Split Subject Agreement in Northern Athabaskan

Contrast Preservation and Morphological Typology

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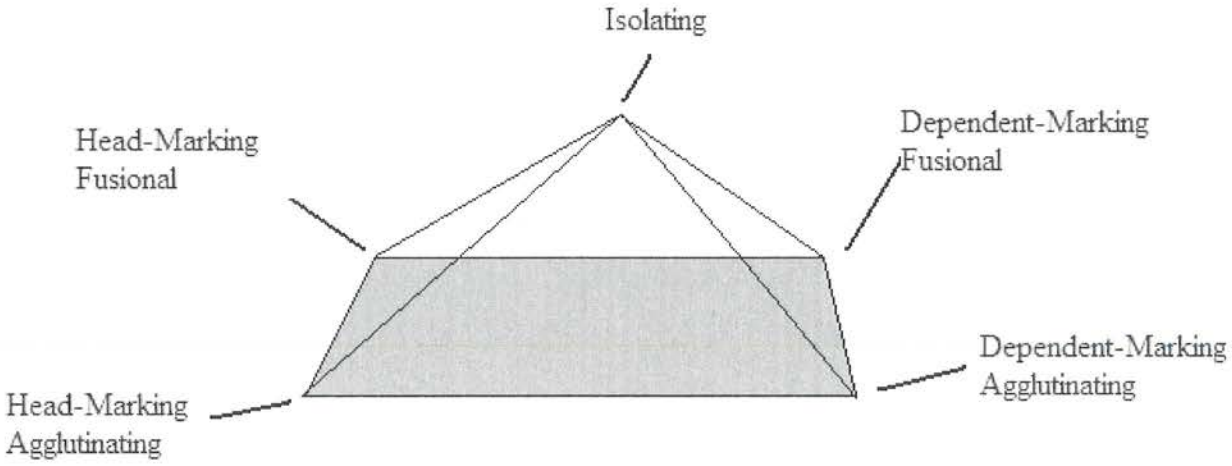
1.0 Introduction.

1.1 Morphological typology in the 19th century.

Morphological typology is the study of cross-linguistic variation in the structure of words. Although there are numerous ways in which word structure may vary across languages, Sapir (1921) identified three principal criteria with which to classify languages into morphological types. These are *what kind* of information is expressed within a word, *how much* information, and *what technique* is used to convey that information. This is represented schematically below, in Figure 1.1.

Figure 1.1: Three-dimensional representation of morphological types.



In Figure 1.1, the x-axis represents the head-marking vs. dependent-marking distinction. Loosely speaking, a dependent-marking language has case marking on nouns and puts possessors in the genitive case, while in a head-marking language verbs show agreement with subjects, objects, and indirect objects, and possessed nouns agree with their possessor. The z-axis Figure 1.1 represents the fusional vs. agglutinating distinction. In a strictly agglutinating language, every morpheme represents one and only one feature, while in a fusional language, several inflectional and derivational features may be expressed by a single morpheme. Finally, the y-axis represents the amount of information expressed within a word. As shown at the top of the pyramid, if a language is isolating (that is, if words to not carry any derivational or inflectional information), then the distinctions mentioned above simply do not apply. Conversely, the shaded plane

at the bottom of the pyramid represents the area occupied by languages in which all inflectional information is somehow realized morphologically; different points within this plane represent different possibilities as to where (on heads or dependents) and how (by fusion or agglutination).

While morphological typology has been largely neglected within generative linguistics, in the 19th century, morphological typology was a culturally important concept. Humboldt (1767-1835) considered a language's morphological type to be related to the national character of its speakers: "Language is, as it were, the external manifestation of the minds of peoples. Their language is their soul, and their soul is their language. It is impossible to conceive them ever sufficiently identical" (Humboldt 1970 [1836] pg. 24). Humboldt attributed the achievements of different societies to the particular "excellences" of their languages:

> "Nobody can deny that the old style Chinese reveals a stirring dignity owing to the fact that important ideas impinge directly upon each other; it reveals a simple grandeur because, by discarding all useless secondary designations, it seems to take recourse in depicting pure thought via language. The actual Malayan tongue is not unjustly praised for its facility of expression and for the simplicity of its associations. The Semitic languages preserve an admirable artistry envinced in the fine distinction they make in the significance of many vowel gradations. Basque possesses in its lexical structure and in its speech associations a special power resulting from the brevity and boldness of its expression. The Delaware Indian tongue and other American Indian dialects combine in a single word a number of ideas for which we would require many words. All these examples, however, only prove that in whatever direction the human intellect proceeds unilaterally, it is always capable of producing something great, something what has a fruitful and stimulating reactive effect upon itself. These individual points do not decide the advantages of languages with respect to each other..." (pg. 124-125).

While Humboldt believed that languages of any morphological type could stimulate intellectual development (albeit to varying degrees, depending on their "clarity" and "expressivity"), later authors sought to associate particular morphological characteristics of a language with particular characteristics of its speakers. Nikolai Jakovlevič Marr (1865-1934) proposed a Marxist theory of morphological typology called "Stadialism," whereby different morphological types result from different economic systems. According to this theory, hunter-gatherer cultures speak polysynthetic languages, pastoralist societies speak either isolating or agglutinating languages, and agrarian societies speak fusional languages:

> "The successive steps in the thought process are three systems for the construction of oral speech which, in their totality, issue from different economic systems and the social structures which correspond to them: (1) primitive communism, with a synthetic speech structure, with polysemantism in words, without a differentiation between basic and functional meanings; (2) a social structure based on the separating out of different aspects of the economy with a social division of labor, that is, with a division of society by professions—the stratification of a single society into productive-technical groups which represented a primitive form of guild—accompanied by a speech structure which distinguishes parts of speech...with various functional words which later were transformed into morphological elements, with differentiation, in words, between basic meanings and the functional meaning which developed in them alongside the basic [meanings]; (3) estate or class society, with a technical division of labor, with a morphology of a flexional order" (Thomas 1957, pg. 125).

However, Thomas notes that "Marr's efforts to correlate linguistic stages, thought stages, and social stages (not to mention the occasional reference to archeological epochs) are so inconsistent that no conclusion can be drawn concerning their possible validity" (pg. 134).

Helena Blavatsky (1831-1891) also saw morphological typology as a progression from isolating to agglutinating to fusional languages, which she associated with particular human races, and with different levels of mystical development:

> "Speech then developed, according to occult teaching, in the following order:
> I. Monosyllabic speech; that of the first approximately fully developed human beings at the close of the Third Root-race, the 'golden-coloured,' yellow-complexioned men, after their separation into sexes, and the full awakening of their minds. Before that, they communicated through what would now be called 'thought-transference'....This monosyllabic speech was the vowel parent, so to speak, of the monosyllabic languages mixed with hard consonants, still in use amongst the yellow races which are known to the anthropologist.
> II. These linguistic characteristics developed into the agglutinative languages. The latter were spoken by some Atlantean races, while the other parent stocks of the Fourth Race preserved their mother-language....While the 'cream' of the Fourth Race gravitated more and more toward the apex of physical and intellectual evolution, thus leaving as an heirloom the nascent Fifth (the Aryan) Race the inflectional, highly developed languages, the agglutinative decayed and remained as a fragmentary fossil idiom, scattered now, and nearly limited to the aboriginal tribes of America.
> III. The inflectional speech—the root of the Sanskrit, very erroneously called 'the elder sister' of the Greek, instead of its mother—was the first language (now the mystery tongue of the Initiates, of the Fifth Race). At any rate, the 'Semitic' languages are the bastard descendants of the first phonetic corruption of the eldest children of the early Sanskrit.....To these belong all the Jews and the Arabs. The former are a tribe descended from the Tchandalas of India, the outcasts, many of them ex-Brahmins, who sought refuge in Chaldea, in Scinde, and Aria (Iran), and were truly born from their father A-bram (No Brahmin) some 8,000 years B.C. The latter, the Arabs, are the descendants of those Aryans who would not go into India at the time of the dispersion of nations" (Blavatsky 1888, vol.2, pg. 198-200, cited in Joseph 2000 pg. 96).

By the end of the 19th century, morphological typology had become thoroughly racialized, such that Sapir noted, "One celebrated American writer on culture and language delivered himself of the dictum that, estimable as the speakers of agglutinative languages might be, it was nevertheless a crime for an inflecting woman to marry an agglutinating man" (1921 pg. 124). The main point of Sapir's chapter on "Types of Linguistic Structure" was (to use a modern term) to *deconstruct* the notions of morphological typology that had been built up over the preceding century. Sapir argued that there is no single dimension (isolating-agglutinating-fusional) along which languages can be classified, and there is no basis to consider any type "superior" to any other type.

After Sapir, morphological typology received little attention in structuralist and generative linguistics. But Optimality Theory (Prince & Smolensky 1993) emphasizes deriving typological patterns from constraint re-ranking. In applying OT to morphology, one should therefore expect to be able to derive some sort of morphological typology from constraint interaction, as well as particular morphological systems. Accordingly, this paper will propose a set of constraints which, on the one hand, are able to derive Sapir's typology of morphological types, and which, on the other hand, are able to describe a morphological system which has thusfar proven challenging to formal

linguistic theories, namely, subject agreement in Northern Athabaskan. First, a bit of background on formal theories of morphology.

1.2 Formal approaches to morphology.

In modeling morphological typology within a formal generative framework, I will assume a lexicalist architecture of grammar. In Lexical Functional Grammar (LFG), the Lexical Integrity Principle states that "Morphologically complete words are the leaves of the c-structure tree and each leaf corresponds to one and only one c-structure node" (Bresnan 2001, pg. 92). Words are formed in the Lexicon; the Syntax interprets words and arranges them in a particular constituent structure and linear order, but does not itself create words or have any access to their internal structure. The question then arises as to how this structure is generated, and why a language inflects its words the way it does and not some other way. In some Lexicalist theories such as A-Morphous Morphology, it is in fact claimed that words have no internal structure at all (Anderson 1992). In Lexical Morphology and Phonology (Kiparsky 1982) and related theories, inflected words do have internal structure, but the richness of inflection in a language and how this inflection is to be realized (head-marking or dependent-marking, fusional or agglutinating) are not explananda of the theory. Rather, the input already consists of morphemes for which the relationship between morphosyntactic features and phonological form has been pre-determined. I propose here a more radical view of morphology in the generative Lexicon: the Lexicon does not merely arrange morphemes or re-adjust their phonological shape—the Lexicon *creates* morphemes. Which words will be inflected, what morphosyntactic features will be expressed, the number of morphemes and their linear order are all governed by ranked and violable constraints—no such information is present in the input. I call this theory Contrast Preservation Morphology, after Contrast Preservation Theory (Lubowicz 2003) in phonology, to which it is related. In Contrast Preservation Morphology (henceforth PC Morphology), all morphological typology can be shown to follow from the interaction of three general principles: Contrast ("that which is different in meaning shall be different in form"), No-Allomorphy ("that which has the same meaning shall have the same form") and Alignment ("be adjacent").

To illustrate this theory, I will rely primarily on Dogrib, an Athabaskan language of the Canadian Arctic. Athabaskan morphology is highly complex and has been difficult to account for in formal theories of morphosyntax: "It often appears as if any generalization that one draws about morphosyntax is falsified by the verb of some Athapaskan language" (Rice 2000, pg. 1). In Optimality Theory (Prince & Smolensky 1993), it is held there is a universal inventory of constraints which are the same for all languages, and that cross-linguistic variation is the result of constraint re-ranking. Therefore, if it can be shown that there are a set of constraints which, by factorial typology, will derive the entire set of attested morphological systems (including "unusual" systems such as Athabaskan), while still ruling out genuinely unattested systems, this will support both the particular set of constraints argued for and Optimality Theory in general. I will argue that this is the case here: Contrast, No-Allomorphy, and Alignment are able to derive Athabaskan just as easily as more frequently attested language types. The bulk of this paper will be devoted to developing a formal OT analysis of split subject agreement in Athabaskan; however, in section 6.1 I will outline how the same principles mentioned above can be used to derive more familiar systems.

1.3 Templatic Morphology in Northern Athabaskan.

It has been observed that, cross-linguistically, the order of morphemes within a word is not entirely arbitrary, but rather is explainable based on other principles. In general, three main views have been proposed concerning morpheme order. Mark Baker (1985) proposed what he called the *Mirror Principle*: "Morphological derivations must directly reflect syntactic derivations (and vice versa)" (pg. 375). Under this view, words are formed in the syntax: a single process "simultaneously has morphological effects and syntactic effects" (pg. 375), that is, the order in which morphemes are concatenated reflects the process by which we build syntactic structure, since, in this view, these are essentially the same thing. With the introduction of an "exploded" functional hierarchy (Cinque 1999), this implies that the order of morphemes should reflect the functional hierarchy. A second view, proposed by Alsina (1999) is that the Mirror Principle operates within the lexicon. Alsina criticizes Baker's view on the grounds that "morphologically complex forms such as causatives, applicatives and passives behave like lexical items with respect to the possibility of undergoing further lexical operations (nominalizations, reciprocal formations, and stem reduplication), and show no signs of a complex underlying syntactic structure" (pg. 22). Alsina therefore proposes that the Mirror Principle is derived in the lexicon. That is, there are morpholexical operations, or "grammatical function changing rules" (pg. 25) which take place in the lexicon. These rules simultaneously affix phonological information and alter argument-structure (indeed, they are considered one and the same process), and so the Mirror Principle "follows as an automatic consequence" (pg. 25). Joan Bybee (1985) presents a third view, in which the order of morphemes in relation to the verb stem is determined by their *relevance* with respect to the stem, where relevance is defined as, "the extent to which the meaning of the affix directly affects the meaning of the stem" (pg. 4). Thus aspectual markers typically occur closer to the verb stem than subject-agreement markers, because aspect more directly describes the nature of the event, i.e. two events with the same aspect but different participants are more like each-other than two events with different aspect but the same participants. Bybee's criterion of relevance is essentially semantic in nature.

