Agreement Bottlenecks in Italian*

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Abstract
This paper follows a progression of pregroup analyses of agreement in the Italian DP as they are successively modified so as to express more sophisticated relationships between overt expressions of agreement. The desire to state our intuitions about the data directly in the object language of the theory will be seen to put pressures on the underlying combinatory system that the types will be unable to accommodate. Allowing more expressive types (while holding constant the underlying calculus) will alleviate some of the pressure put on the combinatory system, and allow us to capture certain generalizations about relations between paradigms that are out of the reach of previous analyses. In particular, it will be shown that certain kinds of 'meta-paradigmatic' phenomena [Bobaljik, 2002] are statable without additional stipulation in our setting.

1 Introduction

There are, to a first approximation, two classes of adjectives in Italian.[1,2] The first class agrees in number (s/p) and in gender (m/f) with

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[1]Thanks to Manola Salustri for her help.

[2]Whether both classes are productive, I do not know. It would be interesting to see the results of a wug-test which gives prompts with the novel adjective in a masculine plural context (where both class I and class II inflections coincide). Impressionistically, class I takes up far more of the dictionary than class II, and seems to be more frequent in speech and writing.

the head noun. The second class agrees only in number (s/p) with the head noun, with no accompanying regular variation depending upon its gender. This is sketched in figure 1.[3]

gen / num	CLASS I	CLASS II
m / s	bello	triste
m / p	belli	tristi
f / s	bella	triste
f / p	belle	tristi

Figure 1: Two classes of adjectives

Nouns in Italian also vary their form depending on their number. Moreover, there are also roughly two classes of nouns, with respect to the forms they take in the singular and the plural. A class I noun is one which inflects like a class I adjective (holding gender constant), and a class II noun inflects like a class II adjective. There are class I and II nouns of both genders, as shown in figure 2.[4]

gen / num	CLASS I	CLASS II
m / s	gallo	cane
m / p	galli	cani
f / s	rana	volpe
f / p	rane	volpi

Figure 2: Class and gender are independent

Since the form of a class I adjective immediately following a class II adjective is not predictable from the form of the class II adjective, one might wonder whether a class II adjective's lack of gender information puts a bottleneck of sorts on the agreement exponents of the adjectives that follow it. This is not the case, as shown in 1 and 2 below.

(1) *il* *gallo* *triste* *nero*
the.M.S rooster.M.S sad.S black.M.S

[3] *gallo* means rooster, *cane* dog, *rana* frog, *volpe* fox, *bello* pretty, *nero* black, and *triste* sad.

[4] The gender of a noun is unambiguously determinable from the form of its determiner, and the adjectives in the noun phrase [see Saporta, 1962, for discussion in the context of Spanish].

"the sad black rooster"

(2)	**il*	*gallo*	*triste*	*nera*
	the.M.S	rooster.M.S	sad.S	black.F.S

This paper aims to provide a consistent description of this data, as well as to investigate the effects that various limitations of our theoretical vocabulary have on the descriptions we can formulate about the objects of study. I give three successive analyses of this data, each motivated by deficiencies of the one before.

2 Agreement in the Italian Noun Phrase

The pattern described above is not a complicated one; in fact, it is even regular. However, our choice of theoretical machinery limits the descriptions we can give to our data. When external factors, such as semantic interpretability and parsimony considerations, further restrict the available descriptions, intuitions may be formalizable only at great predictive cost. One natural intuition to have is that these two paradigms (the nominal and adjectival) are related, in some sense. Whether grammar should be able to describe such 'meta-paradigmatic' relations (in the sense of Williams [94]) is controversial (see Bobaljik [2002]for arguments based on restrictiveness to the contrary), but seems a question that is best resolved by the ability to account for psycholinguistic data. Before we ask whether we *should* describe this kind of relation, it behooves us to see how in principle we *could* describe it. It will become clear that in the theoretical framework of this paper (some) such relations are simply stated, without the additional mechanisms needed by the other theories of morphology referenced above. In the remainder of this section, I make explicit the theoretical vocabulary at my disposal in § 2.1, and use it to present an initial analysis of the data § 2.2 that, while lacking in ways outlined in § 2.3, serves as a starting point for the later alternatives.

2.1 Introducing Pregroups

A linguistic object is sign associated with a category, or type. More complex linguistic objects are built up from less complex ones by combination of signs, and corresponding operations on categories. A very simple system results if the categories are drawn from a pregroup (to be defined shortly) [Lambek, 2001], and the combining operation on categories is the multiplication operation in the pregroup. For the purposes of this paper, signs are identifiable with strings over a finite alphabet, and their combination is represented by string-concatenation.

A pregroup $P = \langle M, \cdot, 1, \leq, {}^r, {}^l \rangle$ is a partially ordered monoid $\langle M, \cdot, 1, \leq \rangle$ with left and right inverses satisfying the following equations:[5]

$$x^l \cdot x \leq 1 \leq x \cdot x^l$$
$$x \cdot x^r \leq 1 \leq x^r \cdot x$$

Given a partially ordered set of atomic types $\mathbb{T} = \{a, b, \ldots\}$, the free pregroup over $\mathbb{T}$ is the ordered monoid freely generated from the infinite set of simple types $\Sigma = \{a^n : a \in \mathbb{T} \wedge n \in \mathbb{Z}\}$, where $\mathbb{Z}$ is the set of both positive and negative integers (including 0). A simple type a^n stands for a^{l^n} if $n < 0$, a^{r^n} if $n > 0$ and for a if $n = 0$ [Lambek, 1999]. In this paper, we will not make use of iterated adjoints, and shall simply write a^l, a, and a^r for a^{-1}, a^0, and a^1. The order on types in the free pregroup over $\mathbb{T}$ is given as the transitive closure of the smallest relation satisfying, for $a, b \in \mathbb{T}$, $n \in \mathbb{N}$, and c, d arbitrary types, with $a \leq b$ if n is odd, and $b \leq a$ otherwise

Induced step $ca^n d \leq cb^n d$

Generalized contraction $ca^n b^{n+1} d \leq cd$

Generalized expansion $cd \leq ca^{n+1} b^n d$

As per the discussion above, a binary operation $\otimes$ is defined over $\Sigma^* \times M$ such that $\langle \sigma, a \rangle \otimes \langle \tau, b \rangle = \langle \sigma\tau, ab \rangle$. The associativity of $\otimes$ follows from the associativity of the multiplications of the string algebra and the pregroup. A pregroup grammar is a triple $G = \langle \mathbb{I}, s, P \rangle$, where P

[5] A monoid $\langle M, \cdot, 1 \rangle$ consists of a set M together with a distinguished element $1 \in M$ and a binary operation over M satisfying the following equations:

$$1 \cdot x = x = x \cdot 1 \qquad \text{(unit)}$$
$$x \cdot (y \cdot z) = (x \cdot y) \cdot z \qquad \text{(associativity)}$$

