of Russian second declension nouns*

Leading Form	Exemplary Paradigm	
⟨[GAZETA, N, FEM, NOM, SG], *gazeta*⟩	⟨[NOM, SG], *komnata*⟩	⟨[NOM, PL], *komnaty*⟩
	⟨[GEN, SG], *komnaty*⟩	⟨[GEN, PL], *komnat*⟩
	⟨[ACC, SG], *komnatu*⟩	⟨[ACC, PL], *komnaty*⟩
	⟨[PREP, SG], *komnate*⟩	⟨[PREP, PL], *komnatax*⟩
	⟨[DAT, SG], *komnate*⟩	⟨[DAT, PL], *komnatam*⟩
	⟨[INST, SG], *komnatoj*⟩	⟨[INST, PL], *komnatami*⟩

2.3.1. Leading Forms

It is straightforward to schematize the exemplary paradigm in (8) to abstract out the stems that are implicit in the use of the forms of KOMNATA as an analogical base. Section 2.3.2 presents a system of schematic declensions, along the lines suggested for Latin in Bender (2000). The same patterns could be described by means of pairwise correspondences, of the sort given in Matthews (1991, 193), or in terms of the *Kennformen* and "paradigm structure conditions" proposed by Wurzel (1990, 207):

> Thus paradigm-structure conditions specify, on the whole, the predictable inflectional properties of words, due to the properties of certain "Kennformen". In German noun declensions the (nominative) plural functions as the canonical "Kennform". In the unmarked cases, the lexical base form is also the only "Kennform"; in the marked cases, reference to further "Kennformen" is necessary. The various inflectional systems differ regarding which inflectional forms represent "Kennformen".

Each of these alternatives factors an inflectional system into two components: an abstract representation of predictable inflectional patterns, and a form or set of forms that predict which pattern a given lexeme follows. It is the interdependence of elements in a paradigm that underlies the economy achieved by these patterns and forms. It is not only that inflectional exponents are "encapsulated" in classes in a WP analysis, but also that they cannot, in principle, be exhaustively distributed over these classes. In order to factor an inflectional system into exemplary paradigms and leading forms, a high

degree of interdependence is, in fact, necessary, as Matthews (1991, 197) remarks.

> The most general insight [of the classical WP approach] is that one inflection tends to predict another ... Traditionally, it is the basis for the method of exemplary paradigms.

Fully independent paradigms, of the sort illustrated in (2) cannot, in principle, be described in terms of exemplary paradigms and leading forms. It is, of course, possible to establish exemplary paradigms for each of the independent classes in (2). Yet no form is a reliable predictor of any other form in these paradigms. Hence no set of leading forms smaller than a whole paradigm is sufficient to identify the class of any other noun. The forms of each paradigm must therefore be listed in full, so that the distinction between exemplary paradigms and leading forms collapses entirely.

In short, a WP analysis requires an interdependency between forms that excludes the pathological paradigms in (2). The key premise of any WP model is just that some set of forms smaller than a whole paradigm will suffice to identify the class of a lexeme. The tighter notions of economy assumed in classical WP models can, as noted earlier, be characterized in terms of the inventories of leading forms required to identify inflection class. A system is **lexically economical** if exactly one leading form suffices to identify the inflection class of an open-class lexeme. A system is **lexically congruent** if, for every lexeme in a given word-class, the same form (or set of forms) suffices.

A description of Russian that uses the nouns in (5) as exemplary paradigms is both lexically economical and congruent. Nouns can be assigned to classes based on the form of their nominative singular, reflecting the traditional view that "the nominative is clearly the basic case" (Corbett (1991, 35)), or, at any rate, the most highly differentiated case form in Russian. A noun with a nominative singular in *-a* belongs to the second declension, a noun with a nominative singular in *-o* is a first declension neuter, while a noun ending in a "hard" consonant is a first declension masculine. Nouns with nominative singulars ending in a "soft" palatal consonant likewise belong to the first declension if they are masculine, and to the third declension, if they are feminine. Hence a nominative singular entry that includes inherent features, such as gender, will uniquely identify the class of a noun.

In other systems, such as the Estonian declensional system in section 3.1, a single form may not suffice. However, from a WP perspective, there is no

principled reason why each lexeme must be identified by a single leading form. One can perhaps attribute the tendency toward lexical economy as a strategy for reducing memory load. However, there is no reason to believe that storing more than one entry per lexeme imposes an excessive memory burden. Moreover, it is evident that systems exhibiting a high degree of stem allomorphy are perfectly stable, as Estonian again indicates.

A WP model thus provides a graded notion of economy. In any system that is sensibly described in terms of inflection classes, there will be a correlation between the number of leading forms and inflection classes. In a system that is lexically economical and congruent, such as Russian, the number of classes will be bounded by the number of leading forms. In other systems, the correlation will be more indirect, depending on the number and type of forms needed to identify classes. Hence there is no need to consolidate or exclude paradigms whenever there is a shortfall of leading forms.

2.3.2. Inflection Classes

The correspondence between leading forms and exemplary paradigms remains largely implicit in traditional WP accounts. However, this notion can be made explicit by schematizing exemplary paradigms to extract the patterns that characterize the classes that they represent. Abstracting the lexical content of KOMNATA out of the paradigm in (8) yields the paradigm schema in (9)b.

(9) a. Leading Entry: $\langle$[GAZETA, N, FEM, NOM, SG], *gazeta*$\rangle$

b.

Schematic Second Declension Paradigm	
$\mathbb{R}([\lambda, \text{NOM, SG}]) = X + a$	$\mathbb{R}([\lambda, \text{NOM, PL}]) = X + y$
$\mathbb{R}([\lambda, \text{GEN, SG}]) = X + y$	$\mathbb{R}([\lambda, \text{GEN, PL}]) = X$
$\mathbb{R}([\lambda, \text{ACC, SG}]) = X + u$	$\mathbb{R}([\lambda, \text{ACC, PL}]) = X + y$
$\mathbb{R}([\lambda, \text{PREP, SG}]) = X + e$	$\mathbb{R}([\lambda, \text{PREP, PL}]) = X + ax$
$\mathbb{R}([\lambda, \text{DAT, SG}]) = X + e$	$\mathbb{R}([\lambda, \text{DAT, PL}]) = X + am$
$\mathbb{R}([\lambda, \text{INST, SG}]) = X + oj$	$\mathbb{R}([\lambda, \text{INST, PL}]) = X + ami$

As in a classical WP model, matching the leading form *gazeta* against the nominative singular cell in (9) identifies *gazet* as the base for the remaining forms of GAZETA. The schematization in (9)b merely clarifies that the pro-

cesses of "matching" a leading form against an exemplary paradigm in order to derive new entries involves "solving for" the lexeme variable "λ" and the stem variable "X".