There exist cases, however, which are problematic for all three of the hypotheses mentioned above, that is, cases in which the order of morphemes does not seem to follow from any general principle (syntactic or semantic), but rather appears fixed in an arbitrary sequence called a "template". Recently, this problem has received considerable attention in relation to the Bantu and Athabaskan language families, of which only the latter will be treated in this paper. Hyman (2002) notes that in Bantu languages, there are cases where more than one morpheme-order is allowed, and each morpheme-order has a different interpretation (consistent with the Mirror Principle). There are other cases, however, in which morpheme order is fixed, e.g. in Chichewa the causative morpheme *its* always occurs before the applicative morpheme *il*, regardless of whether the causative has scope over applicative or vice versa (pg. 5). Hyman approaches this problem in terms of constraint-conflict, "each suffix-system represents a language-specific resolution of a basic tension between two competing pressures: the pressure for affix ordering to be compositional vs. the pressure for affix ordering to be fixed (invariant)" (pg. 2). Hyman formalizes his analysis in OT using the constraints MIRROR and TEMPLATE. That is, a language in which MIRROR is undominated will have a morpheme-order which is purely

compositional and follows both the functional hierarchy and the mirror-principle, while a language in which TEMPLATE is undominated will have a fixed morpheme order bearing no relation to semantic compositionality. Since, in OT, constraints are gradiently violable and can be subdivided to refer to more specific properties, various intermediate cases are possible, and Hyman develops a typology of Bantu languages with partially fixed morpheme orders.

In the Athabaskan languages, not only is morpheme-order generally fixed in a template, but this template seems to go *against* the mirror principle. The template for Slave as presented in Rice (2000) is given below.

Figure 1.2: Template for Slave Verb.
preverb # quantificational elements # incorporate # object % **third person subject** % qualifier + subsituation aspect + situation aspect + viewpoint aspect + **1/2 person subject** = voice/valence + root + tense/mode/aspect suffix (Rice 2000 pg. 33).[1]

The preverbs consist mostly of adverbial information, that is, manner, e.g. the preverb *ts'e* "in half" combined with the root *ch'i* "tear" yields *ts'enech'i* "you tore it in half" (Rice 2000 pg. 36). The quantificational elements include both "A-quantifiers" which describe events, as in English *always* and *usually*, and "D-quantifiers" which describe arguments of the verb, as in English *most, all, every,* and *many* (pg. 41). Rice also distinguishes three types of aspect. Viewpoint aspect consists of the categories perfective, imperfective, and optative, of which the imperfective is morphologically unmarked. The optative is somewhat controversial, because it is not clear whether it is an aspect or a mode, and in some dialects it appears to function as a future-tense (pg. 248). Situation aspect consists of the categories of activity, accomplishment, achievement, and semelfactive (pg. 257). Subsituation aspect consists of inceptive, conative, and egressive (pg. 262). The incorporate consists of an incorporated noun, which can have virtually any thematic role, including agent (pg. 68). The qualifier refers to a system of noun-class agreement markers based on the shape of the object, e.g. round or sticklike (pg. 327). Finally, there is agreement with nominal arguments, both subject and object. It is interesting to note that subject agreement occurs in two different places: first and second person subjects are expressed between aspect and the root, while third person subjects are expressed to the left of aspect.

The template described in (1) appears problematic for the Mirror Principle, since, with respect to the verbal root, the order of morphemes is almost exactly backwards from that which we would expect, and furthermore having subject agreement in two different positions seems completely inexplicable. It is this "split" in the position of subject agreement that will be the topic of this paper.

1.4 Overview.

The remainder of this paper is organized as follows. In Section 2 I present data illustrating the phenomenon of split subject agreement in Athabaskan. In section 3 I present theoretical background information, both on PC Morphology and on previous

[1] The symbols #, %, =, and + refer to different phonological boundaries, at which different types of phonological processes occur.

analyses of Athabaskan, as well as some illustrations. In section 4 I develop a formal Optimality-Theoretic analysis of split subject agreement using the devices introduced in section 3. In Section 5 I compare my analyses with two alternative accounts of Athabaskan morphology, the syntactic approach of Rice & Saxon 1994 and Rice 2000 and the alignment-based approach of Potter 1996 and Hargus & Tuttle 1997. Finally, in section 6, I illustrate how the PC Morphology model can account for morphological typology in general.

2.0 Data.

The following data are taken from my own field notes on the Weledeh dialect of Dogrib, spoken in and around the city of Yellowknife, Northwest Territories, Canada.

2.1 Sometimes split not visible.

As seen in Figure 1.1, the categories of Qualifier, Subsituation Aspect, Situation Aspect, and Viewpoint Aspect intervene between 3rd Person Subject and 1st/2nd Person Subject in the template for the Slave verb. It frequently happens, however, that these four positions (8, 9, 10, and 11, according to the system of Rice 1989) are empty, in which case the split between the persons is not visible. This is the case in the Weledeh Dogrib paradigm in Figure 2, in which there are no aspect markers, and the only prefix is a locative adverbial *nà* "to a specific destination," which, being a disjunct prefix[2] in position 1, always occurs to the left of subject agreement, regardless of person.

Figure 2.1: Imperfective of nà√zè 'hunt'; Weledeh Dogrib.

nàhzè (nà-**h**-zè)	nàwìzè (nà-**wì**-zè)	nàts'ezè (nà-**ts'e**-zè)
nąązè[3] (nà-**ą**-zè)	nàahzè (nà-**ah**-zè)	nàahzè (nà-**ah**-zè)
nàzè (nà-zè)	nàgezè (nà-**ge**-zè)	nàgezè (nà-**ge**-zè)

Glosses: *nà* adverbial locative prefix, 'to a specific destination' (Coleman pg. 28)
zè root 'hunt'. (Must occur with prefix *nà*).

h	1sg subject	*wìd*	1dual subject	*ts'e*	1pl subject[4]
ne	2sg subject	*ah*	2dual/pl subject	*ge*	3dual/pl subject

e.g. *nà-ts'e-zè*
adv.-1plSubj-hunt "we hunt".

In Figure 2.1, subject agreement always appears immediately adjacent to the root, except in the 3rd person singular, where there is no overt subject agreement marker. In the 2nd person singular, the morpheme which was historically *ne* is realized as lengthening and nasalization on the preceding vowel.

[2] See section 3.1.4 for discussion of conjunct/disjunct prefixes.

[3] Also: nànezè

[4] Historically, this was an impersonal / unspecified subject, similar to French *on*.

2.2 Split visible with aspect marker intervening.

Figure 2.2: Perfective of nà√zè 'hunt'; Weledeh Dogrib.

nàwhehzè (nà-whe-**h**-zè)	nàwhìzè (nà-whɪ-**ì**-zè)	nàts'ehzè (nà-**ts'e**-h-zè)
nàwhęęzè[5] (nà-whę-**ę**-zè)	nàwhahzè (nà-wh-**ah**-zè)	nàwhahzè (nà-wh-**ah**-zè)
nàhzè (nà-h-zè)	nàgehzè (nà-**ge**-h-zè)	nàgehzè (nà-**ge**-h-zè)

Figure 2.2 above illustrates the difference in positioning between 3rd person dual/plural and 1st person plural, on the one hand, and all other person/number combinations, on the other. In Figure 2.2, all subject agreement markers are highlighted in bold, except in the 3rd person singular, where there is no subject agreement morpheme. In the perfective paradigm of *nà√zè*, an aspect morpheme occurs which is realized as *whe, wh, or h* depending on phonological environment. Note that this aspect morpheme occurs to the left of subject agreement in all persons except the 3rd person dual/plural and 1st person plural. It is in this sense that subject agreement is "split" in Athabaskan languages: sometimes it occurs to the left of aspect, and sometimes to the right.

It is facts like these that make morpheme order in Athabaskan langauges seem "completely without rhyme or reason" (Rice 2000, pg. xi). However, if split subject agreement were a merely a historical accident, an anomaly left over from some previous state of the language, we would expect diachronic changes to occur in at least some of the languages which would erode this system, either directly by re-ordering or somehow re-interpreting subject agreement and aspect morphemes, or indirectly through morphophonological fusion and reduction. Yet Rice notes that despite "the number of phonological, morphosyntactic, syntactic, semantic, and lexical ways that Athabaskan languages have changed, the order of morphemes has been largely stable" (pg. 396). Such stability suggests that there is an underlying principle or set of principles at work which serve to maintain subject agreement in two separate positions, which, I will argue, are Contrast, No-Allomorphy, and Alignment.

[5]Also: nàwhenezè or nàwhęęzè

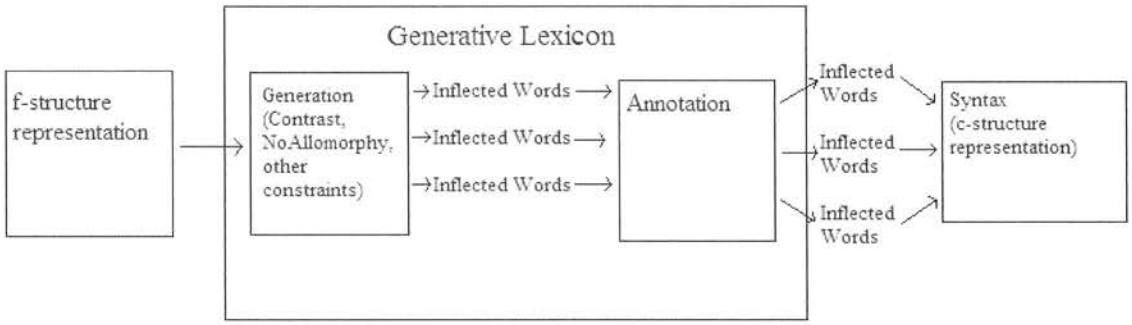
3.0 Theoretical Background.

3.1 Contrast Preservation Morphology.

3.1.1 Morphology and the Lexicon.

PC Morphology is a theory of word formation within the grammatical architecture of LFG which relies upon many concepts and formal devices from Contrast Preservation Theory in phonology (Lubowicz 2003). In LFG, the Lexical Integrity Principle states that fully inflected words are the leaves of the c-structure tree. In PC Morphology, the Lexicon is seen as that component of the grammar which generates fully inflected words, complete with all phonological information, from an abstract, language-independent and phonologically vacuous f-structure representation. Put another way, the Lexicon takes f-structures, filters them through various constraint-types, assigns them phonological content, and spits out fully inflected words, which become, in turn, terminal nodes in the syntax. This is illustrated in Figure 3.1.

Figure 3.1: The Lexicon in Contrast Preservation Morphology.



The formation of fully inflected words in the Lexicon proceeds in two steps,as shown in Figure 3.1 above, Generation and Annotation. The Generation component contains both universal and arbitrary, language-specific properties. Different languages assign phonological form to morphosyntactic features differently in part due to differences in the ranking of constraints given in universal grammar, and in part due to differences in arbitrary sound-meaning associations. These universal constraints make conflicting demands; no system can satisfy all of them simultaneously. It is therefore predicted that languages will belong to different morphological types depending on which constraints they choose to obey and which they ignore; thus, morphological typology follows from constraint re-ranking. The Annotation component erases all brackets, coindexation, and word-internal structure, and annotates words with the information they carry in c-structure, e.g.

nàts'ehzè
(↑ PRED) = 'hunt'
(↑ SUBJ NUM) = PL
(↑ SUBJ PERS) = 1
(↑ ASP) = PERF etc.

The annotation procedure will be more fully described in section 4.4

Note finally that the f-structures which are the input to the Lexicon and which generate inflected words are not necessarily the same f-structures which are the input to the Syntax and which generate sentences. Rather, the Lexicon generates the set of all possible inflected words in the language, from which the syntax chooses based on independent principles.

3.1.2 Coindexation and Morphemes.

In PC Morphology, the input to the Lexicon is a set of morphosyntactic features (f-structure), and the output is a phonological structure (henceforth, p-structure) which is associated with those features. Pieces of f-structure are related to pieces of p-structure through coindexation. A *morph* is the smallest unit of p-structure for which a coindexation relationship with some piece of f-structure can be defined. Every morph in p-structure is coindexed with a feature in f-structure. This is illustrated in Figure 3.2

Figure 3.2: Coindexation between Input and Output.

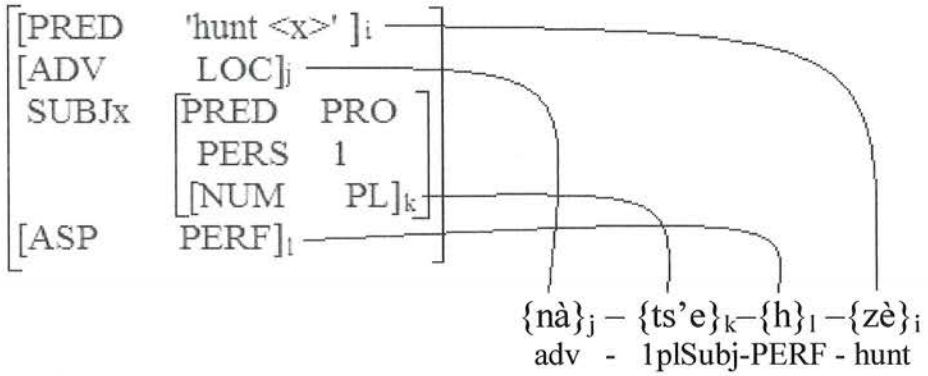


Figure 3.2 shows the representation of the verb form *nàts'ehzè* 'we have hunted'. Note that the subject agreement marker *ts'e*, while glossed as '1plSubj', is coindexed only with the feature [NUM PL] and not [PERS 1]. This is important, since the order of morphemes is determined by alignment constraints (cf. 3.2.2), and morphs are aligned according to the feature in f-structure with which they are coindexed. Throughout my analysis of Athabaskan, I will assume that every morph is coindexed with only one feature in f-structure, even if that morpheme happens to carry additional information about another feature (as with *ts'e* above). However, I leave it as an open question for furthern inquiry whether under some circumstances a morpheme might be coindexed with more than one feature in f-structure.