A partially ordered monoid $\langle M, \cdot, 1, \leq \rangle$ is a monoid $\langle M, \cdot, 1 \rangle$ together with a reflexive, antisymmetric, and transitive relation $\leq$ over M such that for any $a, b, c, d \in M$,

$$a \leq c \text{ and } b \leq d \rightarrow a \cdot b \leq c \cdot d \qquad \text{(monotonicity)}$$

In this paper $x \cdot y$ is often abbreviated xy.

is a pregroup, $s \in M$, and $\mathbb{I} \subseteq_{fin} \Sigma_\epsilon \times M$. We write $\mathbb{I} \vdash w$ in case there are $a_1, \ldots, a_n \in \mathbb{I}$ such that $a_1 \otimes \ldots \otimes a_n = w$. The language of a pregroup grammar G is $L(G) = \{\sigma : \exists t \leq s.\ \mathbb{I} \vdash \langle \sigma, t \rangle\}$.

Intuitively, in a free pregroup, an atomic type $a \in \mathbb{T}$ is a categorial feature (like an NP) which can be selected for by an adjoint (a^l or a^r, depending on whether it should appear to the right or the left of the selector). $a \leq b$, $a, b \in \mathbb{T}$, means that b is a subtype of a, namely, that the distribution of expressions of type a includes that of those of type b.

Consider the pregroup grammar $G_{\text{CASE}} = \langle \mathbb{I}, s, P \rangle$, where $P = P_{\{n, n_n, n_a, s\}}$, $n \leq n_n, n_a$, and

$$\begin{aligned}\mathbb{I} = &\{\langle \texttt{it}, n \rangle, \langle \texttt{he}, n_n \rangle,\\ &\langle \texttt{him}, n_a \rangle, \langle \texttt{saw}, n_n^r s n_a^l \rangle\}\end{aligned}$$

We show that $\texttt{it saw him} \in L(G_{\text{CASE}})$ as follows.

$$\langle \texttt{it}, n \rangle \otimes \langle \texttt{saw}, n_n^r s n_a^l \rangle \otimes \langle \texttt{him}, n_a \rangle = \langle \texttt{it saw him}, n n_n^r s n_a^l n_a \rangle$$

and

$$n n_n^r s n_a^l n_a \leq n n_n^r s \leq n_n n_n^r s \leq s$$

Pregroup grammars have been used in descriptions of, among others, English, French, German, and Italian sentence structure [Lambek, 2004, Bargelli and Lambek, 2001, Lambek and Preller, 2004a, Casadio and Lambek, 2001], and of agreement in the German and French DP [Lambek and Preller, 2004b, Degeilh and Preller, 2005]. It is usually at least implicit in these works that the sub-word level relations (i.e. morphology) be accounted for in the same system as accounts for the word level (i.e. sentential) relations, on which reading they are of like mind with Baker [1988] and Halle and Marantz [1993].

2.2 A Simple Account

What follows is a formal description of a simplified fragment of Italian. The intent of the endeavor being to investigate the patterns of agreement amongst adjectives and nouns, I abstract away from anything that isn't obviously directly related to this problem; in particular, from restrictions on adjective ordering (see e.g. Cinque [1994]). The problem addressed can then be stated as the following. Given sets

$X_{y,z}$, $X \in \{N, A, D\}$, $y \in \{s, p\}$, and $z \in \{m, f\}$, give a description of the language $\bigcup\{D_{x,y}N_{x,y}A^*_{x,y} : x \in \{s,p\} \text{ and } y \in \{m,f\}\}$. As a nod to semantic intuitions, elements of $D_{x,y}$ will be assigned categories $d_{x,y}n^l_{x,y}$ (determiners are functions from noun denotations to GQs), and elements of $A_{x,y}$ will be given the type $n^r_{x,y}n_{x,y}$ ((restricting) adjectives are functions from noun denotations to noun denotations). Fixing a vocabulary, we have a grammar $G_{\text{AGR}} = \langle \mathbb{I}, d, P_{\mathbb{T}} \rangle$, where $\mathbb{T} = \{d_{x,y}, n_{x,y}, d : x \in \{s,p\} \text{ and } y \in \{m,f\}\}$ is the set of basic types with $d_{m,s}, d_{m,p}, d_{f,s}, d_{f,p} \leq d$ and $\Sigma = \bigcup\{D_{x,y} \cup N_{x,y} \cup A_{x,y} : x \in \{s,p\} \text{ and } y \in \{m,f\}\}$, where

$$
\begin{array}{lll}
D_{m,s} = \{il\} & N_{m,s} = \{gallo, cane\} & A_{m,s} = \{bello, triste\} \\
D_{m,p} = \{i\} & N_{m,p} = \{galli, cani\} & A_{m,p} = \{belli, tristi\} \\
D_{f,s} = \{la\} & N_{f,s} = \{rana, volpe\} & A_{f,s} = \{bella, triste\} \\
D_{f,p} = \{le\} & N_{f,p} = \{rane, volpi\} & A_{f,p} = \{belle, tristi\}
\end{array}
$$

2.3 Some Shortcomings of the Simple Account

In G_{AGR}, each inflectional form of every adjective and noun is treated as a separate lexical item, which means that for every adjectival root there are four lexical items, and for every noun root there are two. In effect, G_{AGR} (more precisely, intuitive extensions of it) treats all forms as irregular. While this may ultimately turn out to be the best story, it is in a sense the worst possible case, and thus should only be adopted after all other avenues are explored. In § 3, I explore and compare different strategies for reducing the redundancy in the lexicon.

3 Some Syntactification

Both analyses presented in this section begin with the observation that G_{AGR} can be simplified if stems are stored separately from their inflections in the lexicon. This means in particular a sizeable reduction in the size of the lexicon, as each adjective is given only one entry (as opposed to four) and each noun only one (as opposed to two).