It might be thought that this schematization covertly reintroduces stems and exponent entries. This is an understandable misinterpretation, but a misinterpretation just the same. The "leading form" in (9)a is, in fact, a "leading lexical entry", which identifies the morphosyntactic properties of the wordform *gazeta*. The nominative singular cell in the schematic paradigm, on the other hand, does not represent an entry, but rather expresses a **constraint** on entries. The constraint "$\mathbb{R}([\lambda, \text{NOM, SG}]) = X + a$" states that an entry containing the properties NOM and SG is **realized** by a form that ends in a. Finding a leading entry that satisfies this constraint establishes values for λ and X that permit the forms of the remaining entries to be deduced analogically. The fact that "$\mathbb{R}([\lambda, \text{NOM, SG}]) = X + a$" is satisfied by $\langle[\text{GAZETA, N, FEM, NOM, SG}], \textit{gazeta}\rangle$ implies that "$\mathbb{R}([\text{GAZETA, NOM, PL}]) = \textit{gazety}$" will be satisfied by the nominative plural entry, and so on.

Leading entries and schematic paradigms allow one to deduce the form of stems and exponents in a system, and it would be implausible to claim that speakers are unaware of these sub-word patterns. However, although stems and exponents emerge as implicit "units of analysis" in a WP model, the important thing is that these elements do not function as "units of storage". Inflectional exponents do not have independent entries; they are encapsulated in schematic paradigms, and do not have the freedom to associate with exponents from other paradigms. One can ask why certain exponents cooccur within a given inflectional system, but this is again primarily a historical question. Instantiating stem variables in a schematic paradigm also defines stem forms, but yet again these forms have no independent status, and, in particular, are not "cached out" in separate stem entries.

The constraints in (9)b are, in effect, "realization rules" (Zwicky (1985)) that specify the formal "spell out" of a set of grammatical properties. However, unlike the rules proposed in stem and paradigm models, such as Anderson (1992), Aronoff (1994) and Stump (2001), the constraints in (9)b are not interpreted as "structure building rules". Instead, like the "morphological transformations" of Matthews (1991), or, indeed, the *rapports associatifs* of Saussure (1916), these constraints represent "entry admissibility conditions". These constraints characterize general patterns within a lexicon of inflected

wordforms, and provide the base for deducing new entries. It is particularly useful to regard these deductions as defeasible predictions about unlisted entries, rather than as inviolable constraints. This interpretation tolerates suppletion, and other variation within a class of nouns that otherwise inflect alike, and thereby avoids the need to introduce a separate paradigm for every deviation.

But the key point is that the lexicon of a WP account contains inflected wordforms, and that inflectional stems and affixes are abstractions over this lexicon, as Kuryłowicz (1949, 159) proposes:

> Car la notion du thème est postérieure aux formes concrètes composant le paradigme: on trouve le thème en dégageant les éléments communs à toutes les formes casuelles du paradigme (quand il s'agit de la déclinaison).[6]

A lexicon containing inflected wordforms does not need to assign inflection class features to Russian nouns, because wordforms retain the exponents that identify class. In the examples considered above, a nominative singular in *-a* suffices to identify KOMNATA and GAZETA as second declension nouns. A nominative singular in *-o* likewise identifies SLOVO as a first declension neuter in (10).

(10) a. Leading Entry: $\langle$[SLOVO, N, NEUT, NOM, SG], *slovo*$\rangle$

b.

Schematic First Declension Neuter Paradigm	
$\mathbb{R}([\lambda, \text{NOM, SG}]) = X + o$	$\mathbb{R}([\lambda, \text{NOM, PL}]) = X + a$
$\mathbb{R}([\lambda, \text{GEN, SG}]) = X + a$	$\mathbb{R}([\lambda, \text{GEN, PL}]) = X$
$\mathbb{R}([\lambda, \text{ACC, SG}]) = X + o$	$\mathbb{R}([\lambda, \text{ACC, PL}]) = X + a$
$\mathbb{R}([\lambda, \text{PREP, SG}]) = X + e$	$\mathbb{R}([\lambda, \text{PREP, PL}]) = X + ax$
$\mathbb{R}([\lambda, \text{DAT, SG}]) = X + u$	$\mathbb{R}([\lambda, \text{DAT, PL}]) = X + am$
$\mathbb{R}([\lambda, \text{INST, SG}]) = X + om$	$\mathbb{R}([\lambda, \text{INST, PL}]) = X + ami$

The first declension masculine noun ŽURNAL is identified by the fact that its nominative singular ends in a "hard" unpalatalized consonant. Since this consonant is part of the noun stem, it will be useful to have a way of referring to the final segment of a stem. Let Yc represent a consonant-final stem. Adapting the standard transliterations of "soft" and "hard" signs, let Yc' represent

[6] 'For the notion of the stem is dependent on the concrete forms composing the paradigm: One finds the stem in disengaging the elements common to all the case forms of a paradigm (when dealing with declination)' [JPB].

a stem that ends in a soft consonant and Yc'' represent a stem that ends in a hard consonant. Then the nominative singular constraint in (11)b indicates that the stem X ends in a hard consonant in (11)b.

(11) a. Leading Entry: $\langle$[ŽURNAL, N, MASC, NOM, SG], *žurnal*$\rangle$

b.

Schematic First Declension Masculine Paradigm	
$\mathbb{R}([\lambda, \text{NOM, SG}]) = (X = Yc'')$	$\mathbb{R}([\lambda, \text{NOM, PL}]) = X + y$
$\mathbb{R}([\lambda, \text{GEN, SG}]) = X + a$	$\mathbb{R}([\lambda, \text{GEN, PL}]) = X + ov$
$\mathbb{R}([\lambda, \text{ACC, SG}]) = X$	$\mathbb{R}([\lambda, \text{ACC, PL}]) = X + y$
$\mathbb{R}([\lambda, \text{PREP, SG}]) = X + e$	$\mathbb{R}([\lambda, \text{PREP, PL}]) = X + ax$
$\mathbb{R}([\lambda, \text{DAT, SG}]) = X + u$	$\mathbb{R}([\lambda, \text{DAT, PL}]) = X + am$
$\mathbb{R}([\lambda, \text{INST, SG}]) = X + om$	$\mathbb{R}([\lambda, \text{INST, PL}]) = X + ami$

There is, as noted above, only one place in the regular noun system where the nominative singular **form** does not uniquely identify class, and that is with nouns ending in "soft" palatalized consonants. The nominative singular forms of third declension nouns, such as DVER′ ('door') and "soft stem" first declension nouns, such as SLOVAR′ ('dictionary') both end in a soft palatalized consonant (indicated by the right quotation mark, which transliterates the "soft sign"). However, a leading **entry** will still suffice, as first declension nouns ending in a soft consonant are masculine, while regular third declension nouns are feminine. Hence representing gender in the third declension paradigm in (12)b will distinguish soft stem leading forms. Feminines like DVER′ will follow the pattern in (12)b.

(12) a. Leading Entry: $\langle$[DVER′, N, FEM, NOM, SG], *dver′*$\rangle$

b.

Schematic Third Declension Paradigm	
$\mathbb{R}([\lambda, \text{FEM, NOM, SG}]) = (X = Yc')$	$\mathbb{R}([\lambda, \text{FEM, NOM, PL}]) = X + y$
$\mathbb{R}([\lambda, \text{FEM, GEN, SG}]) = X + y$	$\mathbb{R}([\lambda, \text{FEM GEN, PL}]) = X + oj$
$\mathbb{R}([\lambda, \text{FEM, ACC, SG}]) = X$	$\mathbb{R}([\lambda, \text{FEM, ACC, PL}]) = X + y$
$\mathbb{R}([\lambda, \text{FEM, PREP, SG}]) = X + y$	$\mathbb{R}([\lambda, \text{FEM, PREP, PL}]) = X + ax$
$\mathbb{R}([\lambda, \text{FEM, DAT, SG}]) = X + y$	$\mathbb{R}([\lambda, \text{FEM, DAT, PL}]) = X + am$
$\mathbb{R}([\lambda, \text{FEM, INST, SG}]) = X + u$	$\mathbb{R}([\lambda, \text{FEM, INST, PL}]) = X + ami$

Soft-stem masculines like SLOVAR′ follow the pattern in (11)b, except that *y* and *o* surface as the regular alternants *i* and *e* (Unbegaun (1957, 39)), and the

genitive plural is marked by *-ej*.