As is the case in Figure 3.2, it is possible for an input feature to have no surface morph coindexed with it, yet the information may still be expressed. Conversely, a

feature may have a surface correspondent while the information is unexpressed. See section 4.4 on annotation.

3.1.3 Allomorphy and Correspondence.

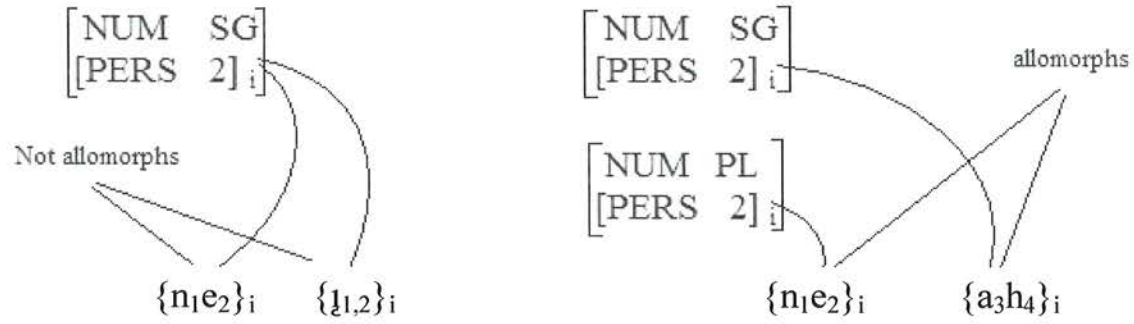
In this paper I make use of the theory of String-Based Correspondence (McCarthy & Wolf 2005). This version of correspondence theory requires that correspondence relations between input-output pairs of segments (or features) always be defined as a function in both directions: from input to output and output to input. Since in PC Morphology the input is phonologically vacuous (consisting only of morphosyntactic features), it is not possible to speak of a phonological correspondence relation between input and ouput. However, it is possible to define phonological correspondence as a surface-to-surface relation among forms which share some f-structure properties. Phonological forms which enter into this correspondence relation are subject to Faithfulness constraints and any other relevant phonological constraints, which, however, operate strictly on the surface. This notion of phonological correspondence is necessary prerequisite for the definition of Allomorphy in PC Morphology, given below.

DEF: For any 2 morphs, M_1 and M_2
M_1 and M_2 are *allomorphs* if and only if:
—M_1 and M_2 are coindexed with value v of attribute α;
—$\mathcal{R}$ is not a total bijective function from M_1 to M_2.
Informally: M_1 and M_2 are allomorphs if and only if they have the same meaning but are not in a phonological correspondence relation.
(cf. McCarthy & Wolf 2005).

$\mathcal{R}$ is defined as follows:
Given two strings S_1 and S_2, **correspondence** is a relation $\mathcal{R}$ from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as **correspondents** of one another when $\alpha \mathcal{R} \beta$.
(McCarthy & Prince 1995, pg. 14).

Note that by this definition morphophonemic or allophonic alternations do not consitute allomorphy, provided that the alternants in question can be successfully analyzed as being in correspondence. Furthermore, contextual non-exponence of a morphosyntactic feature (i.e. alternations with zero) do not constitute allomorphy, either, since the definition requires at least two *morphs* which are coindexed with the same value of the same feature but are not in correspondence; that which does not exist is not capable of allomorphy.

Figure 3.3: Allomorphy and Correspondence.



There is no *a priori* way to determine whether two morphs which are coindexed with the same value of the same feature are in a phonological correspondence relation or not, regardless of their degree of phonetic similarity or difference. For any two morphs M_1 and M_2 which are coindexed with the same value of the same feature in f-structure, there are two possible representations: one in which are M_1 and M_2 allomorphs and are not in phonological correspondence, and another representation in which M_1 and M_2 are not allomorphs and a phonological correspondence relation holds between them. In the former case, M_1 and M_2 will incur a violation of No-Allomorphy (cf. section 3.1.6); in the latter case they will incur a violation of Faithfulness in the phonology. Which representation is appropriate for M_1 and M_2 is determined both by the constraint ranking in the language and the degree of phonetic similarity between M_1 and M_2. See section 3.3 for further discussion.

3.1.4 Constraints and Domain Specification.

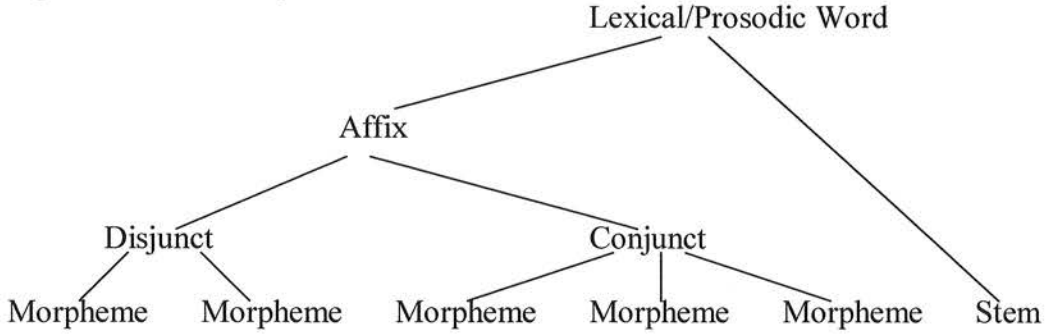
In PC Morphology, all constraints are of the following type:

$$\left(\begin{array}{c}\underline{\text{Constraint(Feature)}} \\ \text{Linear Domain}\end{array}\right) \text{ Morphosyntactic Domain}$$

If no morphosyntactic domain is specified, it is assumed that the constraint applies within all morphosyntactic domains, as will be the case throughout my analysis of Athabaskan.

Linear domains are arranged in the hierarchy shown in Figure 3.4.

Figure 3.4: Hierarchy of Linear Domains.



The Lexical or Prosodic Word is divided into the Stem and Affix domain, the Affix domain comprises both the Conjunct and Disjunct domains, each of which may contain several morphemes. In Athabaskan, stems are stressed and license more phonological contrast than affixes. Within the affix domain, disjunct prefixes are mostly derivational and contain a larger inventory of phonemes than the conjunct prefixes, which are inflectional. Thus there is both phonological and morphosyntactic evidence to distinguish stems, conjunct prefixes, and disjunct prefixes in Athabaskan languages.

3.1.5 Scenarios.

As stated in section 3.1.2, the input in PC Morphology consists of morphosyntactic features, while the output consists of a phonological structure coindexed with those features. However, unlike in standard Optimality Theory, both inputs and outputs are complex. That is, the input consists of a set of paradigmatically related f-structures, while the output consists of a set of paradigmatically related phonological forms. PC Morphology thus provides a means to evaluate whole paradigms. Richness of the Base applies here just as in standard OT: any f-structure can be an input, and GEN generates an infinite number of output candidates for each input.

3.1.6 No-Allomorphy.

The basic notion behind No-Allomorphy is that that which has the same meaning should have the same form. However, No-Allomorphy does not penalize all deviations from the principle of "one meaning, one form," but only those cases in which multiple phonological outputs for a given f-structure input must be separately listed. The first step in formalizing this notion is to define the *morphophonological alternant set*.

DEF: A set of morphs M_1, M_2, M_3...M_n constitute a *morphophonological alternant set* if and only if:
—All morphs in the set are coindexed with value v of attribute α in f-structure;
— $\mathcal{R}$ is a total bijective function between all morphs in the set.
Informally: A set of morphs constitute a morphophonological alternant set if they have the same meaning and all morphs in the set are in a phonological correspondence relation.

No-Allomorphy constraints regulate the number of morphophonological alternant sets within a particular morphosyntactic and linear domain.

DEF: No-Allomorphy: For a set of outputs S such that all members of S are contained within linear domain L, all members of S are within morphosyntactic domain D, and some morph coindexed with value v of attribute α in f-structure is contained within L for all S, $\mathcal{R}$ is a total bijective function between all members of S. Let N be the number of morphophonological alternant sets contained within L. If $\mathcal{R}$ is not a total bijective function between all outputs in S, assign N-1 violation marks.
Informally: "If a set of outputs share an element with the same meaning, then all segments in the specified linear domain must be in a phonological correspondence relation, provided the relevant morphosyntactic specification is met."

No-Allomorphy is surface-oriented. It assigns violation makrs based on pairs of *overt* morphs which have the same meaning but are not in correspondence. Contextual non-exponence (i.e. alternation with zero), however conditioned, does not constitute allomorphy and does not enter into the calculation of the number of allomorphs.

3.1.7 Contrast.

The Preserve Contrast (PC) family of constraints is the mirror-image of No-Allomorphy: PC requires that that which is different in meaning be different in form. Just as before, "form" in this sense refers to the phonological correspondence relation and not the actual phonetic form of the output: it is possible for two morphemes to be phonetically identical yet satisfy Contrast, provided that they are not in a phonological correspondence relation (see section 3.3 for further discussion). Following Lubowicz 2003, we distinguish two types of Preserve Contrast constraints, input-oriented and output-oriented.

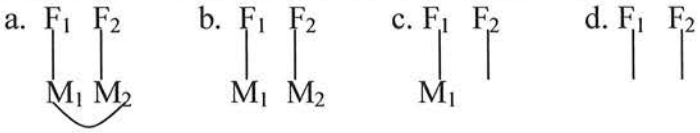
Output-oriented PC:
PC_{OUT}(attribute α)
For each morphophonological alternant set that is coindexed with two or more f-structures contrasting in attribute α assign a violation mark.

Output-oriented PC is both surface-oriented and categorical. PC_{OUT} is surface-oriented in that if an f-structure or pair of f-structures has no surface exponent, PC_{OUT} cannot be violated. PC_{OUT} is categorical in that it does not matter how many different input values of attribute α are ambiguously represented: whether a morpheme neutralizes 2 values or 10 values of a given attribute, PC_{OUT} still assigns only one violation mark.

Input-oriented PC:
PC_{IN}(attribute α)
For each pair of f-structures F_1 and F_2 contrasting in attribute α, assign a violation mark if and only if:
—F_1 and F_2 map onto morphs M_1 and M_2 respectively, and M_1 and M_2 are members of the same morphophonological alternant set; or,
—Neither F_1 nor F_2 have any correspondent in the output scenario.

Input-oriented PC is different from Output-oriented PC in two respects. First, Input-oriented PC is gradient: the more input contrasts are merged in the output, the more violations of PC_{IN} are incurred. Secondly, PC_{IN} takes non-exponence into account: it is possible to satisfy PC_{IN} if one member of an input pair maps on to a morpheme M on the surface, while the other member of the pair has no surface correspondent.

Figure 3.5: Illustration of Input-oriented PC.



There are four logical possibilities with respect to the relationship between a pair of inputs F_1 and F_2 contrasting in attribute α and their surface exponence or lack thereof, and these are illustrated in Figure 3.5 above. In 3.5a, two inputs F_1 and F_2 map onto two outputs M_1 and M_2 that are in a phonological correspondence relation, that is, M_1 and M_2 are members of the same morphophonological alternant set. 3.5a therefore incurs a violation of input-oriented PC. In 3.5b, no phonological correspondence relation holds between M_1 and M_2, so PC_{IN} is satisfied. 3.5c, in which only one input value has a surface correspondent, satisfies PC_{IN}, while 3.5d, where neither F_1 nor F_2 have any surface correspondent, violates it.

Definition of Contrast in attribute α:
A pair of f-structures F_1 and F_2 contrast in attribute α if attribute α has value v in F_1 and has value w ($\neq$v) in F_2.

3.1.8 REL.

REL refers to a family of language-specific constraints whose purpose is to account for *l'arbitraire du signe* (Saussure 1915). For example, the fact that the 2nd person singular subject agreement morpheme is *ne* in Dogrib is an arbitrary fact about the relationship between sound and meaning: it is independent of whether the language is fusional or agglutination or whether subject agreement is split or symmetrical. This fact is formulated as a constraint REL [2sg] $\rightarrow$ [ne],which requires that at least one member of the morphophonological alternant set coindexed with the f-structure value [2sg] be of the phonetic form [ne]. There are two reasons for expressing such facts as constraints rather than by some other means. Formally, PC Morphology is a strictly parallelist theory of the lexicon, mapping from morphosyntactic features to phonetic form in a single step. If information about sound-meaning correspondences were already present in the input (as in Lexical Phonology), this would defeat the purpose of trying to derive a typology of such correspondences from the interaction of a set of universal constraints (Contrast, Alignment, and No-Allomorphy). It is necessary, therefore that inputs be phonologically vacuous, yet information about arbitrary facts must be represented somewhere. It is for this reason that such information has been moved into the constraint-set. Empirically, there is evidence that arbitrary facts interact with non-arbitrary facts, that is, the relationship between sound and meaning is often much less arbitrary than it appears. For example, Tamil has 3 tenses: past, present, and future. It also has 6 points of articulation, velar, palatal, retroflex, alveolar, dental, and labial, of which only velar, dental, and labial can occur in any position. The morphemes for past, present, and future are *t, k,* and *p*, respectively. While it is arbitrary, e.g., that the future morpheme is *p* and not *t* or *k*, it is not arbitrary that the language has assigned form to meaning in a way that preserves morphosyntactic contrast and is maximally unmarked and optimally dispersed phonetically (cf. Flemming 1995). If phonological information were present in the input, it would be impossible to formulate any generalizations of this

type, and it would be a complete accident that Tamil does not use marked segments in frequent inflectional morphemes.