3.1 Some Segmentation

In this section, we will see how to squeeze more and more redundancy out of the lexicon while preserving the basic structure of G_{AGR} as defined in § 2.2. We begin, as suggested above, by separating stems and their inflectional affixes. As the stems form an open class, it is better to assign to them as simple a category as possible (because we are concerned not only with the size of the lexicon[6]), but also with the rate of growth of this number as open class items are added to the lexicon). As a concrete example, consider the class I adjective *bello*. The lexical items $\langle \texttt{bello}, n^r_{m,s}n_{m,s}\rangle, \langle \texttt{belli}, n^r_{m,p}n_{m,p}\rangle, \langle \texttt{bella}, n^r_{f,s}n_{f,s}\rangle$, and $\langle \texttt{belle}, n^r_{f,p}n_{f,p}\rangle$ are replaced with the adjectival root $\langle \texttt{bell}, a_1\rangle$ and the class I adjectival inflectional affixes $\langle \texttt{o}, a^r_1 n^r_{m,s}n_{m,s}\rangle, \langle \texttt{i}, a^r_1 n^r_{m,p}n_{m,p}\rangle, \langle \texttt{a}, a^r_1 n^r_{f,s}n_{f,s}\rangle$, and $\langle \texttt{e}, a^r_1 n^r_{f,p}n_{f,p}\rangle$. The inflected forms, no longer 'axioms' in our new system, are still derivable as theorems:

$$\langle \texttt{bell}, a_1\rangle \otimes \langle \texttt{o}, a^r_1 n^r_{m,s}n_{m,s}\rangle = \langle \texttt{bello}, a_1 a^r_1 n^r_{m,s}n_{m,s}\rangle$$

and

$$a_1 a^r_1 n^r_{m,s}n_{m,s} \leq n^r_{m,s}n_{m,s}$$

Although in this (degenerate) case, we have a net loss of one lexical item (i.e. separating root and affix in this case results in the addition of a lexical item), the size of our new lexicon grows only one quarter as fast as that of our old one as we introduce new class I adjectives. The class II adjectives work similarly. Turning to the nouns, consider the feminine class I noun *rana*. The lexical items $\langle \texttt{rana}, n_{f,s}\rangle$, and $\langle \texttt{rane}, n_{f,p}\rangle$ are replaced with the feminine nominal root $\langle \texttt{ran}, n_{1,f}\rangle$ and the feminine class I nominal inflectional affixes $\langle \texttt{a}, n^r_{1,f}n_{f,s}\rangle$ and $\langle \texttt{e}, n^r_{1,f}n_{f,p}\rangle$. Again, as new nouns are added, our new lexicon grows only half as fast.

Our new grammar, G'_{AGR}, has, instead of the classes $N_{x,y}$ and $A_{x,y}$, the expressions shown in figure 3.

In some sense, this is the best we can do; all further decomposition will not affect the open class items, and thus reduces the cardinality of the lexicon by only a constant factor.[7] However, at this point we have

[6]We can measure the size of the lexicon in terms of the sum of the size of the types assigned to lexical items, where the size of a type $\alpha = a_1 \cdot \ldots \cdot a_n$ is n. However, for simplicity we will often choose to speak about the cardinality of the lexicon as its size. The arguments made herein are independent of which of these two measures is chosen.

[7]There is a great deal of *potential* redundancy, were the endings not a closed set, as currently each ending is assigned a complex type.

Nouns	Adjectives	Nominal Inflection	Adjectival Inflection
$\langle \mathtt{gall}, n_{1,m} \rangle$	$\langle \mathtt{bell}, a_1 \rangle$	$\langle \mathtt{o}, n^r_{1,m} n_{m,s} \rangle$	$\langle \mathtt{o}, a^r_1 n^r_{m,s} n_{m,s} \rangle$
$\langle \mathtt{ran}, n_{1,f} \rangle$		$\langle \mathtt{a}, n^r_{1,f} n_{f,s} \rangle$	$\langle \mathtt{a}, a^r_1 n^r_{f,s} n_{f,s} \rangle$
$\langle \mathtt{can}, n_{2,m} \rangle$	$\langle \mathtt{trist}, a_2 \rangle$	$\langle \mathtt{i}, n^r_{1,m} n_{m,p} \rangle$	$\langle \mathtt{i}, a^r_1 n^r_{m,p} n_{m,p} \rangle$
$\langle \mathtt{volp}, n_{2,f} \rangle$		$\langle \mathtt{e}, n^r_{1,m} n_{f,p} \rangle$	$\langle \mathtt{e}, a^r_1 n^r_{f,p} n_{f,p} \rangle$
		$\langle \mathtt{e}, n^r_{2,m} n_{m,s} \rangle$	$\langle \mathtt{e}, a^r_2 n^r_{m,s} n_{m,s} \rangle$
		$\langle \mathtt{e}, n^r_{2,f} n_{f,s} \rangle$	$\langle \mathtt{e}, a^r_2 n^r_{f,s} n_{f,s} \rangle$
		$\langle \mathtt{i}, n^r_{2,m} n_{m,p} \rangle$	$\langle \mathtt{i}, a^r_2 n^r_{m,p} n_{m,p} \rangle$
		$\langle \mathtt{i}, n^r_{2,f} n_{f,p} \rangle$	$\langle \mathtt{i}, a^r_2 n^r_{f,p} n_{f,p} \rangle$

Figure 3: Separating stems and inflection

not captured any of the intuitions we have about paradigmatic relations.[8] Consider, for instance, the flexional suffixes. There are, in the fragment under discussion, two classes of suffixes, nominal and adjectival, which bear striking resemblances to one another. We can inquire as to whether we can express the similarity between the adjectival and nominal inflectional paradigms in the language of our theory.[9] The grammar we currently have does not relate the two paradigms. The pregroup grammar formalism gives us the ability to do so only to a limited extent; we can explain the homophony between the adjectival and

[8]Which might have empirical reflections in language change data, or psycholinguistic data. Again, as we here intend only to see what we can describe in this system, and not what we *should* describe in this system, we do not attempt to adjudicate between these possibilities.

[9]To make this notion precise, we identify a cell in a paradigm with a(n equivalence class of) derivation tree(s). Thus, in grammar G'_{AGR}, the feminine plural cell in the paradigm of *bello* (as in figure 1) is identified with the derivation $\langle \mathtt{bell}, a_1 \rangle \otimes \langle \mathtt{e}, a^r_1 n^r_{f,p} n_{f,p} \rangle$. An abstract paradigm (i.e. what the paradigms of *bello* and *nero* have in common) is then a set of linear contexts $\mathcal{P}$ over one variable such that $\mathcal{P}[\langle \mathtt{bell}, a_1 \rangle]$ (i.e. the result of substituting "bell" for the unique variable in each context in $\mathcal{P}$) is the paradigm of *bello*, and $\mathcal{P}[\langle \mathtt{ner}, a_1 \rangle]$ the paradigm of *nero*.