2.3.3. Declension-Neutral Patterns

The schematic paradigms in (9)b–(12)b are conservative in various respects. They represent the four declension classes proposed in Corbett (1991, 36), rather than the three recognized in many grammars. Moreover, since these paradigms simply extract the patterns of exponence from each of the exemplary paradigms in (5), they fail to capture the class-independent patterns exhibited in (13). As (13) illustrates, dative, prepositional and instrumental plural exponents do not vary across declensions. Accusatives also exhibit a highly general animacy-sensitive alternation. Both patterns are also characteristic of adjectives, which inflect for gender, not inflection class in Russian.

(13)

			1ST MASC		1ST NEUT	2ND FEM	3RD FEM
SING	NOM		$X=Yc''$	$X=Yc'$	Xo	Xa	$X=Yc'$
	GEN		Xa			Xy	
	ACC	ANIM(ATE)	Xa			Xu	Xy
		INANIM	X		Xo		X
	PREP		Xe				Xy
	DAT		Xu			Xe	Xy
	INST		Xom			Xoj	Xu
PLU	NOM		Xy		Xa	Xy	
	GEN		Xov	Xoj	X		Xoj
	ACC	ANIM	Xov	Xoj	X		Xoj
		INANIM	Xy		Xa	Xy	
	PREP		Xax				
	DAT		Xam				
	INST		$Xami$				

Hence it is appropriate to remove each of these declension-neutral patterns from the schematic paradigms in (9)b–(12)b, and declare them as constraints on nouns in general. The constraints that sanction prepositional, dative and instrumental plural forms of nouns are stated in (14).

(14) General exponence constraints

a. $\mathbb{R}([\lambda, \text{PREP, PL}]) = X + ax$

b. $\mathbb{R}([\lambda, \text{DAT, PL}]) = X + am$
c. $\mathbb{R}([\lambda, \text{INST, PL}]) = X + ami$

A similar strategy is applicable to the "virtual" accusative in Russian. Only second declension singular nouns have distinctive accusative forms. All other accusative forms are syncretic: The accusative forms of inanimate nouns are identical to their nominative forms, while accusative forms of animates are identical to their genitive forms. Within a WP approach, these relations are naturally expressed by "referral" rules of the sort proposed by Zwicky (1985) and Stump (1993). The referral rule in (15)a defines the accusative form of an inanimate noun in terms of the corresponding nominative. The deduction of an accusative form is thus "parasitic" on a nominative constraint that is satisfied in all respects except in that it specifies a NOM feature where the deduced entry has an ACC. The referral in (15)b likewise relates the accusative forms of animate nouns to the corresponding genitives.

(15) *Accusative case constraints*
a. $\mathbb{R}([\lambda, \text{INANIM, ACC}]) = \mathbb{R}([\lambda, \text{NOM}])$
b. $\mathbb{R}([\lambda, \text{ANIM, ACC}]) = \mathbb{R}([\lambda, \text{GEN}])$
c. $\mathbb{R}([\lambda, \text{ACC, SG}]) = X + u$

If animacy is taken to be the marked property in Russian, the INANIM property can be omitted from (15)a, so that (15)b will be more specific than (15)a, and take priority. However, neither (15)a nor (15)b is intrinsically less specific than the constraint in (15)c that defines second declension accusative singulars in *-u*. There are various ways to regulate the interaction of these constraints, but the most straightforward is to assign class-specific constraints priority over general constraints.

2.3.4. Schematic Macroparadigms

Given the generality of the patterns in (14), (15)a and (15)b, the forms that they sanction are of no predictive value. Removing these constraints from individual schematic paradigms thus isolates the patterns that distinguish the four basic declensions in (13), and also clarifies the basis for constructing traditional macroparadigms. For example, hard and soft stem masculines inflect alike except in the genitive plural, where the alternation between the *-v* in hard stems and the *-j* in soft stems does not reflect any regular phonological

alternation. Hence both of the constraints in (16) are required.

(16) *First declension masculine genitive plural constraints*

a. $\mathbb{R}([\lambda, \text{GEN, PL}]) = Yc'' + ov$

b. $\mathbb{R}([\lambda, \text{GEN, PL}]) = Yc' + oj$

Although the alternation between *-v* and *-j* is not attributable to a regular phonological process, it is nevertheless phonologically conditioned. Since the application of the constraints in (16) is conditioned by the stem of a leading form, there is no contradiction in assigning both constraints to the genitive plural cell of a schematic first declension masculine paradigm.

First declension masculine and neuters can also be consolidated into a more abstract class, though at the cost of complicating the interpretation of schematic paradigms. The trade-off between the number and complexity of schematic paradigms is illustrated by the first declension macroparadigm in (17), which combines the neuter paradigm in (10)b and the masculine paradigm in (11)b.

(17) *Consolidated WP analysis of Russian first declension nouns*

<table>
<tr><td>$\mathbb{R}([\lambda, \text{MASC, NOM, SG}], (X = Yc)$
$\mathbb{R}([\lambda, \text{NEUT, NOM, SG}]) = X + o$</td><td>$\mathbb{R}([\lambda, \text{MASC, NOM, PL}]) = X + y$
$\mathbb{R}([\lambda, \text{NEUT, NOM, PL}]) = X + a$</td></tr>
<tr><td>$\mathbb{R}([\lambda, \text{GEN, SG}]) = X + a$</td><td rowspan="3">$\mathbb{R}([\lambda, \text{MASC, GEN, PL}]) = Yc'' + ov$
$\mathbb{R}([\lambda, \text{MASC, GEN, PL}]) = Yc' + oj$
$\mathbb{R}([\lambda, \text{NEUT, GEN, PL}]) = X$</td></tr>
<tr><td>$\mathbb{R}([\lambda, \text{PREP, SG}]) = X + e$</td></tr>
<tr><td>$\mathbb{R}([\lambda, \text{DAT, SG}]) = X + u$</td></tr>
<tr><td>$\mathbb{R}([\lambda, \text{INST, SG}]) = X + om$</td><td></td></tr>
</table>

The complementarity of the constraints in the multiply-filled cells in (17) avoids conflict or indeterminacy. First declension masculine and neuters may thus be consolidated, reducing the number of paradigms. Yet this reduction complicates the relation between paradigms and leading forms. The matching between a leading form and paradigm cell in (17) no longer "instantiates" all stem variables in the paradigm, but only those in cells with compatible gender values. So, in effect, the distinction between masculines and neuters reemerges in the way that (17) is interpreted.