3.2 Devices based on previous analyses of Athabaskan.

3.2.1 Template Positions; Subject Number vs. Person.

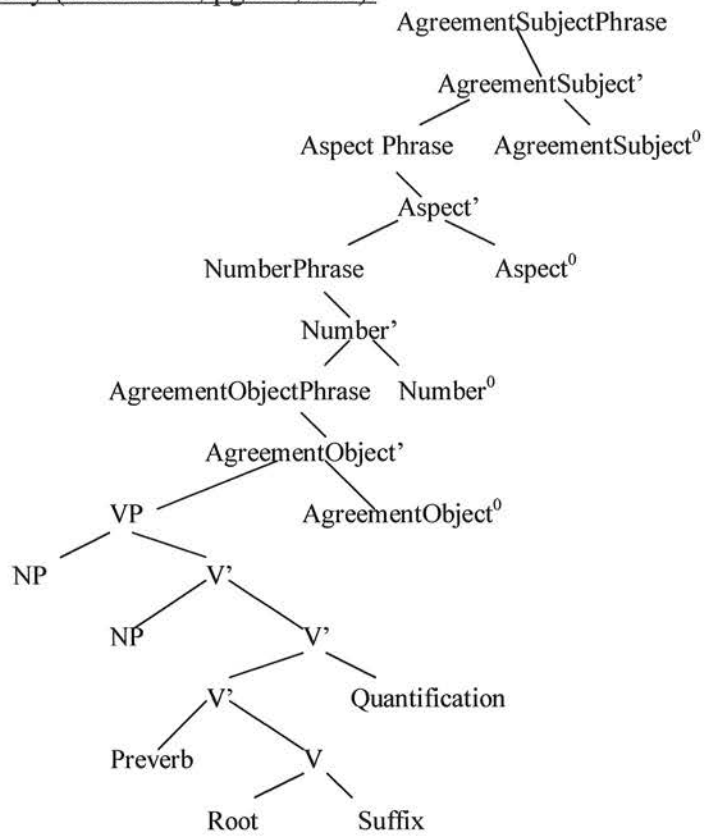
Following Rice (1989), I will make reference to the formal labels in Figure 3.6, referring to the template.

Figure 3.6: Numbered Template Positions.
Classifier = Position 13
SubjPers = Position 12
Viewpoint Aspect = Position 11
Situation Aspect = Position 10
Subsituation Aspect = Position 9
Qualifier = Position 8
SubjNum = Position 7
Object = Position 6
Number = Position 5
Incorporate = Position 4
Quantifiers = Position 2, 3
Adverbial = Position 1

Positions 7 through 13 are the "conjunct prefixes", while positions 1 through 6 are the "disjunct prefixes". I will use the template positions merely as descriptive, formal labels; the template itself has no formal theoretical status in PC Morphology, being an epiphenomenon of alignment constraints (cf. section 3.2.2). Note that there are no zero morphemes in PC Morphology. Thus to say that *nàzè* contains a disjunct prefix in position 1 is merely a descriptive statement of the fact that no other prefix ever precedes *nà*; it does not imply the existence of any phonologically null elements between *nà* and the stem.

In her book *Morpheme Order and Semantic Scope,* Keren Rice proposes a solution to the problem of affix ordering in Athabaskan which essentially has two parts: positing a (putatively universal) structurally represented functional hierarchy, and then positing movement. Rice's functional hierarchy is given below.

Figure 3.7: Functional Hierarchy (Rice 2000, pg. 29, 212).



Rice proposes that the root, voice/valence marker, and suffixes originate at the bottom of the tree (i.e. at the left edge of the word), and subsequently raise to the top of the tree above AgrS (i.e. at the right edge of the word). Two main arguments support this proposal. The first is that Athabaskan languages are consistently head-final (nouns have postpositions, basic word order is SOV), and so if Infl is the head of IP, it should occur at the end of the sentence, to the right of the verb. The second argument has to do with idioms. The lexical entry for a given verb contains information about the preverbs and/or incorporate with which it co-occurs, and these often have idiomatic meaning, e.g. from the verbal root *ʔǫ* 'place' and the noun *yati* 'word', we get a verbal expression meaning 'to blame', as in *níyatıdeníʔǫ* "she blamed" (literally "placed words") (pg. 68). Many such idioms also occur with preverbs. For Rice, this is evidence that the verbal root originates adjacent to the incorporate and preverbs because, "semantic relationships between a verb and its arguments are directly reflected at some deep level of structure; if an argument is removed from a verb, it must have originated in a position that reflects its semantic relationship with the verb" (pg. 77-78). Therefore, since idioms are typically formed out of a combination of the verbal root (which appears at the right edge of the verb) and various preverbal elements (which appear at the left edge), it follows that the verbal root originates as a sister to the preverbs, and then moves (raises) to the right edge.

In their analysis of subject agreement in Slave, Rice and Saxon (1994) cite Benveniste (1946), who argued that, cross-linguistically, the 3rd person is fundamentally

different from the 1st and 2nd persons, because the 3rd person is a non-person: "la «3e personne» n'est pas une «personne»; c'est même la forme verbale qui a pour fonction d'exprimer la *non-personne*" (Benveniste 1946 pg. 4, emphasis in original). Benveniste cites examples from numerous languages in which the 3rd person form of the verb carries no overt morphological marking for person. Rice and Saxon (1994) adopt a version of this view, saying that "'third person' is a misnomer; rather, apparent 'third persons' involve a lack of person specification" (pg. 193).

Rice and Saxon (1994) and Rice (2000) posit a functional hierarchy (cf. Figure 3.7) in which Person and Number are distinct functional nodes (corresponding to different linear positions on the surface). They argue that these two projections, called $AgrS^0$ and Num^0, should be distinguished based on several types of distributional evidence. From this, combined with the earlier assertion that the third person is a "non-person," several empirical facts seem to follow straightforwardly: 1st and 2nd person subjects are located under $AgreementSubject^0$ (since these are truly persons), 3rd person plural subjects are located under $Number^0$ (since they represent number, not person), and 3rd person singular subjects are morphologically unmarked (since they constitute the absence of both number and person). I will call this the Two Functional Projections analysis.

I agree with Rice and Saxon that number and person should be regarded as distinct categories, which I will refer to henceforth as Subject Number and Subject Person, respectively. I depart from their analysis, however, in that I regard these as distinct categories within the lexicon, referred to by separate constraints, rather than as different functional projections represented in the syntax. A comparison of the predictions made by the Two Functional Projections analysis versus the PC Morphology analysis will be developed in section 5.2.

3.2.2 Feature Alignment.

Potter (1996) and Hargus & Tuttle (1997) develop an approach to affix-ordering based on Alignment within Optimality Theory. Alignment is defined as follows:

Align(Category1, R, Category2, L)—align the right edge of category 1 with the left edge of category 2.

Hargus and Tuttle state that "violations of affix-order constraints are assigned gradiently: a prefix earns one * for every prefix that intervenes between it and the stem, and violations are awarded for the number of intervening prefixes, not segments" (pg. 200). For example, Hargus and Tuttle propose the following constraint-ranking for the language Witsuwit'en:

Align(Classifier-R, $Stem_V$-L) >>
Align(Subject-R, $Stem_V$-L) >>
Align(Tense-R, $Stem_V$-L) >>
Align(Conjugation-R, $Stem_V$-L) >>
Align(Negative-R, $Stem_V$-L) >>
Align(Qualifier-R, $Stem_V$-L) >>
Align(Pronominal-R, $Stem_V$-L) (pg. 199).
This ranking generates the following as the optimal affix-order:
Pronominal + Qualifier + Negative + Conjugation + Tense + Subject + Classifier + Verb-stem.
This ordering incurs one violation of Align(Subject), two violations of Align(Tense), etc.

Hargus & Tuttle do not specifically address the issue of split subject agreement. The constraints given above make a distinction between "pronominal", which Hargus and Tuttle also call Pronominal Subject or Deictic Subject Prefix, and "subject", also called Inner Subject or Subject Pronoun Prefix. Presumably, the former refers to those subject agreement morphemes which occur to the left of aspect (3rd dual/plural, 1st plural), while the latter refers to all other subject agreement morphemes. I will call this the Feature Alignment Analysis, since morphemes are aligned according to the morphosyntactic features which they express. I will give here a slightly revised definition of Alignment, in terms of PC Morphology.

Alignment:
Align(Attribute α, R, Attribute β, L)
For any pair of morphs M_1 and M_2 in the output such that M_1 is coindexed with some value of Attribute α and M_2 is coindexed with some value of Attribute β in the input, assign a violation mark for each morph that intervenes between the right edge of M_1 and the left edge of M_2.

This definition of alignment is surface-oriented: it refers only to the overt position of morphs in the output, not their position in some abstract template. It follows that alignment favors non-exponence of all morphemes: that which does not exist is not capable of violating alignment[6]. For example, the form *nàzè* 'he/she hunts' consists of the stem *zè* and the disjunct prefix *nà* in position 1 (cf. Figure 3.6). In terms of the template, *nà* is separated from *zè* by 12 affix positions. Alignment, however, looks only at the surface: since there are no overt morphs intervening between *nà* and the stem, the form *nàzè* does not incur any violations of alignment.

I will assume the hierarchy of alignment constraints given in Figure 3.8 throughout my analysis; however, to save space, only a few of these will appear in any

[6] In phonology, this same notion has been applied to metrical theory by Elenbass and Kager in *Ternary Rhythm and the Lapse Constraint*: "Orientation towards the left edge is implemented by All-Ft-L...a constraint stating the (surprisingly strong) requirement that every foot stand in the initial position of the PrWd. If All-Ft-L were undominated (that is, if it were surface-true), no candidates with multiple feet would ever be selected" (Elenbass & Kager 1999, pg. 277).

particular tableau. I provide the full constraint on the left, followed by an abbreviated version on the right.

Figure 3.8: Alignment Constraints in Northern Athabaskan.

Align-R(Stem$_V$, PrWD) >>		
Align(Classifier-R, Stem$_V$-L)[7]	Align(Clf-Stem) >>	[pos. 13]
Align(SubjectPerson-R, Stem$_V$-L)	Align(SubjPers-Stem) >>	[pos. 12]
Align(Aspect-R, Stem$_V$-L)	Align(Asp-Stem) >>	[pos. 9-11]
Align(Qualifier-R, Stem$_V$-L)	Align(Qual-Stem) >>	[pos. 8]
Align(SubjectNumber-R, Stem$_V$-L)	Align(SubjNum-Stem) >>	[pos. 7]
Align(Object-R, Stem$_V$-L)	Align(Obj-Stem) >>	[pos. 6]
Align(Number-R, Stem$_V$-L)	Align(Num-Stem) >>	[pos. 5]
Align(Incorporate-R, Stem$_V$-L)	Align(Incorp-Stem) >>	[pos. 4]
Align(Quantifier-R, Stem$_V$-L)	Align(Quant-Stem) >>	[pos. 2-3]
Align(Adverbial[8]-R, Stem$_V$-L)	Align(Adv-Stem)	[pos. 1]

For ease of exposition, I have collapsed the alignment of viewpoint aspect, situation aspect, and subsituation aspect into a single constraint Align(Asp-Stem), governing positions 9-11.

3.3 Illustrations.

In this section I will illustrate some interactions of the constraints defined in sections 3.1 and 3.2 using Athabaskan data.

Figure 3.9: Alignment and Affix Order.

[PRED 'hunt <x>']$_i$ [ADV LOC]$_j$ SUBJ$_x$ [PRED PRO, PERS 1, [NUM PL]$_k$] [ASP PERF]$_l$]$_m$	Align-R(Stem, LexWd)	Align(Asp-Stem)	Align(SubjNum-Stem)	Align(Adv-Stem)
☞A. [{nà}$_j$-{ts'e}$_k$-{h}$_l$-{zè}$_i$]$_m$			*	**
B. [{nà}$_j$-{h}$_l$-{ts'e}$_k$-{zè}$_i$]$_m$		*!		**
C. [{ts'e}$_k$-{h}$_l$-{nà}$_j$-{zè}$_i$]$_m$		*!	**	

Figure 3.9 above illustrated three possible affix-orders for the form *nàts'ehzè* 'we have hunted'. In all three candidates, the stem occurs at the right edge of the lexical word, and so Align-R(Stem, LexWd) is satisfied. In candidate A, the perfective aspect morpheme *h* is perfectly aligned with the stem, while in candidates B and C, *h* is separated from the stem by another morpheme, and so B and C fatally violate Align(Asp-Stem). Candidates B and C each satisfy a lower-ranked alignment constraint,

[7] Also called "voice/valence".
[8] Also called "preverb".

Align(SubjNum-Stem) and Align(Adv-Stem), respectivel, but these candidates fail because they incur additional violations of more highly ranked alignment constraints.

Figure 3.10: Contrast, Allomorphy, and String-Based Correspondence.