In order to relate two abstract paradigms $\mathcal{A}$ and $\mathcal{B}$ together, we would like to find a single context C such that $\mathcal{A}[C] = \mathcal{B}$ (or vice versa). In other words, we can relate paradigms $\mathcal{A}$ to $\mathcal{B}$ by finding a lexical item a in the context $x \otimes a$ such that every context $C_\beta \in \mathcal{B}$ is constructable from some context $C_\alpha \in \mathcal{A}$ by substituting $x \otimes a$ in for the variable in C_α. The intuition is that relatedness of paradigms is achieved by deriving one systematically from the other.

nominal endings by deriving the adjectival endings from the nominal ones. In so doing we must allow for lexical items with no phonological content.[10,11]

We can derive the class I feminine plural adjectival inflection from the nominal by representing it as the expression $\langle \epsilon, a_1^r n_{f,p}^r n_{1,f} \rangle$. We can again derive the lexical items of G_{AGR} as theorems:

$$\begin{aligned} \langle \texttt{bell}, a_1 \rangle \otimes \langle \epsilon, a_1^r n_{f,p}^r n_{1,f} \rangle \otimes \langle \texttt{e}, n_{1,f}^r n_{f,p} \rangle \\ = \langle \texttt{belle}, a_1 a_1^r n_{f,p}^r n_{1,f} n_{1,f}^r n_{f,p} \rangle \end{aligned}$$

and

$$a_1 a_1^r n_{f,p}^r n_{1,f} n_{1,f}^r n_{f,p} \leq n_{f,p}^r n_{1,f} n_{1,f}^r n_{f,p} \leq n_{f,p}^r n_{f,p}$$

The resulting inflectional categories are shown in figure 4. This gets us closer, but still doesn't quite express the generalization we want. We are (at best) stipulating for every cell of the adjectival paradigm, that that cell is the same as the corresponding nominal cell. What we want is to state once that the adjectival and nominal paradigms are the same.

3.1.1 The Invisible Hand

The ultimately arrived at system above is presented in its entirety in figure 5. The categories have been renamed to emphasize that nouns and adjectives are not natural kinds in this system.[12] One interesting aspect of this grammar is that every phonetically open-class lexical item is assigned an atomic type, and the distribution of these non-null lexical items is determined by complex type assignments to non-overt expressions. This is not an accidental property of the analysis, but

[10]Note that these aren't 'zero morphs', which serve to regularize paradigms - these new null items never alternate with phonologically overt ones. Instead, these empty lexical items are more like rules, or constructions, which, when applying to large (or growing) classes of items, allow redundancies in the grammar (such as assigning the same complex type to every lexical item in the class) to be factored out. Here they may be usefully thought of as on a par with rules of referral (as in e.g. Stump [2001]).

[11]Lambek [2007] and Degeilh and Preller [2005] invoke meta-rules at this point. Meta-rules are statements about redundancies in the pre-group lexicon, and thus, being external to the calculus, simply acknowledge that there remain significant regularities unexpressed by the grammar. Such statements can be expressed in the language of the theory as null lexical items.

[12]Precisely this issue will be taken up in § 3.2.

Nominal Endings	**Adjectival Rules**
$\langle \texttt{o}, n^r_{1,m} n_{m,s} \rangle$	$\langle \epsilon, a^r_1 n^r_{m,s} n_{1,m} \rangle$
$\langle \texttt{a}, n^r_{1,f} n_{f,s} \rangle$	$\langle \epsilon, a^r_1 n^r_{f,s} n_{1,f} \rangle$
$\langle \texttt{i}, n^r_{1,m} n_{m,p} \rangle$	$\langle \epsilon, a^r_1 n^r_{m,p} n_{1,m} \rangle$
$\langle \texttt{e}, n^r_{1,f} n_{f,p} \rangle$	$\langle \epsilon, a^r_1 n^r_{f,p} n_{1,f} \rangle$
$\langle \texttt{e}, n^r_{2,m} n_{m,s} \rangle$	$\langle \epsilon, a^r_2 n^r_{m,s} n_{2,m} \rangle$
$\langle \texttt{e}, n^r_{2,f} n_{f,s} \rangle$	$\langle \epsilon, a^r_2 n^r_{f,s} n_{2,f} \rangle$
$\langle \texttt{i}, n^r_{2,m} n_{m,p} \rangle$	$\langle \epsilon, a^r_2 n^r_{m,p} n_{2,m} \rangle$
$\langle \texttt{i}, n^r_{2,f} n_{f,p} \rangle$	$\langle \epsilon, a^r_2 n^r_{f,p} n_{2,f} \rangle$

Figure 4: Deriving the adjectival from the nominal endings.

rather a consequence of our desire to reduce the amount of repetition in our grammar. In lexicalized formalisms (in which the lexicon is the locus of all variation), this is achieved by factoring out commonalities across lexical items, and forming new lexical items which express these regularities. To the extent that we have multiple such new lexical items that deal with the same expressions, there are generalizations about the distributions of expressions that the type system can't handle.

Determiners	**Nouns**	**Adjectives**
$\langle \texttt{il}, d_{m,s} n^l_{m,s} \rangle$	$\langle \texttt{gall}, a \rangle$	$\langle \texttt{bell}, e \rangle$
$\langle \texttt{i}, d_{m,p} n^l_{m,p} \rangle$	$\langle \texttt{ran}, b \rangle$	$\langle \texttt{trist}, f \rangle$
$\langle \texttt{la}, d_{f,s} n^l_{f,s} \rangle$	$\langle \texttt{can}, c \rangle$	
$\langle \texttt{le}, d_{f,p} n^l_{f,p} \rangle$	$\langle \texttt{volp}, d \rangle$	

Class I Endings	**Class I Adjectives**	**Class II Endings**	**Class II Adjectives**
$\langle \texttt{o}, a^r n_{m,s} \rangle$	$\langle \epsilon, e^r n^r_{m,s} a \rangle$	$\langle \texttt{e}, c^r n_{m,s} \rangle$	$\langle \epsilon, f^r n^r_{m,s} c \rangle$
$\langle \texttt{a}, b^r n_{f,s} \rangle$	$\langle \epsilon, e^r n^r_{f,s} b \rangle$	$\langle \texttt{e}, d^r n_{f,s} \rangle$	$\langle \epsilon, f^r n^r_{f,s} d \rangle$
$\langle \texttt{i}, a^r n_{m,p} \rangle$	$\langle \epsilon, e^r n^r_{m,p} a \rangle$	$\langle \texttt{i}, c^r n_{m,p} \rangle$	$\langle \epsilon, f^r n^r_{m,p} c \rangle$
$\langle \texttt{e}, b^r n_{f,p} \rangle$	$\langle \epsilon, e^r n^r_{f,p} b \rangle$	$\langle \texttt{i}, d^r n_{f,p} \rangle$	$\langle \epsilon, f^r n^r_{f,p} d \rangle$

Figure 5: The revised G_{AGR}.