Merging (17) with the third declension in (12) would introduce even greater complications of this sort. None of the stem variables in the gender-neutral cells in (17) could be instantiated when a third declension entry was matched against the consolidated macroparadigm. Thus the elements of the

original paradigms would have to be kept apart in some way. As these examples suggest, the conventions needed to interpret macroparadigms invariably reintroduce "virtual" declension classes. Hence the false economy achieved by macroparadigms comes out plainly in a WP description.

2.3.5. Patterns and Predictability

The schematization of exemplary paradigms raises questions about the level of abstractness that is appropriate for the description of inflection classes. Consider the patterns summarized in (18).

(18) *Declension-specific patterns of affixal exponence in Russian*

		1ST MASC		1ST NEUT	2ND FEM	3RD FEM
SING	NOM	$X = Yc''$	$X = Yc'$	Xo	Xa	$X = Yc'$
	GEN	Xa			Xy	
	ACC	—			Xu	—
	PREP	Xe				Xy
	DAT	Xu			Xe	Xy
	INST	Xom			Xoj	Xu
PLU	NOM	Xy		Xa	Xy	
	GEN	Xov	Xoj	X		Xoj

Declension classes are traditionally defined in terms of shared patterns of exponence. According to this criterion, first masculine clearly comprises a distinct declension, first masculine and neuter make up a somewhat less uniform declension, and no other groupings show more similarities than differences. However, if one were to approach the same question from a morphosyntactic perspective, the second and third declensions might appear more uniform, as they are predominantly feminine. More abstract patterns of form variation might also suggest a different organization.[7] Thus the third declension exhibits a distinctive syncretism between prepositional and genitive singular, while the second and third declensions both exhibit a syncretism between dative and prepositional singular. If these types of patterns of co-variation were treated as the basis for defining paradigms and inflection classes, one might

[7] See, for example, Wiese (2000) for a proposal regarding the organization of German declensions into natural classes.

again be led to combine the traditional second and third declensions.

The way that declension classes are defined will likewise determine whether particular exponents or patterns are regarded general or class-specific. If the second and third declension are grouped together, then shared patterns within these declensions will count as class-specific; they are treated as separate declensions, shared patterns will be class-neutral. Hence the status of principles such as the NBP depend on the criteria that are applied to define paradigms and inflection classes. As discussed above, this is a point on which the paradigm economy literature is not altogether clear.

It is perhaps also worth mentioning in this context that the genitive plural exponents in (18) provide a *prima facie* violation of the NBP, as this principle is formulated in (7). In the second declension and in first declension masculines the genitive plural is realized by the noun stem; in the third declension, and in soft stem first declension masculines, genitive plural is realized by the exponent *-oj*. Hence more than one affixal exponent fails to "identify inflection class unambiguously". One can, of course, reconcile this pattern with the letter of the NBP by exempting the phonologically-conditioned selection of *-oj*. However, any move of this sort salvages the NBP at the cost of severing the connection between blur avoidance and predictability. It remains the case that neither the lack of an exponent (alternatively, a "zero" exponent), nor *-oj* identifies the inflection class of a form.

From a WP perspective, this type of "blurring" is no more problematic than the existence of exponents, such as *-ax*, *-am* and *-ami*, which are uniform across declensions. The phenomenon that Carstairs-McCarthy (1994) terms "blurring" is merely an instance of non-predictive exponence. The fact that one might be able to construct blur-free descriptions of inflectional systems arguably reveals more about the descriptive flexibility that is gained by recognizing diverse types of macroparadigms and by granting various kinds of exemptions than it does about the organization of inflection classes. Furthermore, as discussed in section 3.5, a language can exhibit pathologically uneconomical patterns of inflectional exponence and still satisfy the NBP, provided that the exponents are non-affixal.

A WP approach differs from an account that imposes an affix-based economy constraint like the NBP in requiring that some form or set of forms must be of predictive value. A central question for WP approaches thus concerns the basis for selecting leading forms. The use of the nominative singular as a citation form reflects its predictive value in many Indo-European declensions.

One might want to relate the use of nominative singular as a leading form to the unmarked morphosyntactic status that Jakobson (1936) attributes to nominative singular properties. Yet there are languages in which the nominative singular is not of great predictive value. In some, such as Estonian (described in section 3 below), the nominative singular may even be the **least** predictive form in a paradigm.

The definition of lexical congruence given earlier represents the classical WP view that the leading forms of a declensional system should be morphosyntactically coherent, in the sense that they all realize the same paradigm cell. However, one could just as well select a **morphotactically** coherent set of leading forms in Russian. That is, all regular noun declensions contain a singular form in *-u*, but differ in the case that they associate this form. This form realizes dative in the first declension, accusative in the second declension and instrumental in the third. Hence the inflection class of any noun is uniquely identified by a leading entry that identifies the case of the form in *-u*.

2.4. Summary

Three points should be stressed in connection with the brief discussion of open issues above. The first is that these issues represent largely free choices within a WP analysis. The second point is that the resolution of these questions ultimately hinges on how speakers actually represent inflection class systems. Traditional WP accounts can be regarded as idealizations of a network-based model of a mental lexicon. Which assumptions of this idealization are psychologically plausible or perhaps even correct is ultimately an empirical question, which cannot be determined entirely *a priori*.

A third, more general, point leads back to the central claim of this section. That is, that the economy of an inflectional system rests on patterns of interpredictability. As the earlier analyses indicate, interpredictability holds between leading entries and deduced entries, rather than between simple forms. The soft stem leading forms in (18) underscore this point. One must know the gender, and, indeed, case, of such a form in order to associate it with the appropriate exemplary paradigm.

This suggests a natural treatment of indeclinable nouns in Russian. Some indeclinable nouns have a form that prevents them from being coerced into any declension class. Yet others, such as *radio* (‘radio’) or *kino* (‘cinema’), appear to have a suitable form and gender, in this case one that is compatible

with the first neuter declension. A simple way of describing these indeclinables is to assign them a single, case-neutral, entry. This entry will not serve as a leading form, as it does not satisfy the morphosyntactic properties specified in the corresponding cell in a schematic exemplary paradigm. Hence any lexeme represented by a degenerate entry will fall outside the inflection class system.

3. Declensional Economy in Estonian

Previous sections suggest that the economical distribution of affixal exponents in an inflectional system reflect the intrinsic interdependence of wordforms, and that the way that WP models express this interdependence subsumes the effects of affix-based economy principles. The present section reinforces these conclusions by showing how a WP description captures the economical distribution of stems in Estonian declensional paradigms. Rather than "one inflection predicting another", as in many Indo-European languages, it is stems that tend to predict one another in Estonian. As with affixal dependencies, these interlocking patterns of stem syncretism effectively constrain the number of declension classes and the size of lexical inventories in Estonian. Yet since these patterns do not involve affixal exponence, they do not interact with affixal economy principles.