$\begin{bmatrix} \text{PRED} & \text{'hunt <x>'} \\ \text{SUBJ}_x & \begin{bmatrix} \text{PERS} & 2 \end{bmatrix}_i \\ & \begin{bmatrix} \text{NUM} & \text{SG} \end{bmatrix} \\ \text{ASP} & \text{IMP} \end{bmatrix}_j$ $\begin{bmatrix} \text{PRED} & \text{'hunt <x>'} \\ \text{SUBJ}_x & \begin{bmatrix} \text{PERS} & 2 \end{bmatrix}_k \\ & \begin{bmatrix} \text{NUM} & \text{PL} \end{bmatrix} \\ \text{ASP} & \text{IMP} \end{bmatrix}_l$	Ident(Nasal)	PC_{IN}(SubjNum) Conjunct	NoAll(Person) Person
☞A. Phonetically different, not in correspondence. $[nà\text{-}\{n_1e_2\}_i\text{-}zè]_j$ $[nà\text{-}\{a_3h_4\}_k\text{-}zè]_l$			*
B. Phonetically different, in correspondence. $[nà\text{-}\{n_1e_2\}_i\text{-}zè]_j$ $[nà\text{-}\{a_1h_2\}_k\text{-}zè]_l$	*!	*	
C. Phonetically identical, in correspondence. $[nà\text{-}\{n_1e_2\}_i\text{-}zè]_j$ $[nà\text{-}\{n_1e_2\}_k\text{-}zè]_l$		*!	
☹D. Phonetically identical, not in correspondence. $[nà\text{-}\{n_1e_2\}_i\text{-}zè]_j$ $[nà\text{-}\{n_3e_4\}_k\text{-}zè]_l$			*

As mentioned in section 3.1.3, there is no *a priori* way to determine whether two morphemes which are coindexed with the same value of the same feature in f-structure are in a phonological correspondence relation based on the degree of phonetic similarity between them. Rather, this depends largely on the constraint-ranking of the language in question. This is illustrated in Figure 3.10 above. In Figure 3.10, the ranking of $PC_{IN/OUT}$(SubjNum) >> NoAll(Person) demands that the morphemes which represent 2nd person singular and plural not be in correspondence with each other, which excludes scenarios B and C. In addition, scenario B is harmonically bounded, since a morphophonemic alternation $n_1e_2 \sim a_1h_2$, in which the alternants in question are so radically different phonetically, violates numerous Faithfulness constraints which are undominated in the phonology of Dogrib (of which Ident(Nasal) is just one), and there is no phonological markedness constraint which could motivate such an alternation. The choice remains between scenarios A and D. Although scenario A is the actual winning candidate, it is tied with scenario D, in which the 2nd person singular and plural morphemes are not in phonological correspondence but are nonetheless phonetically identical. A scenario such as D should be harmonically bounded, but cannot be ruled out using the constraints given. This is because there are 4 logical possibilities for

constraints governing the relationship between phonological correspondence and phonetics:

1) If you're in phonological correspondence, be phonetically similar.
2) If you're phonetically similar, be in phonological correspondence.
3) If you're *not* in phonological correspondence, be phonetically different.
4) If you're phonetically different, then *don't* be in phonological correspondence.

Faithfulness Constraints in standard OT (e.g. Ident(Nasal) above) are of type 1. One would require constraints of types 2-4 in order to rule out candidates such as D above. I leave the development of these other constraint-types as an area for future research; at present, the unattestedness of representations such as D cannot be accounted for in PC Morphology.

Figure 3.11: Alignment and Contrast.

[PRED 'hunt <x>']$_i$ [ADV LOC]$_j$ SUBJ$_x$ [PRED PRO, PERS 1, [NUM PL]$_k$] [ASP PERF]$_l$ $]_m$ [PRED 'hunt <x>']$_i$ [ADV LOC]$_j$ SUBJ$_x$ [PRED PRO, PERS 1, [NUM PL]$_k$] [ASP IMP]$_n$ $]_o$	PC_{IN}Aspect Conjunct	Align(Asp-Stem)	Align(SubjNum-Stem)	Align(Adv-Stem)
A. No Aspect Contrast. [{nà}$_j$-{ts'e}$_k$-{h}$_l$-{zè}$_i$]$_m$ [{nà}$_j$-{ts'e}$_k$-{h}$_n$-{zè}$_i$]$_o$	*!		**	****
B. No Aspect Contrast. [{nà}$_j$-{ts'e}$_k$-{zè}$_i$]$_m$ [{nà}$_j$-{ts'e}$_k$-{zè}$_i$]$_o$	*!			**
C. Aspect Contrast. [{nà}$_j$-{ts'e}$_k$-{h}$_l$-{zè}$_i$]$_m$ [{nà}$_j$-{ts'e}$_k$-{zè}$_i$]$_o$			*	***

Figure 3.11 above illustrates the relationship between alignment and contrast. Alignment in general favors the non-exponence of morphosyntactic features, as is the case in scenario B, which incurs very few violations of alignment since there are no aspect morphemes present in either output form. In doing so, however, B merges aspect contrast. Scenario A also merges aspect contrast, but is even worse, since it incurs more alignment violations than B. The optimal candidate is C, which preserves aspect contrast with the minimal number of alignment violations.

4.0 Analysis.

In this section I will give a detailed formal analysis of split subject agreement in the Weledeh dialect of Dogrib, using the PC Morphology framework developed in section 3.

4.1 Non-exponence of unmarked categories.

Figure 4.1: Deriving Unmarked 3rd Person (result underspecified).

$\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{SUBJ}_x \begin{bmatrix}\text{PERS } 1\end{bmatrix}_i \\ \text{NUM } \text{SG}\end{bmatrix}_j$ $\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{SUBJ}_x \begin{bmatrix}\text{PERS } 2\end{bmatrix}_k \\ \text{NUM } \text{SG}\end{bmatrix}_l$ $\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{SUBJ}_x \begin{bmatrix}\text{PERS } 3\end{bmatrix}_m \\ \text{NUM } \text{SG}\end{bmatrix}_n$	$\underline{\underline{PC_{IN}SubjPers}}$ Conjunct	Align(SubjPers-Stem)	Align(Adv-Stem)
A. All Persons Marked [nà-{h}$_i$-zè]$_j$ [nà-{ne}$_k$-zè]$_l$ [nà-{we}$_m$-zè]$_n$			***!
☜B. 1st Person Unmarked [nà-zè]$_j$ [nà-{ne}$_k$-zè]$_l$ [nà-{we}$_m$-zè]$_n$			**
☜C. 2nd Person Unmarked [nà-{h}$_i$-zè]$_j$ [nà-zè]$_l$ [nà-{we}$_m$-zè]$_n$			**
☞D. 3rd Person Unmarked [nà-{h}$_i$-zè]$_j$ [nà-{ne}$_k$-zè]$_l$ [nà-zè]$_n$			**
E. 2nd & 3rd Persons Unmarked [nà-{h}$_i$-zè]$_j$ [nà-zè]$_l$ [nà-zè]$_n$	*!		*

Figure 4.1 derives the fact that the third person singular form has no surface exponent. The more affixes precede the stem, the more alignment violations will be incurred. Therefore, alignment would favor the non-exponence of all subject person values. This conflicts with contrast, since non-exponence merges morphosyntactic contrast. However, for a given attribute, one value can have no surface exponent with no damage done to contrast, i.e. one morphologically unmarked form in each scenario (cf. section 3.1.7). This underdetermines the final outcome: scenarios B, C, and D are all tied as winners.

Figure. 4.2: Deriving Unmarked 3rd Person, Markedness Weighted by Frequency.

$\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{SUBJ}_x \begin{bmatrix}\text{PERS } 1]_i \\ \text{NUM } \text{SG}\end{bmatrix}\end{bmatrix}_j$ $\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{SUBJ}_x \begin{bmatrix}\text{PERS } 2]_k \\ \text{NUM } \text{SG}\end{bmatrix}\end{bmatrix}_l$ $\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{SUBJ}_x \begin{bmatrix}\text{PERS } 3]_m \\ \text{NUM } \text{SG}\end{bmatrix}\end{bmatrix}_n$	$\underline{\underline{PC_{IN}SubjPers}}$ Conjunct	Align(SubjPers-Stem)	Align(Adv-Stem)
A. All Persons Marked $[nà\text{-}\{h\}_i\text{-}zè]_j$ $[nà\text{-}\{ne\}_k\text{-}zè]_l$ $[nà\text{-}\{we\}_m\text{-}zè]_n$			***!
B. 1st Person Unmarked $[nà\text{-}zè]_j$ $[nà\text{-}\{ne\}_k\text{-}zè]_l$ $[nà\text{-}\{we\}_m\text{-}zè]_n$			**♨!
C. 2nd Person Unmarked $[nà\text{-}\{h\}_i\text{-}zè]_j$ $[nà\text{-}zè]_l$ $[nà\text{-}\{we\}_m\text{-}zè]_n$			**♨!
☞D. 3rd Person Unmarked $[nà\text{-}\{h\}_i\text{-}zè]_j$ $[nà\text{-}\{ne\}_k\text{-}zè]_l$ $[nà\text{-}zè]_n$			**
E. 2nd & 3rd Persons Unmarked $[nà\text{-}\{h\}_i\text{-}zè]_j$ $[nà\text{-}zè]_l$ $[nà\text{-}zè]_n$	*!		*

The constraints given in Figure 4.1 underdetermine the final outcome: scenarios B, C, and D are all tied as winners. There are two ways in which this could be resolved. One way would be to use REL constraints to stipulate that an input value of [3sg] has no surface exponent, while [1sg] and [2sg] do have a correspondent in the output. While this would work, it would also imply that having an unmarked 3rd person singular form is merely an idiosyncratic property of Athabaskan, whereas, in fact, it is a common pattern cross-linguistically (cf. discussion of Benveniste, section 5.2). It has been observed that the 3rd person is more frequent than both the 1st and 2nd persons (Greenberg 1966). Therefore, Figure 4.2 introduces an additional device whose purpose is to distinguish between scenarios such as B, C, and D in 4.1: as a tie-breaker, we assign a ♨ to accompany the markedness violation(s) incurred by the most frequently occurring form, in this case, the 3rd person. Under this procedure, scenarios B and C now fatally violate Align(Adv-Stem), and scenario D emerges as the winner.

If one accepts the notion that the non-exponence of the 3rd person singular is related to its frequency, the question remains as to the direction of the causal relationship between these. There are two possibilities. One could argue either that:
(a) Grammar drives Frequency. The form which is morphophonologically least marked according to the constraint ranking of the language will be used more frequently, regardless of its meaning; or,
(b) Frequency drives Grammar. At any given time the referent of the subject of a clause is more likely to be a non-participant in the discourse (i.e. 3rd person) than a participant (1st and 2nd person). Languages assign the most frequently occurring meaning to the least marked form for reasons of economy.

(a) predicts that a morphologically unmarked 3rd person should be no more common cross-linguistically than an unmarked 1st or 2nd person, but that in languages in which the 1st or 2nd person are morphologically unmarked, these should be used for frequently. By adopting (b), however, we can capture the cross-linguistic generalization that it is the 3rd person which is most often unmarked morphologically. In other words, the 3rd person is more frequent in the output because it is already more frequent in the input.

4.2 Number contrast: singular vs. plural.

Figure 4.3: Number in the 2nd Person.

[PRED 'hunt <x>' ASP PERF SUBJ$_x$ [[PERS 2]$_i$ [NUM SG]$_j$]$_m$ [PRED 'hunt <x>' ASP PERF SUBJ$_x$ [[PERS 2]$_i$ [NUM PL]$_k$]$_n$	Align(Asp-Stem)	Align(SubjNum-Stem)	PC_{IN}SubjNum Conjunct	Align(Adv-Stem)	NoAll(Person) Person
A. No Number Contrast. [nà-whɻ-{ɻ}$_1$-zè]$_m$ [nà-whɻ-{ɻ}$_1$-zè]$_n$	**		*!	(****)	
☞B. Number by Position 12 Allomorphy. [nà-whɻ-{ɻ}$_1$-zè]$_m$ [nà-wh-{ah}$_1$-zè]$_n$	**			(****)	*
C. Number by Position 7 Affix. [nà-whɻ-{ɻ}$_1$-zè]$_m$ [nà-{ge}$_k$-whɻ-{ɻ}$_1$-zè]$_n$	**	**!		*(****)	
D. Multiple Exponence. [nà-whɻ-{ɻ}$_1$-zè]$_m$ [nà-{ge}$_k$-wh-{ah}$_1$-zè]$_n$	**	**!		*(****)	*

Figure 4.3 illustrates several possibilities with respect to the realization of Subject Number in the 2nd person. Figure 4.3 presupposes that there will be an overt affix in Position 12, following that which was established in Figure 4.2. Number can be realized by allomorphy in position 12 (as in scenario B), an affix in position 7 (as in scenario C), both (scenario D), or neither (scenario A). Scenario A fatally violates Contrast. Alignment is ranked higher than No-Allomorphy in Dogrib. Therefore, scenario B, which expesses number through allomorphy, is preferable to scenario C, which does so by inserting an affix in position 7, thereby creating several more alignment violations. A scenario such as C could win, however, if NoAll(Person) were high-ranked, as in an agglutinating language. Scenario D, the multiple exponence scenario, violates both No-Allomorphy and Alignment, and is therefore harmonically bounded.

The PC-constraints PC_{IN}SubjPers and PC_{IN}Aspect are high-ranked and undominated in Dogrib. The evidence for PC_{IN}(±pl)SubjNum being ranked lower comes from data which show that realization of the feature PC_{IN}(±pl)SubjNum is actually optional in Northern Athabaskan. The following data are taken from Rice (2000), from the closely related language Slave:

John beya-**ke** 'eyá **ke**-yį-lé
John 3-son-**pl** sick **pl**-aspect-be

John beya-**ke** 'eyá yį-lé
John 3-son-**pl** sick aspect-be

John beya 'eyá **ke**-yį-lé
John 3-son sick **pl**-aspect-be

John beya 'eyá yį-lé
John 3-son sick aspect-be (pg. 190).