This grammar allows us to view class I pairs like *zio*/*zia* (uncle/aunt) as inflected forms of the same lexeme, *zi*. We add the new lexical item $\langle \texttt{zi}, k \rangle$, and the ordering $k \leq a, b$. Similarly for class II pairs like *cantante*/*cantante* (male/female singer); a new lexical item $\langle \texttt{cantant}, l \rangle$ and the ordering $l \leq c, d$. Although still possible to describe, other deviations from the simplified class I/class II nominal classification require more than new types and orderings. A small class of nouns[13] are masculine in the singular and feminine in the plural.[14]

(3) *l'* *uovo*
the.M.S egg

(4) *le* *uova*
the.F.P eggs

To account for this class, we add a new type, m, and new endings, which are again accidentally homophonous with already existing endings, as shown in figure 6.

$$\langle \texttt{uov}, m \rangle \quad \begin{array}{l} \langle \texttt{o}, m^r n_{m,s} \rangle \\ \langle \texttt{a}, m^r n_{f,p} \rangle \end{array}$$

Figure 6: A new class of nouns

Turning finally to (some) derivational morphology, the diminutive morpheme *in*, and the pejorative morpheme *acc* form new class I nouns from nouns irrespective of their class (examples 5 and 6). These derivational morphemes interact interestingly with nouns of the same type as *uovo*, as shown in 8.

(5) *le* *ranine* *nere*
the.F.P frog.DIM.F.P black.F.P
the little black frogs

(6) *le* *volpine* *nere*
the.F.P fox.DIM.F.P black.F.P
the little black foxes

[13] I have found eight such.

[14] The definite determiners in examples 3 and 8 are not the ones we've seen previously. The masculine singular definite determiner alternates between *il*, *l'*, and *lo*, and the masculine plural definite determiner between *i* and *gli* depending on the phonological properties of the word next to it in its phrase. The existence of this phonologically conditioned allomorphy will be ignored in the remainder of this paper.

(7) *le* *uova* *nere*
the.F.P eggs black.F.P
the black eggs

(8) *gli* *ovini* *neri*
the.M.P egg.DIM.M.P black.M.P
the little black eggs

Figure 7 shows lexical items for the derivational morphemes discussed above, expressing the generalization that masculine nouns of any class go to masculine nouns of class I, and feminine nouns of any class become feminine class I nouns. Note that nothing additional needs to be said in order to account for the behaviour of these morphemes on our non-inherently gendered nouns.[15]

$$\begin{array}{cc} \langle \mathtt{in}, n\rangle & \langle \epsilon, o^r a n^l\rangle \\ \langle \mathtt{acc}, n\rangle & \langle \epsilon, p^r b n^l\rangle \\ \multicolumn{2}{c}{a, c, m \leq o \text{ and } b, d \leq p} \end{array}$$

Figure 7: Some derivational morphology

The diminutive and pejorative morphemes *in* and *acc*, can affix to both nouns and adjectives alike. Just as with nouns, class II adjectives take class I agreement when diminuted. Because our type assignments currently make adjectives similar to nouns (so they can take nominal endings), we also correctly predict the cross-categorial behaviour of these derivational morphemes.

$$\langle \mathtt{bell}, e\rangle \otimes \langle \epsilon, e^r n^r_{m,s} a\rangle \otimes \langle \epsilon, o^r a n^l\rangle \otimes \langle \mathtt{in}, n\rangle \otimes \langle \mathtt{o}, a^r n_{m,s}\rangle =$$

$$\langle \mathtt{bellino}, e e^r n^r_{m,s} a o^r a n^l n a^r n_{m,s}\rangle$$

and

$$e e^r n^r_{m,s} a o^r a n^l n a^r n_{m,s} \leq n^r_{m,s} a o^r a n^l n a^r n_{m,s} \leq$$

$$n^r_{m,s} o o^r a n^l n a^r n_{m,s} \leq n^r_{m,s} a n^l n a^r n_{m,s} \leq n^r_{m,s} a a^r n_{m,s} \leq n^r_{m,s} n_{m,s}$$

[15]Because *zi* is assigned to the type k which is ordered beneath (in particular) a, transitivity nets us that $k \leq o$. Similarly for the feminine gender.

3.2 Intuition Lost : The Price of Redemption

The grammar in the preceding section, although able to give a description of a number of complex facts, is unable to state certain generalizations about those facts that we as linguists would like to be able to state. For example, kinds that we feel to be natural, like adjectives and nouns, are not describable as such without stipulation: the fact that class I and II adjective roots, for example, end up being adjectives and not nouns, or adjectives of different type, or something altogether different, is a consequence of an inexplicable convergence of two different stipulations about the behaviour of each adjective class. Similarly, the fact that adjectives and nouns of the same class vary in the same way with gender and number is unstatable. Nor can we express the intuition, stated in § 1, that the class II adjectives are simply unspecified for gender. In the remainder of this section, I show how we can capture these intuitions if we draw types from non-free pregroups [Kobele and Kracht, 2006].

3.2.1 A Conservative Extension

As noted by [Buszkowski, 2001], and discussed in [Kobele and Kracht, 2006], the class of pregroups is closed under taking products. Given two pregroups $P_1 = \langle M_1, \cdot_1, 1_1, \leq_1, {}^{r_1}, {}^{l_1}\rangle$ and $P_2 = \langle M_2, \cdot_2, 1_2, \leq_2, {}^{r_2}, {}^{l_2}\rangle$, their product $P = \langle M, \cdot, 1, \leq, {}^{r}, {}^{l}\rangle$ is a pregroup, where

- $M \equiv M_1 \times M_2$
- $\langle a, b\rangle \cdot \langle c, d\rangle \equiv \langle a \cdot_1 c, b \cdot_2 d\rangle$
- $\langle a, b\rangle^l \equiv \langle a^{l_1}, b^{l_2}\rangle$
- $\langle a, b\rangle^r \equiv \langle a^{r_1}, b^{r_2}\rangle$
- $\langle a, b\rangle \leq \langle c, d\rangle$ iff $a \leq_1 c$ and $b \leq_2 d$

Given a pregroup grammar $G = \langle \mathbb{I}, \langle s, t\rangle, P\rangle$ over a product pregroup $P = P_1 \times \ldots \times P_n$, we write an expression $\langle \sigma, \langle a_1, \ldots, a_n\rangle\rangle$ in the more legible form below.

$$\left(\begin{smallmatrix} a_1 \\ \vdots \\ a_n \\ \sigma \end{smallmatrix}\right)$$

3.2.2 A Stratified Analysis

We begin with the question of how to make the class II adjectives unspecified for gender. If we factor out the gender information of each expression and keep track of it independently, we could leave the gender component of class II adjectives empty without creating an informational bottleneck. This is illustrated below, where 'leaving a component empty' is represented by assigning to it the unit type.