3.1. Declension Classes in Estonian

Descriptions of Estonian differ widely in the number of declensional subtypes that they recognize, though there is some basic agreement about the rough number of classes. Expatriate descriptions are the most exuberant, as Saagpakk (2000) recognizes over 400 types, organized into six classes, and Murk (1997) distributes 260-odd types over eight classes. Estonian sources tend to be somewhat more conservative. Erelt (1999, 18ff) identifies 38 basic "word types" (*tüüpsõnad*), Viks (1992, 43ff) distinguishes 26 nominal "types", and Erelt et al. (1995, 333) give twelve basic "exemplary declensional paradigms" (*käändsõnade näidisparadigmad*). Perhaps the most useful classification of all is provided by Erelt et al. (2000, 240f), who identify seven "declensions" (*käändkonnad*), containing 22 "open-class types" (*avatud tüübid*) and another 23 "closed-class types" (*suletud tüübid*). The "declension classes" in

these schemes are typically defined with reference to properties of the nominative singular form, notably its syllable (or mora) count, the type of segment it ends in, and whether its grade alternates with that of the genitive singular. Subtypes are then specified in terms of other properties, such as the form of the partitive singular, or the vowel that terminates the genitive singular.

The exponent inventory of this system is listed in full in (19). There are at most two allomorphs of the "grammatical" cases in (19)a, while the "semantic" cases in (19)b each have a single form.

(19) *Case-number exponents in Estonian*

a.

Case	Exponent	
	SING	PLU
NOM(INATIVE)	-Ø	-d
GEN(ITIVE)	-Ø	-de, -te
PART(ITIVE)	-Ø, -t	-sid, -id

b.

Case	Exponent
ILLA(TIVE)	-sse
INES(SIVE)	-s
ELA(TIVE)	-st
ALLA(TIVE)	-le
ADES(SIVE)	-l
ABLA(TIVE)	-lt
TRANS(LATIVE)	-ks
TERM(INATIVE)	-ni
ESS(IVE)	-na
ABES(SIVE)	-ta
COM(ITATIVE)	-ga

The original PEP thus sets a bound of two declension classes in Estonian. Interestingly, this is not far off. If one restricts attention initially to the open-class patterns identified in Erelt et al. (2000), it is possible to reduce the nominal system to the three basic declensions in (20).[8]

[8]It is worth clarifying that orthographic *d* and *t* in genitive plural exponents contrast in length, not voicing. Orthographic *d* always represents a short voiceless /t/, while a single intervocalic *t* represents the longer version /t:/.

(20) *Exemplary noun paradigms in Estonian*

	First declension		Second declension		Third declension	
	SING	PLU	SING	PLU	SING	PLU
NOM	pesa	pesad	raamat	raamatud	kõne	kõned
GEN	pesa	pesade	raamatu	raamatute	kõne	kõnede
PART	pesa	pesasid	raamatut	raamatuid	kõnet	kõnesid
ILLA	pesasse	pesadesse	raamatusse	raamatutesse	kõnesse	kõnedesse
INES	pesas	pesades	raamatus	raamatutes	kõnes	kõnedes
ELA	pesast	pesadest	raamatust	raamatutest	kõnest	kõnedest
ALLA	pesale	pesadele	raamatule	raamatutele	kõnele	kõnedele
ADES	pesal	pesadel	raamatul	raamatutel	kõnel	kõnedel
ABLA	pesalt	pesadelt	raamatult	raamatutelt	kõnelt	kõnedelt
TRANS	pesaks	pesadeks	raamatuks	raamatuteks	kõneks	kõnedeks
TERM	pesani	pesadeni	raamatuni	raamatuteni	kõneni	kõnedeni
ESS	pesana	pesadena	raamatuna	raamatutena	kõnena	kõnedena
ABES	pesata	pesadeta	raamatuta	raamatuteta	kõneta	kõnedeta
COM	pesaga	pesadega	raamatuga	raamatutega	kõnega	kõnedega
GLOSS	'nest'		'book'		'speech'	

Nouns of the first declension have distinctive vowel-final partitive singulars, and genitive and partitive plurals in *-de* and *-sid* that illustrate the default patterns. Thus the vowel-final partitive singular *pesa* predicts the genitive plural *pesade* and the partitive plural *pesasid*. Nouns of the second declension have distinctive genitive plurals in *-te*, default partitive singulars in *-t* and usually also partitive plurals in *-id*. Thus genitive plural *raamatute* predicts the consonant-final partitive singular *raamatut*, as well as the partitive plural *raamatuid*. Third declension nouns appear to be "mixed" in that they decline like second declension nouns in the singular and like first declension nouns in the plural. However, this "mixture" really reflects the fact that third declension nouns exhibit only default patterns. Thus two forms are required to identify the class of KÕNE: the default partitive singular *kõnet*, and the default genitive plural *kõnede*, which predict the partitive plural *kõnesid*.

Hence class can usually be determined from one, and in the worst case from two, leading forms. Moreover, in most cases, the full paradigm of an open-class noun is predictable from the leading forms that identify its class. This remarkable economy reflects two factors: the uniform patterns of affixal exponence in (19), and the highly interdependent patterns of stem selection described below.

3.2. General Patterns of Stem Selection

A number of stem dependencies apply to all paradigms, irrespective of class. The genitive plural form, whether listed or implied, determines the "long" plural forms of the semantic cases in (20). Each of these forms adds a case exponent from (19)b to the **form** of the genitive plural. The singular forms of the semantic cases are similarly "parasitic" (Matthews (1972)) on the genitive singular. One could define this "Priscianic" dependency independently, for each semantic case form. However, such a strategy would miss the obvious generalization that the semantic cases comprise a form class in Estonian. Let this class be designated by the property OBL(IQUE). Then the relation between genitive and semantic cases is expressed by the constraint in (21), in which x matches any affixal exponent.

(21) *Parasitic formation of semantic cases*
$\mathbb{R}([\text{OBL}]) = \mathbb{R}([\text{GEN}]) + x$

This constraint identifies the genitive forms as the stems of semantic case forms, achieving the effect of the referral rules proposed for Estonian in Hughes & Ackerman (2002). It is not necessary to stipulate that x is nonempty in (21), since each semantic case will match x against a different exponent in (19)b. The genitive plural form is, of course, given by the class of a noun. The genitive singular form of a noun is likewise predictable from the partitive singular, and is usually identical to the stem of the partitive singular. In the first declension, the partitive singular stem is just the partitive singular form. In the second and third declensions, it is the partitive singular form, less *-t*. With the exception of second declension types like OTSUS ('decision') and HOBUNE ('horse') in (27) the partitive stem of a noun ends in one of the "stem vowels" *a*, *e*, *i* or *u* (Tuldava (1994, 42)).

The nominative singular of a noun is also predictable from the partitive singular stem. In general, if an open-class noun has a partitive singular stem with three or more moras, it will have a "truncated" nominative singular, corresponding to the stem, minus its stem vowel. Thus RAAMAT (20) has the partitive singular stem *raamatu* and the nominative singular *raamat*. However, words are minimally bimoraic in Estonian, and the lengthening processes that historically produced overlong monosyllables (e.g., *vee* from *vesi* ('water')) are no longer active. So if the partitive singular stem is bisyllablic, then the stem vowel is retained in the nominative singular, as in the forms *pesa* and *kõne*.

An interesting consequence of defining the nominative and genitive singulars from the partitive singular stem is that this accounts for the lack of any nominative or genitive singular inflections in Estonian. Genitive singulars always preserve stem vowels, which, as their traditional name suggests, are stem elements, not "inflexions proper". Nominative singulars likewise end either in stem vowels, or whatever consonant remains once the stem vowel is removed. Genitive plurals similarly lack case inflections, as the endings *-te* and *-de* effectively define a plural stem for the semantic cases.