All of the above sentences are grammatical under the reading "John's sons were sick," i.e., the presence of the plural marker *ke* on either the noun or the verb (or both) requires a plural interpretation, but the absence of a plural marker does not exclude a plural interpretation. Thus, if the referent of the subject NP is plural, one may put a plural marker on the subject NP, on the verb, on both, or on neither. Assuming that the presence of an overt marker *ke* for the plural is motivated by PC_{IN}(±pl)SubjNum, while the constraint Align(SubjNum-Stem) militates against overt number marking, variation between verb forms which do and do not preserve number contrast can be attributed to multiple, competing grammars (Anttila 1997): when PC_{IN}(±pl)SubjNum >> Align(SubjNum-Stem), number is unambiguously realized; when Align(SubjNum-Stem) >> PC_{IN}(±pl)SubjNum, number is not realized overtly, that is, the actual number of the referent of the subject NP is left ambiguous. Since, under this analysis, the absence of an overt number marker is motivated by Alignment, this theory predicts that overt number marking should be *more* likely the *fewer* affixes intervene between number and the stem (or which precede number), and that number should always be overtly realized when there are no other prefixes. That is, if the only reason for not expressing plural number is to avoid Alignment violations, then in those cases in which inserting a plural affix would not incur any alignment violations there would be no reason not to insert it. Corpus data are necessary to test this hypothesis, however. In Figure 4.4, the constraints PC_{IN}(±pl)SubjNum and Align(SubjNum-Stem) are shown as unranked, with scenarios A and C tied as winners.

Figure 4.4: Number in the 3rd Person.

$\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{ASP } \text{PERF} \\ \text{SUBJ}_x \begin{bmatrix}\text{[PERS 3]}_l \\ \text{[NUM SG]}_j\end{bmatrix}\end{bmatrix}_o$ $\begin{bmatrix}\text{PRED } \text{'hunt <x>'} \\ \text{ASP } \text{PERF} \\ \text{SUBJ}_x \begin{bmatrix}\text{[PERS 3]}_l \\ \text{[NUM PL]}_k\end{bmatrix}\end{bmatrix}_p$	Align(Asp-Stem)	Align(SubjNum-Stem)	$\underline{PC_{IN}SubjNum}$ Conjunct	Align(Adv-Stem)	$\underline{NoAll(Person)}$ Person
☞A. No Number Contrast. [nà-whe-zè]$_o$ [nà-whe-zè]$_p$			*	(**)	
B. Number by Position 12 Affix. [nà-whe-zè]$_o$ [nà-whe-{ge}$_l$-zè]$_p$	*!			*(**)	
☞C. Number by Position 7 Affix. [nà-whe-zè]$_o$ [nà-{ge}$_k$-h-zè]$_p$		*		*(**)	
D. Multiple Exponence. [nà-whe-zè]$_o$ [nà-{ge}$_k$-h-{ge}$_l$-zè]$_p$	*!	**		**(**)	

In northern Athabaskan languages, a number distinction is always realized in the 2nd person, but is optional in the 3rd person. Figure 4.4 presupposes that there will be no overt affix in position 12 for the 3rd person singular (cf. Figure 4.2). Figure 4.4 uses the exact same constraint-ranking as in Figure 4.3, but here variation is predicted. Scenario B, which expresses number by inserting an affix in position 12, fails not because it incurs a No-Allomorphy violation (contextual non-exponence does not constitute allomorphy, cf. section 3.1.6); rather, scenario B simply incurs more alignment violations than scenario C. Scenario D, the multiple exponence scenario, is harmonically bounded just as before.

Figures 4.3 and 4.4 presuppose the presence or absence of an affix in the Person position (Position 12) in the singular. In 4.5, this is no longer presupposed, and additional possibilities are compared. Scenarios E, F, and G in Figure 4.5 are all ruled out due to excessive alignment violations. Scenarios A and B are the actual winning scenarios in Dogrib: number is always realized by allomorphy in the 2nd person; in the 3rd person, it is sometimes realized by a separate affix *ge* in position 7 (as in scenario A), and sometimes not realized at all (as in scenario B). Scenario C is the mirror-image of scenario A. In scenario C, number is realized by allomorphy in the 3rd person, and a separate affix in the 2nd person. Scenario C incurs exactly the same number of violations of the all the same constraints as scenario A; the only way to distinguish it from scenario A is by the ☎ device introduced in Figure 4.2: the violations of Align(Asp-Stem) incurred by scenario C are counted as more severe, and hence fatal, since they are incurred by the 3rd person forms *o* and *p*, which are more frequent. Similarly, scenario D is the mirror-image of scenario B, and is distinguished from it only by the ☎ device.

Figure 4.5: Realization of Number in the 2nd & 3rd Person.

[PRED 'hunt <x>', ASP PERF, SUBJx [[PERS 2]i, [NUM SG]j]]m [PRED 'hunt <x>', ASP PERF, SUBJx [[PERS 2]i, [NUM PL]k]]n [PRED 'hunt <x>', ASP PERF, SUBJx [[PERS 3]l, [NUM SG]j]]o [PRED 'hunt <x>', ASP PERF, SUBJx [[PERS 3]l, [NUM PL]k]]p	PC_{IN}SubjPers Conjunct	Align(Asp-Stem)	Align(SubjNum-Stem)	PC_{IN}SubjNum Conjunct	Align(Adv-Stem)	NoAll(Person) Person
☞A. 2nd person by allomorphy, 3rd person by affix. [nà-whɻ-{ɻ}1-zè]m [nà-wh-{ah}1-zè]n [nà-h-zè]o [nà-{ge}k-h-zè]p		**	*		7	*
☞B. 2nd person by allomorphy, 3rd person none. [nà-whɻ-{ɻ}1-zè]m [nà-wh-{ah}1-zè]n [nà-h-zè]o [nà-h-zè]p		**		*	6	*
C. 3rd person by allomorphy, 2nd person by affix. [nà-h-zè]m [nà-{ge}k-h-zè]n [nà-whe-{we}l-zè]o [nà-whe-{ye}l-zè]p		**🚨!	*		7	*
D. 3rd person by allomorphy, 2nd person none. [nà-h-zè]m [nà-h-zè]n [nà-whe-{we}l-zè]o [nà-whe-{ye}l-zè]p		**🚨!		*	6	*
E. 2nd & 3rd person by allomorphy. [nà-whɻ-{ɻ}1-zè]m [nà-wh-{ah}1-zè]n [nà-whe-{we}l-zè]o [nà-whe-{ye}l-zè]p		****!			8	**
F. Allomorphy and non-exponence. [nà-whɻ-{ɻ}1-zè]m [nà-wh-{ah}1-zè]n [nà-h-zè]m [nà-whe-{ye}l-zè]p		***!			7	*
G. 2nd & 3rd person by affix. [nà-whɻ-{ɻ}1-zè]m [nà-{ge}k-whɻ-{ɻ}1-zè]n [nà-h-zè]o [nà-{ge}k-h-zè]p		**	***!		8	

4.3 Number contrast: dual vs. plural.

In the second and third persons, there is no distinct affix to mark the dual number for subjects. "A dual/plural distinction is found only if there is stem variation for number" (Rice 1989, pg. 481). Many verbs in Dogrib exhibit stem variation. Stem variation can take the form of initial consonant mutation, vowel ablaut, tonal ablaut, or complete stem-suppletion, and this variation can be conditioned by aspect, person, number of the subject, and/or number of the object (Ackroyd 1982 pg. 76, 80). Historically, many of these stem alternations were likely caused by aspect-marking suffixes (pg. 68). However, due to the extensive loss of coda-consonants in Dogrib, these stem alternations have no synchronic phonological conditioning.

Of interest here is stem variation conditioned by number. Ackroyd identifies three patterns: (1) separate stems for singular, dual, and plural; (2) one stem for singular and dual, another for plural, and (3) one stem for singular, another for dual and plural. This is illustrated in figure 15. The stem is highlighted in bold.

Figure 4.6: Patterns of Stem Variation according to Number in Dogrib (Ackroyd 1982, pg. 80).

	Singular	Dual	Plural
1. Separate stems for Sg., Dual, Plural.	whi**da** 'I am seated'	whì**ke** 'We (2) are seated'	ts'erè**kw'e** 'We (pl.) are seated'
2. Sg./Dual vs. Plural.	k'**embe** 'He swims'	k'ege**mbe** 'They (2) swim'	k'ege**'ò** 'They (pl.) swim'
3. Sg. vs. Dual/Plural.	nàwhi**tı̨** 'I dreamed'	nàwhi**te** 'We (2) dreamed'	nàts'e**te** 'We (pl) dreamed'

Thus stems in Dogrib can vary unpredictably and in a variety of ways; the pattern of stem variation must be lexically listed for each particular verb stem. In many Athabaskan languages, the only way that a distinction between the dual and plural is ever marked is by stem variation[9]: a single subject agreement prefix serves for both dual and plural in all persons. This is the pattern found in Slave, except for the Bearlake dialect. In Dogrib, however, and in the Bearlake dialect of Slave, the situation is different. In these languages, although there are no distinct dual agreement morphemes in the 2nd and 3rd persons, the 1st person distinguishes 3 numbers by way of affixes: singular (*h*), dual (*wìd*), and plural (*ts'e*). Historically, this system arose in the following way: originally, the 1st person was like the 2nd and 3rd persons in that there was a distinction only between singular (*h*) and plural (*wìd*). *Wìd* was ambiguous between dual and plural; the only way to specify a subject as dual was through stem alternations, just as in the 2nd and 3rd persons. In the 3rd person, there was a distinction between a true 3rd person plural (*ge*) and an impersonal (*ts'e*), similar in meaning to the French *on*. This older state persists in all dialects of Slave except Bearlake. Subsequently, the form *ts'e* came to be used as a 1st person plural. However, the old 1st person plural form *wìd* did not disappear from the language as a result of this. Rather, *wìd* has become restricted in meaning to a dual interpretation, while *ts'e* is used to refer to 3 or more individuals in the 1st person.

[9] A small number of irregular verbs also take a supplementary affix in position 5 in the dual, e.g. *da**ɬe**getłǫ* 'two of them danced' (my field notes). This has no effect on the behavior of conjunct prefixes, however.

At first glance, the resulting system in Dogrib seems typologically unusual in two ways. Firstly, there are more number distinctions in the 1st person than in the 2nd or 3rd persons. Cross-linguistically, we would either expect all persons to be uniform in the amount of number contrast they allow, or else the 3rd person, which is the unmarked person, would be expected to license the most contrast.[10] Secondly, the system in Dogrib and Bearlake seems unusual with respect to morpheme order. Whereas previously one could have made the generalization that all 1st and 2nd person subject agreement prefixes (*h, wìd, ne, ah*) occur in position 12, while all 3rd person prefixes (*ge, ts'e*) occur in position 7, in Dogrib and Bearlake the morpheme *ts'e* still occurs in position 7 (the alleged 3rd person slot) even though it now has a 1st person meaning. Rice notes that "under the scope hypothesis, one might expect morphemes that change in function to change position" (2000, pg. 379). If, as in the Feature Alignment analysis, subject agreement morphemes are aligned according to their person specification (3rd person in position 7, 1st/2nd person in position 12), we would expect the morpheme *ts'e* to have moved from position 7 to position 12 after its meaning changed from 3rd person to 1st person, yet this has not occurred. Why should this be the case?

While these facts are problematic for the Feature Alignment analysis, they follow straightforwardly from the PC Morphology analysis. When viewed in terms of contrast and allomorphy, both the Slave and Dogrib systems allow exactly two allomorphs for every overt affix. This is illustrated below.

Figure 4.7: Contrast and Allomorphy in Person and Number Positions in Slave (except Bearlake).

Grammatical Category	Template Position Num.	Num. of values distinguished	Which values overtly marked	Num. of morphosyntactically conditioned allomorphs for each overt affix.	Morphosyntactic category which conditions allomorphy.
Person	12	3 (1st, 2nd, 3rd person)	1st & 2nd person	2: *h* ~ *ìd* in 1st person; *ne* ~ *ah* in 2nd person.	Number
Number	7	2 (Singular, Plural)	Plural	2: *ke* ~ *ts'e*	Person (a personal vs. impersonal distinction)

Figure 4.8: Contrast and Allomorphy in Person and Number Positions in Dogrib (and Bearlake).

Grammatical Category	Template Position Num.	Num. of values distinguished	Which values overtly marked	Num. of morphosyntactically conditioned allomorphs for each overt affix.	Morphosyntactic category which conditions allomorphy.
Person	12	3 (1st, 2nd, 3rd person)	1st & 2nd person	2: *h* ~ *wìd* in 1st person; *ne* ~ *ah* in 2nd person.	Number
Number	7	2 (Singular, Plural)	Plural	2: *ge* ~ *ts'e*	Person (1st vs. 3rd)

[10] See Siewierska 2004 for an alternative view.

In both Slave and Dogrib, the grammatical category Subject Number is located in position 7 of the template, while Subject Person is located in position 12. For both categories, the least marked value has no surface exponent (singular number, 3rd person), while the other value(s) is/are represented by an affix. In both cases, those values which are represented overtly are subject to morphosyntactically conditioned allomorphy (i.e. fusion). In Slave, the 1st person affix has two allomorphs, *h* used in the singular, and *ìd* used in the dual/plural and the 2nd person has two allomorphs, *ne* used in the singular, and *ah* used in the dual/plural. The 3rd person form is zero for reasons of contrast and alignment, and so no feature (including number) is able to condition allomorphy in the 3rd person. With respect to the category Number, the value plural is overtly marked. Here again, the overtly marked value shows two allomorphs, *ke* and *ts'e*, and this allomorphy is conditioned by the category Person: *ke* is the plural form of the 3rd person; *ts'e* is the plural of the impersonal or universal person. The subject agreement system of Northern Athabaskan, therefore, is perfectly symmetrical: each overtly marked value in each category (Person and Number) has exactly 2 allomorphs, and for each category, this allomorphy is conditioned by the other category—Number conditions allomorphy of Person and Person conditions allomorphy of Number. The result is a system which is both symmetrical and economical.