$$\begin{pmatrix} d_s n_s^l \\ f f^l \\ \texttt{la} \end{pmatrix} \otimes \begin{pmatrix} n_s \\ f \\ \texttt{rana} \end{pmatrix} \otimes \begin{pmatrix} n_s^r n_s \\ 1 \\ \texttt{triste} \end{pmatrix} \otimes \begin{pmatrix} n_s^r n_s \\ f^r f \\ \texttt{nera} \end{pmatrix} = \begin{pmatrix} d_s n_s^l n_s n_s^r n_s n_s^r n_s \\ f f^l f f^r f \\ \texttt{la rana triste nera} \end{pmatrix}$$

Factoring out the number information and the class information allows us to formally capture the natural kind-hood of nouns and adjectives of different classes. After segmentation (but before the unification of nominal and adjectival desiniences), the lexicon comparable to that given in figure 3 is shown in figure 8

With the lexicon fragment in figure 8, we can derive *gallo triste* as follows.

$$\begin{pmatrix} t \\ c_1 \\ 1 \\ m \\ \texttt{gall} \end{pmatrix} \otimes \begin{pmatrix} t^r n \\ c_1^r \\ s \\ m^r m \\ \texttt{o} \end{pmatrix} \otimes \begin{pmatrix} a \\ c_2 \\ 1 \\ 1 \\ \texttt{trist} \end{pmatrix} \otimes \begin{pmatrix} a^r n^r n \\ c_2^r \\ s^r s \\ 1 \\ \texttt{e} \end{pmatrix} = \begin{pmatrix} t t^r n a a^r n^r n \\ c_1 c_1^r c_2 c_2^r \\ s s^r s \\ m m^r m \\ \texttt{gallo triste} \end{pmatrix}$$

where

$$t t^r n a a^r n^r n \leq n a a^r n^r n \leq n n^r n \leq n$$

and

$$c_1 c_1^r c_2 c_2^r \leq c_2 c_2^r \leq 1$$

and

$$s s^r s \leq s, \text{ and } m m^r m \leq m$$

Just as with the grammar in figure 3, this is (nearly) the best we can do in so far as simplifying the description of the distribution of open

Nouns		**Adjectives**
$\begin{pmatrix} t \\ c_1 \\ 1 \\ m \\ \texttt{gall} \end{pmatrix}$	$\begin{pmatrix} t \\ c_1 \\ 1 \\ f \\ \texttt{ran} \end{pmatrix}$	$\begin{pmatrix} a \\ c_1 \\ 1 \\ 1 \\ \texttt{bell} \end{pmatrix}$
$\begin{pmatrix} t \\ c_2 \\ 1 \\ m \\ \texttt{can} \end{pmatrix}$	$\begin{pmatrix} t \\ c_2 \\ 1 \\ f \\ \texttt{volp} \end{pmatrix}$	$\begin{pmatrix} a \\ c_2 \\ 1 \\ 1 \\ \texttt{trist} \end{pmatrix}$

Nominal Inflection		**Adjectival Inflection**	
$\begin{pmatrix} t^r n \\ c_1^r \\ s \\ m^r m \\ \texttt{o} \end{pmatrix}$	$\begin{pmatrix} t^r n \\ c_1^r \\ p \\ m^r m \\ \texttt{i} \end{pmatrix}$	$\begin{pmatrix} a^r n^r n \\ c_1^r \\ s^r s \\ m^r m \\ \texttt{o} \end{pmatrix}$	$\begin{pmatrix} a^r n^r n \\ c_1^r \\ p^r p \\ m^r m \\ \texttt{i} \end{pmatrix}$
$\begin{pmatrix} t^r n \\ c_1^r \\ s \\ f^r f \\ \texttt{a} \end{pmatrix}$	$\begin{pmatrix} t^r n \\ c_1^r \\ p \\ f^r f \\ \texttt{e} \end{pmatrix}$	$\begin{pmatrix} a^r n^r n \\ c_1^r \\ s^r s \\ f^r f \\ \texttt{a} \end{pmatrix}$	$\begin{pmatrix} a^r n^r n \\ c_1^r \\ p^r p \\ f^r f \\ \texttt{e} \end{pmatrix}$
$\begin{pmatrix} t^r n \\ c_2^r \\ s \\ 1 \\ \texttt{e} \end{pmatrix}$	$\begin{pmatrix} t^r n \\ c_2^r \\ p \\ 1 \\ \texttt{i} \end{pmatrix}$	$\begin{pmatrix} a^r n^r n \\ c_2^r \\ s^r s \\ 1 \\ \texttt{e} \end{pmatrix}$	$\begin{pmatrix} a^r n^r n \\ c_2^r \\ p^r p \\ 1 \\ \texttt{i} \end{pmatrix}$

Figure 8: Separating stems and inflection in a product pregroup grammar

class items.[16] However, the grammar here is not only more succinct with four fewer lexical items (as a result of being able to describe the class II affixes as underspecified, instead of systematically homophonous), but also explicitly treats noun and adjective stems as natural kinds.

Consider the nominal and adjectival class I masculine singular endings. Factoring out the similarities gives us the simple masculine singular ending, and the null lexical items shown below,

$$\begin{pmatrix} e \\ c_1^r \\ s \\ m \\ \circ \end{pmatrix}, \begin{pmatrix} t^r n e^l \\ c_1^r c_1 \\ 1 \\ m^r m m^l \\ \epsilon \end{pmatrix}, \begin{pmatrix} a^r n^r n e^l \\ c_1^r c_1 \\ s^r s s^l \\ m^r m m^l \\ \epsilon \end{pmatrix}$$

from which the nominal and adjectival class I masculine singular endings respectively can be derived independently as theorems. The result of this is shown in figure 9.

The phonetically unrealized lexical items in figure 9 are together highly redundant, with the adjectival inflectional elements duplicating information amongst each other, and with the nominal inflectional elements. We can in fact derive the adjectival inflection in figure 9 from the nominal inflection, allowing us to reduce the duplication of information across categories of inflection.

$$\begin{pmatrix} a^r n^r t \\ 1 \\ s^r s s^l \\ 1 \\ \epsilon \end{pmatrix} \otimes \begin{pmatrix} t^r n e^l \\ c_1^r c_1 \\ 1 \\ m^r m m^l \\ \epsilon \end{pmatrix} = \begin{pmatrix} a^r n^r t t^r n e^l \\ c_1^r c_1 \\ s^r s s^l \\ m^r m m^l \\ \epsilon \end{pmatrix}$$

Two such lexical items suffice to derive all six adjectival lexical items from figure 9 above. With the grammar in figure 10 we make only two stipulations: that the singular forms of all adjectives of any class are related in the same way to the singular forms of the nouns of the appropriate class, and that the plural forms are too. Figure 10 is the equivalent of figure 5 in § 3.1.1, and is thus the final version to be presented in this section.