Indeed the only grammatical case other than partitive that is marked by an affixal exponent is the nominative plural, which consists of the genitive singular stem and the exponent *-d*.

(22) *Formation of the nominative plural*
$\mathbb{R}([\text{NOM PL}]) = \mathbb{R}([\text{GEN SG}]) + d$

To summarize these general patterns, noun class is identified by partitive singular and/or genitive plural forms. The stem of the partitive singular underlies the nominative and genitive singular forms. The genitive singular in turn underlies the nominative plural, and the singular semantic case forms. The genitive plural is realized by a plural stem, which again underlies the plural semantic case forms.

3.3. First Declension Nouns

The paradigms in (23) illustrate each of the open-class first declension patterns recognized in Erelt et al. (2000) (though they do not, to be fair, group these paradigms into a single declension).

(23)

SING	NOM	ema	pesa	seminar	`siil	sisa`lik
	GEN	ema	pesa	seminari	siili	sisaliku
	PART	ema	pesa	seminari	`siili	sisa`likku
	ILLA2	—	`pessa	seminari	`siili	sisa`likku
PLUR	NOM	emad	pesad	seminarid	siilid	sisalikud
	GEN	emade	pesade	seminaride	`siilide	sisa`likkude
	GEN2	—	—	—	—	sisalike
	PART	emasid	pesasid	seminarisid	`siilisid	sisa`likkusid
	PART2	—	pesi	seminare	`siile	sisa`likke
	GLOSS	'mother'	'nest'	'seminar'	'hedgehog'	'lizard'

The paradigms in (23) exhibit the vowel-final partitive singulars that define the first declension, along with the partitive plural patterns that are characteristic of this declension. The constraint in (24)a matches a vowel-final partitive singular leading form and defines a partitive singular stem X.[9] The constraint in (24)b defines the regular partitive plural in terms of X and the exponent *-sid*.

(24) *General first declension constraints*

a. $\mathbb{R}([\text{PART SG}]) = (X = Yv)$

b. $\mathbb{R}([\text{PART PL}]) = X + sid$

c. $\mathbb{R}([\text{PART2 PL}]) = \xi(X)$

d. $\xi = \begin{cases} Ya \rightarrow Yi \\ Ye \leftrightarrow Yi \\ Yu \rightarrow Ye \end{cases}$

Most first declension nouns also have a "stem" partitive plural (*tüvimitmus*), listed as PART2 in (23). Stem partitives work by a process of "vowel exchange" with the partitive singular. Open-class nouns show the alternations in (24)d, though Erelt et al. (2000, 199) note other patterns that are preserved in closed-class nouns. A partitive singular in *-a* corresponds to a short plural in *-i*, and a partitive singular in *-u* corresponds to a short plural in *-e*. The vowels *i* and *e* exhibit a pattern of "vowel reversal" (Matthews (1991, 199)); if a noun forms its partitive singular in one, it forms the short partitive in the other. The constraint in (24)c thus identifies stem partitive plurals as the exchange variant of the partitive singular. Stem partitives are limited to the first declension, because only first declension nouns have vowel exchange variants. Yet, as the paradigm for EMA shows, whether a noun has a stem partitive is not itself predictable. Nouns with stem partitives are sometimes assigned to different classes from those without, but these classes merely register the presence or absence of stem partitives. Hence this contrast is best expressed by means of variation in lexical inventories.

The "short" illative (*lühike sisseütlev*), marked as ILLA2 in (23), is also characteristic of the first declension, though as EMA again shows, not all nouns have this form. The description of short illatives requires a brief foray into the phenomenon of gradation in Estonian. In open-class declensions, grade is exclusively "quantitative", exploiting the three-way length contrast between short (*esimene välde* ('first quantity')), long (*teine välde* ('second quantity')) and "overlong" (*kolmas välde* ('third quantity')) syllables.[10] Since

[9] Adapting the notion introduced for Russian in section 2.3.2, Yv represents a vowel-final form in (24)a.

[10] Closed-class also exhibit "qualitative" grade alternations, in which the "weak" form lacks a segment that occurs in the "strong" form, as a consequence of historical processes of conso-

length is not represented consistently in the standard orthography, overlong syllables are marked by a preceding left quotation mark.[11] For example, the first syllable of *pesa* in (23) is short (/e/), and that of *siili* is long (/i:/), whereas the first syllables of *`pessa* and *`siili* are both overlong.

One can make sense of the forms of the short illatives in (23) if one assumes that short illatives are obligatorily trimoraic. Nouns with bimoraic partitive singulars satisfy this demand by lengthening the first syllable of the partitive plural. In nouns with trimoraic partitive singulars, the partitive singular is already an eligible illative singular. Thus the bimoraic partitive singulars *pesa* or *elu* ('life') correspond to the short illatives *`pessa* and *`ellu*, with overlong initial syllables. However, the trimoraic partitive singulars *seminari*, *`siili* and *sisa`likku* are identical to the short illative forms.[12]

Like short partitives, short illatives do not increase the class inventory in Estonian. There is no point in assigning EMA to a class of "defective" nouns without short illatives. The lack of a short illative is a sufficient indication. Conversely, the class of nouns with short illatives is adequately defined by the presence of a short illative in individual lexical inventories. One cannot know for certain that all first declension nouns will have stem partitives and short illatives, but, given the partitive singular, one can determine what form these elements will take, if they do exist.

More generally, the nouns EMA and PESA in (23) illustrate the inflection of bimoraic first declension nouns; SEMINAR, SIIL and SISALIK illustrate the trimoraic pattern. It is not strictly necessary to assign SEMINAR to a separate class, since the form of its truncated nominative *seminar* and its short illative *seminari* can both be attributed to its trimoraic partitive singular. It is only the grade-alternating nouns, like SIIL and SISALIK, that require the introduction of new declensional subtypes.

Yet even these paradigms are fully predictable from a partitive singular leading form. It might initially seem that nouns of this class must at least spec-

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nant loss and mutation, and compensatory lengthening.

[11] Following the practice of most Estonian sources, including Viks (1992), Tuldava (1994) and Erelt et al. (1995; 2000).

[12] The main exceptions to this generalization involve compounds and other complex forms, which often have short illatives determined by their final bisyllabic foot. Thus RAAMATUKOGU ('library') (lit. 'book collection') has the short illative form *raamatu`kokku*, containing *`kokku*, the short illative of KOGU ('collection'). The short illative of ARUTELU ('discussion') is likewise *arut`tellu*, following the pattern of ELU ('life'), even though there is no clear semantic connection in this case.

ify their genitive singulars, since it is precisely the contrast between their partitive and genitive singulars that identifies them as grade-alternating nouns. However, a weak genitive singular is predictable from a strong partitive singular, because no open-class first declension noun has a non-alternating overlong partitive singular. There are second declension nouns, like `AASTA in (27), that are overlong throughout their paradigm, and a few third declension nouns, like `KRAHVINNA ('countess'), that follow a similar pattern. But in the first declension, a strong partitive singular implies a weak genitive singular. The constraints in (25) encapsulate this deduction in a strong sub-declension, where "*X*" marks a strong form with an overlong initial syllable, and "*X*" its weak counterpart, with a merely long initial syllable.