In Dogrib and Bearlake, all of the above observations still hold. Number still has allomorphy conditioned by person in the plural (*ge* ~ *ts'e*); the only difference is that rather than marking a distinction between 3rd person and impersonal or universal person as in Slave, the distinction is now between 3rd person and 1st person. The system is still symmetrical and economical just as before. PC Morphology analysis predicts that the category Number should allow for two allomorphs conditioned by Person. The question now arises as to *what* person distinction should be represented by this allomorphy. In Slave, the distinction is 3rd person vs. impersonal/univeral; in Dogrib and Bearlake it is between 3rd person and 1st person. The theory predicts that it should also be possible for Number to allow allomorphy based on a 3rd person vs. 2nd person distinction, that is, it should have been possible, according to this account, for *ts'e* to evolve into a 2nd person plural form. The resulting system would show a contrast between singular, dual, and plural only in the affixes of the 2nd person, with both 1st person and 3rd person ambiguous between dual and plural. I do not know if such a system exists. While it is predicted to be possible under my analysis, it is likely that an impersonal is more likely to evolve, diachronically, into a 1st person rather than a 2nd person for pragmatic reasons.

The analysis sketched out above is formalized in Figure 4.9. Figure 4.9 illustrates why a dual vs. plural contrast is present only in the 1st person and not in all persons. The first constraint is [NoAll(attribute α)]^2 in the linear domain of attribute α. It is simply the local conjunction of NoAll(attribute α) in the linear domain of attribute α, which is activated whenever a particular value for a particular morphosyntactic feature is realized with more than two allomorphs within the linear domain with which that feature is coindexed. To see what No-Allomorphy violations are present which might activate this constraint, one must look at the bottom of the constraint hierarchy, at NoAll(attribute α) in the linear domain of attribute α. Although, for example, scenario A contains three violations of this constraint, it does not activate the local conjunction, because each of these violations occurs in a different domain (1st person, 2nd person, plural). Similarly in scenario B. In scenario C, however, there are three different morphemes coindxed with

the input value [PERS 2], each of which is part of a different morphophonological alternant set, and similarly with the input value [PERS 1]. In scenario D, there are three different morphemes coindexed with the value [NUM PL], which incurs two no-allomorphy violations for this feature, which activates the local conjunction. The only remaining viable scenarios are A and B, both of which are attested in northern Athabaskan, the choice between being determined by which is ranked higher, contrast of alignment.

To summarize, northern Athabaskan has a split system of subject agreement because in the 1st and 2nd persons, where a person affix is independently motivated, number can be expressed by allomorphy, whereas in the 3rd person number must be expressed by a separate affix in its own position. Additionally, Athabaskan allows every morpheme to have exactly two allomorphs. For the 1st and 2nd person, this is used to express a number contrast in the Person position, thereby saving alignment violations. However, it is also possible to have allomorphy in the Number position, and Athabaskan exploits this possibility as well. In Dogrib, and in the Bearlake dialect of Slave, allomorphy in the Number position (*ge* ~ *ts'e*) is used to express a person contrast; in other Athabaskan languages, it is used to express a personal vs. impersonal distinction. In either case, the generalization that only two allomorphs are allowed for every feature still holds.

4.4 Annotation.

Having generated all of the inflected forms in a paradigm, as in Figure 4.9, annotating each output word for the information it expresses is simple and straightforward. The procedure is as follows.

Bracket-erasure:
Erase all brackets, indices, and word-internal structure from output words.

Annotation:
For every output word W contained within scenario Z, such that W is coindexed with value α of attribute α in f-structure, annotate W (↑ attribute α) = value α iff no violation marks for the constraint PC_{IN}(Attribute α) are incurred by W in scenario Z.
Informally: "Annotate a word for the information it is coindexed with in the input, if it expresses that information unambiguously."

For the output words in Figure 4.9, this results in the following annotations.

Scenario A:

nàwhehzè	nàwhìzè	nàts'ehzè
(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'
(↑ASP) = PERF	(↑ASP) = PERF	(↑ASP) = PERF
(↑SUBJ PERS) = 1	(↑SUBJ PERS) = 1	(↑SUBJ PERS) = 1
(↑SUBJ NUM) = SG	(↑SUBJ NUM) = DU	(↑SUBJ NUM) = PL

nàwhɻ̨̨zè	nàwhahzè	nàwhahzè
(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'
(↑ASP) = PERF	(↑ASP) = PERF	(↑ASP) = PERF
(↑SUBJ PERS) = 2	(↑SUBJ PERS) = 2	(↑SUBJ PERS) = 2
(↑SUBJ NUM) = SG	(↑SUBJ NUM) = DU/PL	(↑SUBJ NUM) = DU/PL
nàhzè	nàgehzè	nàgehzè
(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'
(↑ASP) = PERF	(↑ASP) = PERF	(↑ASP) = PERF
(↑SUBJ PERS) = 3	(↑SUBJ PERS) = 3	(↑SUBJ PERS) = 3
(↑SUBJ NUM) = SG	(↑SUBJ NUM) = DU/PL	(↑SUBJ NUM) = DU/PL

Scenario B:

nàwhehzè	nàwhìzè	nàts'ehzè
(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'
(↑ASP) = PERF	(↑ASP) = PERF	(↑ASP) = PERF
(↑SUBJ PERS) = 1	(↑SUBJ PERS) = 1	(↑SUBJ PERS) = 1
(↑SUBJ NUM) = SG	(↑SUBJ NUM) = DU	(↑SUBJ NUM) = PL
nàwhɻ̨̨zè	nàwhahzè	nàwhahzè
(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'
(↑ASP) = PERF	(↑ASP) = PERF	(↑ASP) = PERF
(↑SUBJ PERS) = 2	(↑SUBJ PERS) = 2	(↑SUBJ PERS) = 2
(↑SUBJ NUM) = SG	(↑SUBJ NUM) = DU/PL	(↑SUBJ NUM) = DU/PL
nàhzè	nàhzè	nàhzè
(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'	(↑PRED) = 'hunt <x>'
(↑ASP) = PERF	(↑ASP) = PERF	(↑ASP) = PERF
(↑SUBJ PERS) = 3	(↑SUBJ PERS) = 3	(↑SUBJ PERS) = 3

Words are now atomic units whose information is visible to the syntax, but whose structure is not. The main thing to note in the annotations above is the treatment of Subject Number. In the 1st person, each form is annotated as either SG, DU, or PL. In the 2nd person, since the single form nàwhahzè is used for both dual and plural and thus violated PC_{IN}(±dual)SubjNum in Figure 4.9, these forms must be annotated ambiguously as DU/PL. In scenario B, the form nàhzè is completely ambiguous with respect to number, hence the 3rd person forms in scenario B bear no annotation for number. Finally, note that, strictly speaking, should not be able to annotate any of the words in Figure 4.9 for Aspect, since we would need imperfective or optative forms with which to compare them, to determine whether or not they satisfy PC_{IN}(Aspect). However, in fact all of them do, I have merely omitted showing this in the tableau to save space. See Figure 3.11 for an illustration of Aspect contrast.

4.9: Analysis of Entire Perfective Paradigm of *nà√zè*, in all Persons and Numbers, and Complete Constraint Ranking.

PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 1]$_i$ [NUM SG]$_l$ $_o$	PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 1]$_i$ [NUM DU]$_m$ $_p$	PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 1]$_i$ [NUM PL]$_n$ $_q$	[NoAll(Feature$_\alpha$)][2] Feature$_\alpha$	Align(Asp-Stem)	PC$_{IN}$(±pl)SubjNum Conjunct	Align(SubjNum-Stem)	PC$_{IN}$(±dual)SubjNum Conjunct	NoAll(Feature$_\alpha$) Feature$_\alpha$
PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 2]$_j$ [NUM SG]$_k$ $_r$	PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 2]$_j$ [NUM DU]$_n$ $_s$	PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 2]$_j$ [NUM PL]$_n$ $_t$						
PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 3]$_k$ [NUM SG]$_u$	PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 3]$_k$ [NUM DU]$_n$ $_v$	PRED 'hunt <x, y>' ASP PERF SUBJ$_x$ [PERS 3]$_k$ [NUM PL]$_n$ $_w$						
☞A. Actual.								
[nà-whe-{h}$_1$-zè]$_o$	[nà-whɪ-{ì}$_1$-zè]$_p$	[nà-{ts'e}$_n$-h-zè]$_q$		*****		***	*(2nd pers) *(3rd pers)	*(1st pers) *(2nd pers) *(pl)
[nà-whɻ-{ɻ}$_j$-zè]$_r$	[nà-wh-{ah}$_j$-zè]$_s$	[nà-wh-{ah}$_j$-zè]$_t$						
[nà-h-zè]$_u$	[nà-{ge}$_m$-h-zè]$_v$	[nà-{ge}$_n$-h-zè]$_w$						
☞B. No Number Contrast in 3rd Person.								
[nà-whe-{h}$_1$-zè]$_o$	[nà-whɪ-{ì}$_1$-zè]$_p$	[nà-{ts'e}$_n$-h-zè]$_q$		*****	*(3rd pers)	*	*(2nd pers) *(3rd pers)	*(1st pers) *(2nd pers)
[nà-whɻ-{ɻ}$_j$-zè]$_r$	[nà-wh-{ah}$_j$-zè]$_s$	[nà-wh-{ah}$_j$-zè]$_t$						
[nà-h-zè]$_u$	[nà-h-zè]$_v$	[nà-h-zè]$_w$						
C. Dual expressed everywhere by Person allomorphy.								
[nà-whe-{h}$_1$-zè]$_o$	[nà-whɪ-{ì}$_1$-zè]$_p$	[nà-whe-{ts'e}$_1$-zè]$_q$	*! (1st pers) *! (2nd pers)	********				**(1st pers) **(2nd pers) *(pl)
[nà-whɻ-{ɻ}$_j$-zè]$_r$	[nà-wh-{ah}$_j$-zè]$_s$	[nà-whe-{xe}$_j$-zè]$_t$						
[nà-h-zè]$_u$	[nà-whe-{ye}$_k$-zè]$_v$	[nà-whe-{ge}$_k$-zè]$_w$						
D. Dual expressed everywhere by Number allomorphy.								
[nà-whe-{h}$_1$-zè]$_o$	[nà-whɪ-{ì}$_1$-zè]$_p$	[nà-{ts'e}$_n$-h-zè]$_q$	*! (pl)	****		***		*(1st pers) *(2nd pers) **(pl)
[nà-whɻ-{ɻ}$_j$-zè]$_r$	[nà-wh-{ah}$_j$-zè]$_s$	[nà-{xe}$_n$-h-zè]$_t$						
[nà-h-zè]$_u$	[nà-{ye}$_n$-h-zè]$_v$	[nà-{ge}$_n$-h-zè]$_w$						

5.0 Comparision with Alternatives.

In this section I will compare and contrast the PC Morphology analysis to two previous approaches to morpheme order in Athabaskan: the alignment-based analysis of Potter 1996 and Hargus & Tuttle 1997, and the syntactic analysis of Rice & Saxon 1994 and Rice 2000.

5.1 Feature Alignment (Potter 1996, Hargus & Tuttle 1997).

In my analysis I have made extensive use of the formal device of Alignment within OT to derive Athabaskan affix order, based on the work of Potter 1996 and Hargus & Tuttle 1997. Neither Potter nor Hargus & Tuttle specifically address the issue of split subject agreement, the former paper being primarily concerned with the Mirror Principle, and the latter with the distribution of conjunct vowels. But one can nonetheless ask what predictions would be made if one were to attempt an analysis of split subject agreement using only the devices presented in the aforementioned papers, interpreted literally as given.

Hargus & Tuttle do make a distinction between "pronominal", which they also call Pronominal Subject or Deictic Subject Prefix, and "subject", also called Inner Subject or Subject Pronoun Prefix. Presumably, the former refers to those subject agreement morphemes which occur to the left of aspect (3rd dual/plural, 1st plural), while the latter refers to all other subject agreement morphemes. I will call this the Feature Alignment Analysis, since morphemes are aligned according to the morphosyntactic features which they express. The distinction between "pronominal" and "inner" subjects is arguably circular: a subject agreement morpheme is "inner" simply by virtue of the position in which it occurs on the surface. The notion of "Deictic Subject" does not help, either: it is difficult to see how 1st person plural and 3rd person dual/plural could be considered more "deictic" than the other person/number combinations (cf. Levinson 1983, pg. 68). Historically, the form *ts'e* (which occurs to the left of aspect) was an impersonal, similar to the French *on*, as it still is in many Athabaskan languages. For such languages, one could argue that all 3rd person forms occur to the left of aspect, while all 1st/2nd person forms occur to the right. This distinction, in turn, could be expressed in terms of discourse participants: participants in the speech event are marked in one position; non-participants in another.

The problem is that in Dogrib (as well as in the Bearlake dialect of Slave), the form *ts'e* has come to mean 1st person plural, while the old 1st person plural *wìd* is now restricted to a 1st person dual interpretation. The result is that those morphemes which occur to the left of aspect no longer form a natural class in terms of their semantics. One way around this problem might be to claim that Alignment is in fact morpheme-specific: each affix has its own alignment constraint, and there is no *a priori* reason to assume that these should form any natural class semantically. Such an approach basically amounts to the Template Hypothesis re-stated in OT as alignment constraints. There is diachronic evidence against such an approach, however:

> "There are cases in the Athapaskan family where a morpheme with a particular phonological form is lost, yet its function is expresed by another phonological form.... Presumably when a morpheme is lost, information about its position is lost as well....Under the template hypothesis, when a new morpheme enters the language or an old morpheme takes over a new function, it brings with it its own restrictions, including restrictions on its position class. It may end up in the same position as the lost morpheme, but, since function is not a general regulator of position, it may occur in a different position. Thus, loss and replacement of morphemes could easily lead to evolution and change of the template" (Rice 2000, pg. 375).

Rice cites the example of the perambulative/repetitive morpheme, which has several phonologically unrelated forms in a number of Athabaskan languages, yet occurs in the same position in all of these languages. While there is no evidence against morpheme-specific alignment based solely on split subject agreement, to adopt such an approach would lead to a loss of generalizations about Athabaskan affix-order in general.