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[16] Since every masculine class I noun (say) has a type m, and a type c_1, we could of course add a total of three empty (closed class) lexical items, which state this kind of generalization:

$$\begin{pmatrix} x^r t \\ c_1 \\ 1 \\ m \\ \epsilon \end{pmatrix}, \begin{pmatrix} y^r t \\ c_1 \\ 1 \\ f \\ \epsilon \end{pmatrix}, \begin{pmatrix} z^r t \\ c_2 \\ 1 \\ 1 \\ \epsilon \end{pmatrix}$$

This wouldn't save much on space for small grammars, but if we have large numbers of (say) masculine class I nouns in our lexicon, specifying for each of them that they are masculine and class I will quickly become costly.

Class	**Endings**
I	$\begin{pmatrix} e \\ c_1^r \\ s \\ m \\ \mathtt{o} \end{pmatrix}$ $\begin{pmatrix} e \\ c_1^r \\ p \\ m \\ \mathtt{i} \end{pmatrix}$ $\begin{pmatrix} e \\ c_1^r \\ s \\ f \\ \mathtt{a} \end{pmatrix}$ $\begin{pmatrix} e \\ c_1^r \\ p \\ f \\ \mathtt{e} \end{pmatrix}$
II	$\begin{pmatrix} e \\ c_2^r \\ s \\ 1 \\ \mathtt{e} \end{pmatrix}$ $\begin{pmatrix} e \\ c_2^r \\ p \\ 1 \\ \mathtt{i} \end{pmatrix}$

Class	**Nominal Inflection**
I	$\begin{pmatrix} t^r n e^l \\ c_1^r c_1 \\ 1 \\ m^r m m^l \\ \epsilon \end{pmatrix}$ $\begin{pmatrix} t^r n e^l \\ c_1^r c_1 \\ 1 \\ f^r f f^l \\ \epsilon \end{pmatrix}$
II	$\begin{pmatrix} t^r n e^l \\ c_2^r c_2 \\ 1 \\ 1 \\ \epsilon \end{pmatrix}$

Class	**Adjectival Inflection**
I	$\begin{pmatrix} a^r n^r n e^l \\ c_1^r c_1 \\ s^r s s^l \\ m^r m m^l \\ \epsilon \end{pmatrix}$ $\begin{pmatrix} a^r n^r n e^l \\ c_1^r c_1 \\ p^r p p^l \\ m^r m m^l \\ \epsilon \end{pmatrix}$ $\begin{pmatrix} a^r n^r n e^l \\ c_1^r c_1 \\ s^r s s^l \\ f^r f f^l \\ \epsilon \end{pmatrix}$ $\begin{pmatrix} a^r n^r n e^l \\ c_1^r c_1 \\ p^r p p^l \\ f^r f f^l \\ \epsilon \end{pmatrix}$
II	$\begin{pmatrix} a^r n^r n e^l \\ c_2^r c_2 \\ s^r s s^l \\ 1 \\ \epsilon \end{pmatrix}$ $\begin{pmatrix} a^r n^r n e^l \\ c_2^r c_2 \\ p^r p p^l \\ 1 \\ \epsilon \end{pmatrix}$

Figure 9: Unifying the exponents of nominal and adjectival inflection

Determiners	Nouns	Adjectives
$\begin{pmatrix} dn^l \\ 1 \\ ss^l \\ mm^l \\ \texttt{il} \end{pmatrix} \begin{pmatrix} dn^l \\ 1 \\ ss^l \\ ff^l \\ \texttt{la} \end{pmatrix}$	$\begin{pmatrix} t \\ c_1 \\ 1 \\ m \\ \texttt{gall} \end{pmatrix} \begin{pmatrix} t \\ c_1 \\ 1 \\ f \\ \texttt{ran} \end{pmatrix}$	$\begin{pmatrix} a \\ c_1 \\ 1 \\ 1 \\ \texttt{bell} \end{pmatrix}$
$\begin{pmatrix} dn^l \\ 1 \\ pp^l \\ mm^l \\ \texttt{i} \end{pmatrix} \begin{pmatrix} dn^l \\ 1 \\ pp^l \\ ff^l \\ \texttt{le} \end{pmatrix}$	$\begin{pmatrix} t \\ c_2 \\ 1 \\ m \\ \texttt{can} \end{pmatrix} \begin{pmatrix} t \\ c_2 \\ 1 \\ f \\ \texttt{volp} \end{pmatrix}$	$\begin{pmatrix} a \\ c_2 \\ 1 \\ 1 \\ \texttt{trist} \end{pmatrix}$

Endings		
$\begin{pmatrix} e \\ c_1^r \\ s \\ m \\ \texttt{o} \end{pmatrix}$	$\begin{pmatrix} e \\ c_1^r \\ s \\ f \\ \texttt{a} \end{pmatrix}$	$\begin{pmatrix} e \\ c_2^r \\ s \\ 1 \\ \texttt{e} \end{pmatrix}$
$\begin{pmatrix} e \\ c_1^r \\ p \\ m \\ \texttt{i} \end{pmatrix}$	$\begin{pmatrix} e \\ c_1^r \\ p \\ f \\ \texttt{e} \end{pmatrix}$	$\begin{pmatrix} e \\ c_2^r \\ p \\ 1 \\ \texttt{i} \end{pmatrix}$

Class I Inflection	Class II Inflection
$\begin{pmatrix} t^r ne^l \\ c_1^r c_1 \\ 1 \\ m^r mm^l \\ \epsilon \end{pmatrix}$	$\begin{pmatrix} t^r ne^l \\ c_2^r c_2 \\ 1 \\ 1 \\ \epsilon \end{pmatrix}$
$\begin{pmatrix} t^r ne^l \\ c_1^r c_1 \\ 1 \\ f^r ff^l \\ \epsilon \end{pmatrix}$	

Adjectival Inflection	
$\begin{pmatrix} a^r n^r t \\ 1 \\ s^r ss^l \\ 1 \\ \epsilon \end{pmatrix}$	$\begin{pmatrix} a^r n^r t \\ 1 \\ p^r pp^l \\ 1 \\ \epsilon \end{pmatrix}$

Figure 10: G_{AGR}, again.