(25) *The strong first subdeclension*

a. $\mathbb{R}([\text{PART SG}]) = \grave{X}$

b. $\mathbb{R}([\text{GEN SG}]) = X$

The fact that strong nouns have truncated nominative singulars is also predictable from their partitive singular. The truncation of a strong partitive stem like *`siili* yields an overlong monosyllable like *`siil*. Since this form remains bimoraic it satisfies the minimal word constraint in Estonian.

The paradigm of SISALIK in (23) is also predictable from the strong partitive singular leading form *sisa`likku*. Every noun that inflects like SISALIK has a partitive singular with a strong trimoraic foot in -*`ikku*. It is this final foot that alternates in grade, and implies the weak genitive singular in -*iku*, in accordance with (25). Hence each noun in the SISALIK class can inflect in the same way as SIIL. However, nouns with strong partitive singulars in -*`ikku* also imply a "stem" genitive plural. This form is defined in (26) as an exchange variant of the weak genitive singular, which extends the grade contrast between strong partitives and weak genitives into the plural.

(26) *Formation of the stem genitive plural*

$\mathbb{R}([\text{GEN PL}]) = \xi(\mathbb{R}([\text{GEN SG}]))$

The form variation within the first declension thus determines at most three subclasses. The nouns EMA, PESA and SEMINAR exhibit the general patterns within this class, while SIIL and SISALIK illustrate the two grade-alternating patterns. These classes show completely uniform patterns of affixal exponence, and are distinguished only by alternations involving grade and stem vowels. Hence, from the standpoint of purely affixal economy principles, the

first declension represents a single class.

3.4. Second and Third Declension Nouns

Consider next the open-class second declension nouns in (27), again from Erelt et al. (2000). Each noun has a genitive plural in *-te* and a partitive singular in *-t*, and most have a partitive plural in *-id*.

(27)

SING	NOM	`aasta	raamat	i`dee	otsus	hobune	inimene
	GEN	`aasta	raamatu	i`dee	otsuse	hobuse	inimese
	PART	`aastat	raamatut	i`deed	otsust	hobust	inimest
	ILLA2	—	—	—	—	—	inimesse
PLUR	NOM	`aastad	raamatud	i`deed	otsused	hobused	inimesed
	GEN	`aastate	raamatute	i`deede	otsuste	hobuste	inimesete
	PART	`aastaid	raamatuid	i`deid	otsuseid	hobuseid	inimesi
	PART2	—	—	i`deesid	—	—	—
	GLOSS	‘year’	‘book’	‘idea’	‘decision’	‘horse’	‘human’

The patterns that characterize the second declension are given in (28). A genitive plural leading form matches the constraint in (28)a and defines a stem that underlies the remaining forms in (28).

(28) *General second declension constraints*

a. $\mathbb{R}([\text{GEN PL}]) = X + te$

b. $\mathbb{R}([\text{PART SG}]) = X + t$

c. $\mathbb{R}([\text{GEN SG}]) = X$

The nouns `AASTA and RAAMAT illustrate the basic second declension pattern.[13] It may not be so evident that IDEE belongs to the second declension, though orthographic *-d* (/t/) here just reflects regular shortening of *-t* (/t:/) following an overlong vowel. Nouns of the IDEE type do constitute a separate class, however, since they are the only open-class type in Estonian that has

[13]The difference between the nominative singulars *`aasta* and *raamat* is again attributable to phonological considerations, if one takes into account the fact that the forms of open-class second declension nouns are minimally bisyllabic, not bimoraic, as in the first declension. This difference in turn reflects the fact that grade remains distinctive for open-class first declension nouns, but all grade alternations in the second declension are confined to closed-class noun types. If words are minimally bisyllabic in the second declension, then truncation of *raamatu* but not *`aasta* will be possible.

both a second declension partitive plural in *-id* and a default partitive plural in *-sid*. It is less obvious that nouns of the OTSUS type form a separate subclass. The vowel *-e* that occurs in the genitive singular could be regarded as phonologically determined, as it also appears epenthetically in alternations between genitive and nominative singulars like *`numbri* ∼ *`number* ('number') and *`kaarna* ∼ *`kaaren* ('raven').

One can at least plausibly regard the *-e* in the genitive singulars in (28) as a default strategy for producing a vowel-final genitive from a consonant-final partitive stem. The remaining variation within this class then involves the nominative singular forms of HOBUNE and INIMENE and the partitive plural of INIMENE. There is no point in defining a class of nouns with nominative singulars in *-ne*, since this class does nothing more than register the fact that their lexical inventory contains a nominative singular entry in *-ne*. Establishing a separate class for nouns like INIMENE has a more secure justification, as the stem plural in this class is correlated with the presence of a short illative.

Moreover, nouns of the INIMENE type lack the alternate "*i*-plural" (*i-mitmus*), as shown in (29).[14]

(29) *Second declension i-plurals*

PART	`aastaid	raamatuid	i`deid	otsuseid	hobuseid	*inimesid
ILLA	`aastaisse	raamatuisse	i`deisse	otsuseisse	hobuseisse	*inimesisse
INES	`aastais	raamatuis	i`deis	otsuseis	hobuseis	*inimesis
ELA	`aastaist	raamatuist	i`deist	otsuseist	hobuseist	*inimesist
ALLA	`aastaile	raamatuile	i`deile	otsuseile	hobuseile	*inimesile
ADES	`aastail	raamatuil	i`deil	otsuseil	hobuseil	*inimesil
ABLA	`aastailt	raamatuilt	i`deilt	otsuseilt	hobuseilt	*inimesilt
TRANS	`aastaisk	raamatuiks	i`deiks	otsuseiks	hobuseiks	*inimesiks

This formation has a number of interesting properties, including the fact that it is not possible for the last four semantic cases. However, for present purposes, it is best to regard *i*-plurals simply as comprising a form class, designated by the mnemonic property "I-STEM". Then the relation between the second declension partitive plural and the *i*-plurals is expressed in (30). The partitive plural is related in (30)a to the genitive singular, and in (30)b and (30)c to the *i*-plurals. As this description clarifies, the second declension par-

[14] Although some descriptions list alternate plurals based on stem plurals, in both the first and second declensions. However, these forms are, as Erelt et al. (2000, 197f) note, confined to fixed expressions, compounds and poetry.

titive plural is, in fact, part of the *i*-plural system.

(30) *The alternate i-plural*

a. $\mathbb{R}([\text{PART PL}]) = \mathbb{R}([\text{GEN SG}]) + id$

b. $\mathbb{R}([\text{PART PL}]) = Y + d$

c. $\mathbb{R}([\text{I-STEM PL}]) = Y + x$

To round out this description, the nouns in (31) illustrate the uniform structure of the third declension. There are no short illatives, stem partitives or *i*-plurals in this declension. The partitive singular exponent *-t* is again shortened to *-d* following a long vowel in *`koid*. The forms of KÕNE and LEPATRIINU likewise show that there is no length-conditioned variation in stem or affixal exponence.