Alternatively, if alignment in Athabaskan were defined strictly in terms of Person (one alignment constraint for 3rd person, another for 1st and 2nd person), we run into a different diachronic problem. One would expect that, when the meaning of *ts'e* in Dogrib and Bearlake changed from 3rd person to 1st person, this affix should have moved from position 7 to position 12 accordingly, yet this has not occurred.

In the PC Morphology analysis, however, there is a straightforward explanation for this: *ts'e* cannot move to position 12, because if it were to do so, it would be interpreted as a third allomorph of the value [PERS 1]. Athabaskan allows only two allomorphs for each feature, not 3. By remaining in position 7, as an exponent of [NUM PL], *ts'e* remains within the allowable limits of allomorphy.

5.2 Two Functional Projections (Rice & Saxon 1994, Rice 2000).

In my analysis, I have also made use of the distinction between AgreementSubject^0 and Number^0 introduced in Rice and Saxon 1994, which I have referred to as SubjectPerson and SubjectNumber, respectively. The former category, Subject Person, includes the morphemes *h, wìd, ne,* and *ah*, which occur in position 12, while the latter category includes the morphemes *ge* and *ts'e* which occur in position 7. Rice & Saxon's analysis correctly predicts the order of observed morphemes based on their position in the functional hierarchy and their scopal relations.

Recall from section 3.2.1 Benveniste's assertion that the 3rd person is a "non-person". Rice and Saxon adopt a version of this view, saying that "'third person' is a misnomer; rather, apparent 'third persons' involve a lack of person specification" (pg. 193). Several empirical facts seem to follow straightforwardly from this analysis: 1st and 2nd person subjects are located under AgreementSubject^0 (since these are truly persons), 3rd person plural subjects are located under Number^0 (since they represent number, not person), and 3rd person singular subjects are morphologically unmarked (since they constitute the absence of both number and person). I will call this the Two Functional Projections analysis.

Upon closer examination, however, it is not clear how the morphophonological realization of Person and Number in Athabaskan, including some facts about their linear order, follow from the Two Functional Projections analysis. First of all, there is the question of what exactly it means for the third person to be a "non-person". One

possibility is the following representation in terms of features (cf. Levinson 1983, Jakobson 1957):

Figure 5.1: Possible Representation of Person-Features.

Feature Representation	Result
[+speaker, +addressee]	1st person inclusive
[+speaker, -addressee]	1st person exclusive
[-speaker, +addressee]	2nd person
[-speaker, -addressee]	3rd person

At this point the question arises, does having all minus values for a set of features automatically translate into a null phonological realization of those features? This seems to be assumed in the Two Functional Projections analysis. There are counterexamples, however, as in Indo-European, where the present tense of the verb "be" is *es-mi* (1sg), *es-si* (2sg), *es-ti* (3sg). For Benveniste, this was an 'anomalous' pattern, motivated by something like paradigm uniformity:

> ...la flexion...à trois personnes symmétriques: loin de représenter un type constant et nécessaire, elle est, au sein des langues, une anomalie. La 3e personne a été conformée aux deux premières pour des raisons de symétrie....Nous avons ici une régularité de caractère extrême et exceptionnel" (Benveniste 1946, pg. 6).

Secondly, granted that a lexical item with all minus values for a set of features is more *likely* to have no overt affix for those features, from what general principle does this follow? The Two Functional Projections Analysis does not say.

Finally, if Position 7 of the Slave verbal template (cf. Rice 1989) corresponds to the functional projection Num^0, why don't all verbs with a plural subject, including 1st person plural and 2nd person plural, have a plural-marking affix in this position (e.g. why not something like **nàgenezè* 'you (pl.) hunt')?[11] Why is it that, for 1st and 2nd person plurals, number is fused with person, with both of these realized in position 12 ($AgrS^0$)?

Although I believe it is both useful and necessary to distinguish two positions for subject agreement, this in itself does not solve the problem of affix-ordering in Athabaskan. That is, the fact that two distinct positions exist in the Athabaskan verb does not by itself tell us what information will be represented in those positions or how that information should be realized phonologically. According to Rice, "...first/second person subject inflection represents agreement, including features of person, number, and gender, while third person subject inflection represents number and gender, but not person" (2000, pg. 181). As stated here, this theory is not very restrictive, since multiple morphosyntactic categories are allowed to be represented under a single X^0 node, and a single category can be represented under multiple nodes. In effect, the Two-Projections

[11] Benveniste proposed that the notion of plurality is different for 1st and 2nd persons versus 3rd persons: "La distinction ordinaire de singulier et de pluriel doit être sinon remplacée, au moins interprétée, dans l'ordre de la personne, par une distinction entre *personne stricte* (= "singulier") et *personne amplifiée* (= "pluriel"). Seule la "troisième personne", étant non-personne, admet un véritable pluriel" (Benveniste 1946, pg. 12). I do not explore this possibility here.

analysis makes no predictions about how these morphosyntactic properties will be realized phonologically, or whether they will be realized at all.

In the PC Morphology analysis, however, these facts have a straightforward explanation. The third person has no overt exponent not because it is a "non-person," but because it is possible for one value of each attribute to have no overt exponent with no damage done to contrast, an it is most economical for this valence to be the 3rd person, since this is the most frequent valence. Agglutinating plural forms such as *nàgenezè* 'you (pl) hunt' are ruled out because they incur too many alignment violations: since alignment is ranked above no-allomorphy in Athabaskan, it is preferable to express number by position 12 allomorphy, *nàahzè*. Redundant plural marking such as in *nàgeahzè* does not occur because it violates both alignment and no-allomorphy, with no additional contrast expressed, and so forth. Thus the Two Functional Projections analysis underdetermines the final outcome, while the PC Morphology analysis is more restrictive and is able to rule out most unattested scenarios.

6.0 Conclusion: Typology of Subject Agreement.

In the preceding analysis, I have shown how the three general principles of Contrast, No-Allomorphy, and Alignment are able to derive the phenomenon of split subject agreement in Athabaskan languages. In this section I will present some possible extensions of this approach.

I stated in the introduction that Athabaskan split subject agreement follows from three general principles: Contrast, No-Allomorphy, and Alignment. It can be shown that all attested morphological systems are in fact derived from different permutations of these constraints. Specifically, Sapir's typology of *isolating, agglutinating*, and *fusional* languages follows directly from Conrast, Alignment, and No-Allomorphy by factorial typology.

Figure 6.1: Morphological Typology.

Constraint-Ranking	Morphological Type	Languages
Alignment, No-Allomorphy >> Contrast	Isolating	Chinese, English
No-Allomorphy, Contrast >> Alignment	Agglutinating	Finnish, Turkish, Tamil, Inuktitut
Contrast, Alignment >> No-Allomorphy	Fusional	Indo-European, Athabaskan

It is impossible to satisfy all three constraint-types simultaneously. Each of the three language types mentioned above chooses to violate one constraint-family in order to satisfy the other two. An *isolating* language is a language that violates Contrast. English verbs incur very few violations of alignment (since they seldom have more than one affix), and only violate no-allomorphy in strong verbs, e.g. *sing ~ sang ~ sung*. However, English verbs carry little inflectional information. An *agglutinating* language is a language that freely violates Alignment. These languages freely pile affix upon affix, e.g. Tamil *sappiTTuttolaittukkoNDuviDugiriirgal* "you (pl) are definitely eating with contempt". Tamil verbs are very transparent and carry large amounts of inflectional, derivational, and adverbial information, but can get extremely long. *Fusional* languages violate No-Allomorphy. In Latin, for example, there is no single affix for "plural"; rather, this depends on whether the word in question is a noun or a verb, and the case and declension of the noun or person, tense, voice, and inflection class of the verb.

A more concrete illustration of this typology is given in Figure 6.2. Scenario A is the actual situation in Northern Athabaskan, with split subject agreement; scenarios B, C, and D are variations upon the Northern Athabaskan system, in the direction of increased fusion, agglutination, and isolatingness, respectively. Scenario B, the fusional scenario, incurs fewer alignment violations than scenario A, but incurs more violations of No-Allomorphy. Scenario C, the agglutinating scenario, satisfies No-Allomorphy, but incurs many more alignment violations than scenario A. Finally, scenario D, the isolating

scenario, perfectly satisfies both No-Allomorphy and alignment, but merges person and number contrast, since it has no inflectional affixes. Using OT Soft (Hayes, Tesar, and Zuraw 2003), I ran the factorial typology for 55 hypothetical scenarios, using the constraints given in Figure 4.9. The result was that, although "mixed" systems are harmonically bounded under the constraints used (e.g., a system that's isolating in the 1st person, agglutinating in the 2nd person, and fusional in the 3rd person), the split subject agreement system of Northern Athabaskan, both with and without number contrast in the 3rd person, emerges as optimal whenever (all other things being equal) [No-Allomorphy]^2 is undominated and the simplex constraint No-Allomorphy is low-ranked. That is, split subject agreement arises from a system that allows exactly two allomorphs for every feature, as illustrated in Figure 4.7.

While the PC Morphology model as presented in this paper is thus successful both in deriving the general cross-linguistic pattern of isolating, fusional, and agglutinating languages, and the split subject agreement system of Northern Athabaskan in particular, numerous issues remain. How are lexical exceptions to be accounted for, without losing typological generalizations, or even generalizations within a given language? Why do some languages have overt morphs for all values of an attribute, including third person, singular number, present tense, and so forth? How is the head-marking vs. dependent-marking distinction to be captured? These are all areas for future research.

Figure 6.2: Representative Typological Variants of *nà√zè*, in all Persons and Numbers .

[PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 1]$_i$ [NUM SG]$_t$]$_o$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 1]$_i$ [NUM DU]$_m$]$_p$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 1]$_i$ [NUM PL]$_n$]$_q$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 2]$_j$ [NUM SG]$_r$]$_r$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 2]$_j$ [NUM DU]$_m$]$_s$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 2]$_j$ [NUM PL]$_n$]$_t$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 3]$_k$ [NUM SG]$_u$]$_u$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 3]$_k$ [NUM DU]$_m$]$_v$ [PRED 'hunt <x, y>', ASP PERF, SUBJ$_x$ [PERS 3]$_k$ [NUM PL]$_n$]$_w$	Align(Adv-Stem)	Align(SubjNum-Stem)	$\underline{PC_{IN}(\pm pl)SubjNum}$ Conjunct	$\underline{PC_{IN}SubjPers}$ Conjunct	$\underline{[NoAll(Attr_\alpha)]^2}$ $Attr_\alpha$	$\underline{NoAll(Attr_\alpha)}$ $Attr_\alpha$
☞A. Actual (Split Subject Agreement). [nà-whe-{h}$_1$-zè]$_o$ [nà-whɪ-{ì}$_1$-zè]$_p$ [nà-{ts'e}$_n$-h-zè]$_q$ [nà-whɻ-{ɻ}$_j$-zè]$_r$ [nà-wh-{ah}$_j$-zè]$_s$ [nà-wh-{ah}$_j$-zè]$_t$ [nà-h-zè]$_u$ [nà-{ge}$_m$-h-zè]$_v$ [nà-{ge}$_n$-h-zè]$_w$	17	**				*(1st pers) *(2nd pers) *(pl)
B. Fusional. [nà-whe-{h}$_1$-zè]$_o$ [nà-whɪ-{ì}$_1$-zè]$_p$ [nà-whe-{ts'e}$_1$-zè]$_q$ [nà-whɻ-{ɻ}$_j$-zè]$_r$ [nà-wh-{ah}$_j$-zè]$_s$ [nà-wh-{ah}$_j$-zè]$_t$ [nà-h-zè]$_u$ [nà-whe-{ge}$_k$-zè]$_v$ [nà-whe-{ge}$_k$-zè]$_w$	17				*(1st pers)	**(1st pers) *(2nd pers)
C. Agglutinating. [nà-whe{h}$_1$-zè]$_o$ [nà{ge}$_n$whe{h}$_1$zè]$_p$ [nà{ge}$_n$whe{h}$_1$zè]$_q$ [nà-whɻ{ɻ}$_j$-zè]$_r$ [nà{ge}whɻ{ɻ}$_j$-zè]$_s$ [nà-{ge}whɻ-{ɻ}$_j$-zè]$_t$ [nà-h-zè]$_u$ [nà-{ge}$_m$-h-zè]$_v$ [nà-{ge}$_n$-h-zè]$_w$	21	10				
D. Isolating. [nà-zè]$_o$ [nà-zè]$_p$ [nà-zè]$_q$ [nà-zè]$_r$ [nà-zè]$_s$ [nà-zè]$_t$ [nà-zè]$_u$ [nà-zè]$_v$ [nà-zè]$_w$			***	***		

The following is the complete constraint-ranking, only a portion of which is represented in the table above:

$[\underset{\text{Feature}_\alpha}{\text{NoAll(Feature}_\alpha)}]^2$ >> $\underset{\text{Conjunct}}{\text{PC}_{\text{IN/OUT}}\text{SubjPers}}$, $\underset{\text{Conjunct}}{\text{PC}_{\text{IN/OUT}}\text{Asp}}$ >> Align(Clf-Stem) >> Align(SubjPers-Stem) >> Align(Asp-Stem) >> Align(Qual-Stem) >>

$\underset{\text{Conjunct}}{\text{PC}_{\text{IN/OUT}}(\pm\text{pl})\text{SubjNum}}$, Align(SubjNum-Stem) >> Align(Adv-Stem) >> $\underset{\text{Conjunct}}{\text{PC}_{\text{IN/OUT}}(\pm\text{dual})\text{SubjNum}}$ >> $\underset{\text{Feature}_\alpha}{\text{NoAll(Feature}_\alpha)}$

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