Note that we are finally and for the first time truly able to express something like the original intuition about the relationship between the nominal and adjectival paradigms. The two adjectival inflectional elements act as rules of referral, stating in turn that the singular, and the plural form of adjectives are found in the singular and plural cells of the nominal inflectional paradigms respectively. What of the finer details of the Italian DP presented in § 3.1.1? With that grammar we were able to succinctly express the relationship between nouns with and without inherent gender simply by stating two simple ordering relations between types. The same option is available to us here, postulating a new type, say u (for *u*nspecified), and the ordering statements $u \leq m, f$. Then we can have the following derivation for *zio*:

$$\begin{pmatrix} t \\ c_1 \\ 1 \\ g \\ \texttt{zi} \end{pmatrix} \otimes \begin{pmatrix} t^r n e^l \\ c_1^r c_1 \\ 1 \\ m^r m m^l \\ \epsilon \end{pmatrix} \otimes \begin{pmatrix} e \\ c_1^r \\ s \\ m \\ \texttt{o} \end{pmatrix} = \begin{pmatrix} t t^r n e^l e \\ c_1 c_1^r c_1 c_1^r \\ s \\ g m^r m m^l m \\ \texttt{zio} \end{pmatrix}$$

The case of *cantante* is particularly interesting, as the underspecification of gender information in the class II affixes means that both *cantante*(m.) and *cantante*(f.) are the same form.

$$\begin{pmatrix} n \\ 1 \\ s \\ g \\ \texttt{cantante} \end{pmatrix}$$

However, the present system affords us another option for non-inherently gendered nouns. Adding the following two 'gender' lexical items,

$$\begin{pmatrix} g \\ 1 \\ 1 \\ m \\ \epsilon \end{pmatrix}, \begin{pmatrix} g \\ 1 \\ 1 \\ f \\ \epsilon \end{pmatrix}$$

we can represent non-inherently gendered nouns like *zi* in the manner shown below.[17]

$$\begin{pmatrix} tg^l \\ c_1 \\ 1 \\ 1 \\ \texttt{zi} \end{pmatrix} \otimes \begin{pmatrix} g \\ 1 \\ 1 \\ m \\ \epsilon \end{pmatrix} = \begin{pmatrix} tg^l g \\ c_1 \\ 1 \\ m \\ \texttt{zi} \end{pmatrix}$$

The diminutive and pejorative morphemes *in* and *acc*, as discussed in § 3.1.1, can affix to both nouns and adjectives alike. In § 3.1.1 we had to assign two lexical entries to this morpheme in order to account for its behaviour across gender (which was constant). We can model its gender neutral behaviour in the present system with the ordering $c \leq c_1, c_2$ and a single lexical item which is unspecified for gender

$$\begin{pmatrix} t^r t \\ c^r c_1 \\ 1 \\ 1 \\ \texttt{in} \end{pmatrix}$$

Below is a derivation of *tristino*.

$$\begin{pmatrix} a \\ c_2 \\ 1 \\ 1 \\ \texttt{trist} \end{pmatrix} \otimes \begin{pmatrix} a^r n^r t \\ 1 \\ s^r s s^l \\ 1 \\ \epsilon \end{pmatrix} \otimes \begin{pmatrix} t^r t \\ c^r c_1 \\ 1 \\ 1 \\ \texttt{in} \end{pmatrix} \otimes \begin{pmatrix} t^r n e^l \\ c_1^r c_1 \\ 1 \\ m^r m m^l \\ \epsilon \end{pmatrix} \otimes \begin{pmatrix} e \\ c_1^r \\ s \\ m \\ \texttt{o} \end{pmatrix}$$
$$= \begin{pmatrix} a a^r n^r t t^r t t^r n e^l e \\ c_2 c^r c_1 c_1^r c_1 c_1^r \\ s^r s s^l s \\ m^r m m^l m \\ \texttt{tristino} \end{pmatrix}$$

where

$$a a^r n^r t t^r t t^r n e^l e \leq n^r t t^r t t^r n e^l e \leq n^r t t^r n e^l e \leq n^r n e^l e \leq n^r n$$

and

$$c_2 c^r c_1 c_1^r c_1 c_1^r \leq c_1 c_1^r c_1 c_1^r \leq c_1 c_1^r \leq 1$$
$$s^r s s^l s \leq s^r s, \text{ and } m^r m m^l m \leq m^r m$$

[17] One interesting aspect of this treatment is that inherently gendered nouns like *gall* can be seen as themselves derived in this manner. One way to think about this is that the lexicon is a repository of grammaticized derivations, and that *zi* was grammaticized before, and *gall* after, combining with the gender morpheme. Work in the Chomskyian tradition treats idioms similarly; Koopman and Sportiche [1991] argue that idioms are lexicalized chunks of tree, which are contiguous in a sense it would take me too far afield to make precise. Even more similar is work in the framework of Distributed Morphology [Halle and Marantz, 1993], which, building on the ideas of Koopman and Sportiche, takes even simple words to be phrasal idioms (for instance, 'cat' is taken to be a syntactically complex object, the combination of at least a categorially unspecified stem together with a noun root).

4 Conclusions

We started this paper with the observation that class II adjectives only seemed to be agreeing in number, not gender, with their head nouns, and that the inflectional paradigms of nouns and adjectives seemed to be very closely related. Couching our descriptions in the vocabulary of pregroup grammars, we saw that, under natural assumptions about the relationship between syntax and semantics, we were able to describe the phenomena in a robust manner using free pregroups, but that many of the intuitions we had about paradigm relatedness were not directly expressible. Moving to product pregroups not only gave us the ability to state our intuitions in the object language of the theory, but allowed us to do so without any decrease in succinctness.

In order to capture our intuitions about the distinction between accidental homophony and identity, we were forced when using free pregroup grammars to assign unrelated types to any two expressions with non-identical distributions, cutting across what our naïve intuitions considered natural class boundaries. By structuring our types in a certain natural way, the relation between distribution and type assignment became non-categorical, allowing us to assign similar types to expressions with similar distributions.

Empty categories are postulated in other frameworks, in particular GB and variants, for much the same reasons as they were postulated here. Their explanatory value is to allow for a unification of otherwise independent stipulations, allowing certain intuitions to be expressed in the object language of the theory. These empty categories here were shown to play the role of rules of referral, which relate cells in paradigms to other cells. Interestingly, these lexical items were also able to state generalizations about relations between paradigms, which Bobaljik has argued neither Distributed Morphology nor paradigm functional morphology can do without additional (stipulated) mechanisms.

The two grammars presented in § 3.1.1 and § 3.2.2, although descriptively equivalent, differ greatly in their ability to express our intuitions about the patterns in the data. The first grammar was unable to unify the factored out regularities across the nominal and adjectival endings, making it incapable of expressing the relationship between the two inflectional paradigms. Holding our modes of combination constant, our second grammar gave us access to types with a richer structure. This in turn gave us access to a more refined metric of similarity, allowing us to see regularities where none had been before, which we could then use in factoring out redundancies in our lexicon.

Still, considering the grammar from § 3.2.2, there are a number of intuitions it seems that even our richer type system is unable to express, in particular the fact that the adjectival inflection and class I nominal inflection lexical items differ only in whether they instantiate their number type or gender type (of the shape $x^r x x^l$) as $s^r s s^l$ or $p^r p p^l$, or as $f^r f f^l$ or $m^r m m^l$, respectively. A system which allowed unification of terms would be able to coalesce these four items into two, but would be a drastically different formal beast.

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