(31)

SING	NOM	`koi	kõne	lepatriinu
	GEN	‘koi	kõne	lepatriinu
	PART	`koid	kõnet	lepatriinut
PLUR	NOM	`koid	kõned	lepatriinud
	GEN	`koide	kõnede	lepatriinude
	PART	`koisid	kõnesid	lepatriinusid
	GLOSS	‘moth’	‘speech’	‘ladybug’

3.5. Form-Based Economy

This somewhat extended description of Estonian shows how interdependent patterns of stem selection can constrain inflection classes to the same degree as interdependent patterns of affixal exponence. The modern Estonian system has no fewer than three general declension classes, and something in the order of two subclasses within each of the first two declensions. So perhaps seven productive classes in all. The system is strikingly economical, in that a single leading entry determines the full paradigm of most open-class nouns. Moreover, many of the closed-class types can be assimilated to these general classes by recognizing various common patterns of suppletion, often involving the nominative singular. In a WP approach, the deviations within closed types will incur a gradually increasing entry overhead, until they reach a point where the exemplary paradigm for a class is of no practical use in deducing forms. At this point, the entire suppletive pattern must simply be listed. Thus the economy of a WP description matches that of the pattern it is modelling.

To what degree do these patterns comply with affixal economy principles? The basic objection to affixal principles raised above was not just that they were arbitrary or capricious, but that their agglutinative bias severs the connection between allomorphic variation and inflection classes, particularly in languages that mark inflection class by non-affixal means. Now the existence of a third declension in (20) does not pose insuperable problems for an affix-based economy principle. Although there are only two allomorphs of the partitive singular and genitive plural in (19)a, -Ø and *-te* identify inflection class, whereas *-t* and *-d* are defaults. So there is no "blurring", in the sense of the NBP in (7). Moreover, it is not unreasonable to suggest, as Carstairs (1983, 127) does, that one "may be justified as treating this kind of paradigm mixture as a specific exemption" to the PEP. Further, if one regards the stem partitive plural form as the realization of a general "partitive plural" property, the corresponding cell in (19)a could have three allomorphs: second declension *-id*, default *-sid*, and now first declension -Ø (i.e., no affix). This would sanction a third declension class, though the affixal resources of Estonian would not appear to justify any additional classes.

A proponent of affixal economy principles might then consolidate paradigms to try to bring the number closer to the quota allowed by the PEP, or else concede this discrepancy but maintain that the NBP is observed, as it appears to be, in Estonian. Some of the issues raised by the strategies employed to consolidate macroparadigms or to avoid blurring are discussed in section 2 above. Yet the fact that the NBP is satisfied in Estonian is completely unconnected to the patterns that determine the economy of Estonian declensions. The reason for this is that the NBP effectively collapses all non-affixal patterns of exponence to the single class "Ø". Consequently, the NBP would also be observed in a language that differed from Estonian in exhibiting utterly unconstrained stem allomorphy. A language could, for example, select a separate stem for each of the fourteen case forms. Or a system could exhibit an exact parallel to the pathologically independent inflection classes in (2). To understand why this is so, consider again the partial Russian exponent inventory in (1), repeated as (32)a. Each of the five distinct affixal allomorphs in (32)a is then mapped onto a unique stem allomorph in (32)b: -Ø onto S0, *-o* onto S1, *-a* onto S2, and so on.

(32) *Nominative and genitive exponents in Russian and corresponding stem allomorphs*

a.

	SINGULAR	PLURAL
NOM	-Ø, -o, -a	-y, -a
GEN	-y, -a	-Ø, -ov, -ej

b.

	SINGULAR	PLURAL
NOM	s0, s1, s2	s3, s2
GEN	s3, s2	s0, s4, s5

The affixal allomorphs in (32)a and the stem allomorphs in (32)b define the same space of thirty-six independent inflection classes. Hence, one can substitute the stem allomorphs in (32)b for their affixal counterparts in the independent classes in (2), precisely duplicating the pathology that economy principles are designed to constrain. But affixal principles simply fail to apply in this case. Provided that the stem allomorphs in (32)b are not distinguished by affixal exponents, the entire set of classes defined by (32)b collapses to the single class "Ø". This class satisfies both the PEP and NBP.

This result is directly attributable to the agglutinative bias of the PEP and NBP. Structuralist procedures of segmentation and classification are simply not appropriate tools for capturing the form dependencies that underlie the economy of Estonian declensions. Hence constraining the output of these procedures just supplies a corrective for a self-inflicted problem. One could, of course, invoke zero "process morphs" to trigger stem alternations. However, as Hockett (1954, 394) observes, this move merely trivializes the notion of an affix, and "seems to be equivalent — perhaps rather unexpectedly — to removing the keystone of the whole IA arch; the model begins to collapse".[15]

A WP approach provides an instructive contrast. A collection of thirty-six independent classes cannot be factored into a system of exemplary paradigms and leading forms. It does not matter whether the classes are marked affixally, or by segmental or suprasegmental stem alternations. The organizing principle of a WP model is that some forms should predict others; the properties that serve as a basis for prediction is of subsidiary importance. Collections of independent forms do not support predictions and, hence, one does not expect to find pathological classes of this sort.

[15] Grade alternations in Sanskrit declensions present problems for an affixal approach that are in many ways analogous to those raised by Estonian. See Stump (2001), especially chapter 6, for a detailed discussion of the Sanskrit stem system.

4. Conclusions

In short, affixal economy reflects a more general phenomenon, namely the independence of **forms** in an inflectional paradigm. Once one appreciates this general pattern, the derivative status of dedicated economy principles becomes clear. Affixal economy principles are no less redundant than the corresponding "stem economy" principles would be. From a classical WP perspective, this makes perfect sense, because affixes and stems are themselves derivative, and grammatical generalizations about these elements are mediated through statements about the forms from which they are abstracted.

It is, ultimately, the post-Bloomfieldian methods of analysis that give rise to the basic problem of paradigm economy, at least in the form that this problem is raised by Carstairs (1983). It is only once one has dissected a morphological system into inventories of "free" and "bound" elements that the problem of constraining their distribution arises. The issues raised by independent stem and exponent entries reflect a more general phenomenon, which one might call the "Humpty Dumpty problem". Given the forms of a paradigm, it is usually possible to isolate a recurrent stem (or possibly stem set) and a set of inflectional exponents. However, once a morphological system has been disassembled into sets of stems and exponents, it is not in general possible to recover the original forms without introducing features that amount to "reassembly instructions". In some cases, class indices may serve this purpose. This is the function of inflection class features in analyses of Russian that represent lexemes by non-predictive stem entries. However, in systems involving slot competition, such as Georgian, even inflection class features may not suffice (Gurevich (2003)).

Non-predictive entries also underlie the proliferation of classes in the descriptions of Estonian nouns in Murk (1997) and Saagpakk (2000). If one starts with an inflected noun, one can identify the stem and affix. For example, the second declension genitive plural *raamatute* consists of the stem *raamatu* and the exponent *-te*. But given genitive singular *raamatu* there is no way of knowing whether the genitive plural is *raamatute* or *raamatude*. Likewise, genitive singular *raamatu* predicts nominative singular *raamat*. But given nominative singular *raamat* all one knows is that the genitive singular will end in one of the stem vowels. A description that represents nouns by their nominative singular has chosen the least informative form in the paradigm, and must compensate by introducing classes to catalogue the lexical variation

that is not predictable from the nominative singular.

From a WP perspective, these problems derive from a shared source, and are amenable to a common solution: recognizing words and paradigms as the basic components of a morphological system.

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