

# **Affixation and the Mirror Principle**

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**Abstract:** In a syntactiocentric approach to morphology, we expect to see morpheme orders which mirror syntactic structure. Three mechanisms are commonly proposed to change the order of syntactic terminal elements at the morphology/syntax interface, including head-movement, morpheme-specific prefix/suffix specification and morphological merger. Given that each mechanism is independently well-motivated, we can ask what kind of patterns we might expect to see when they co-occur. I argue that two particularly flagrant cases of Mirror Principle violations, in Cupeño and Navajo, can be accommodated within the syntactiocentric framework using just these tools, without positing any additional special word-formation mechanisms, or any additional quasi-syntactic operations.

## **1. Introduction**

In a framework in which word-formation, as well as phrase-formation, is considered to be the output of the syntactic component, the Mirror Principle is expected to hold quite generally, cross-linguistically—in other words, morpheme order should respect the hierarchy of syntactic projections, as the default situation. In certain cases, however, this ideal situation does not seem to hold.

In this paper, I first outline three mechanisms that have been proposed to create the attested linear order of affixal morphological elements within a syntactiocentric architecture—head-movement, morpheme-specific prefix/suffix specification and Merger Under Adjacency. Each of these mechanisms is clearly motivated by data from relatively simple phenomena in individual languages. Given that each mechanism is independently well-motivated, we can ask what kind of patterns we might expect to see when they co-occur, and also in what ways we might expect these mechanisms to interact with each

other. I show that two particularly flagrant cases of Mirror Principle violations, in Cupeño and Navajo, can be accommodated within the syntactocentric framework using just these tools, without positing any additional special word-formation mechanisms, or any additional quasi-syntactic operations. The line of argumentation follows closely that presented in Speas 1991.

## **2. Three mechanisms for syntactic manipulation of morpheme order**

Since Baker 1985, it has been recognized that something like the Mirror Principle is generally descriptively correct: morpheme order parallels the hierarchy of syntactic projections. In a syntactico-centric analysis of word formation, this descriptive generalization can be understood to fall out as a consequence of the basic operations which derive syntactic structures, given certain minimal assumptions concerning sub-word-level syntax. In particular, if bound morphemes occupy (or realize) syntactic terminal nodes just as free morphemes do, standard assumptions about the relationship between hierarchical structure and the linear order of terminals predict a very tightly constrained set of possible morpheme orders—too tightly constrained, as we will see, given the empirical situation in languages as familiar as English and as exotic as Cupeño.

Below, I first illustrate this typology with familiar data from French, showing a typical case of morpheme order predictions if complex words are formed by simple left-adjoining head-movement. Then I motivate enriching the head-movement mechanism to allow right-adjunction as well as left-adjunction with data from Cupeño (Hill 2005, Barragán 2003). Finally, I review the case from English proposed by Bobaljik (1994), among others, in favor of including a postsyntactic mechanism of Merger Under Adjacency in the mix, as a supplementary word-formation strategy. With these two

additional, simple and independently motivated mechanisms supplementing basic head-movement, I then go on to show that we have all the tools needed to syntactically produce the correct morpheme order in two particularly egregious cases of apparent Mirror Principle violations: the Cupeño complex predicate construction, and the Athapaskan verb.

## 2.1 *Head-movement*

First, consider the most constrained syntactic word-formation mechanism possible, namely, left-adjoining head-movement, producing consistently right-headed complex  $X^\circ$  structures. In basic X-bar syntax, one key assumption is that word-sized phonological elements correspond to  $X^\circ$  terminal nodes. Morphologically complex phonological words, then, can be derived by head-adjunction of one  $X^\circ$  to another, producing a larger  $X^\circ$  category with complex internal structure.<sup>1</sup> This is essentially Baker's 1986 theory of Incorporation, which, when applied generally, is one instantiation of a head-movement mechanism.

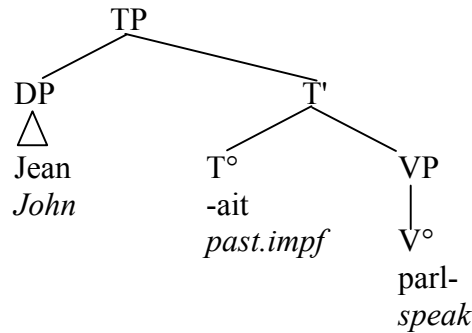
Left adjunction in head-movement in a left-headed language will result in the type of right-headed word structures so familiar from English and French. A simplified derivation of a French past imperfect verb formed by head-movement is illustrated in (1)

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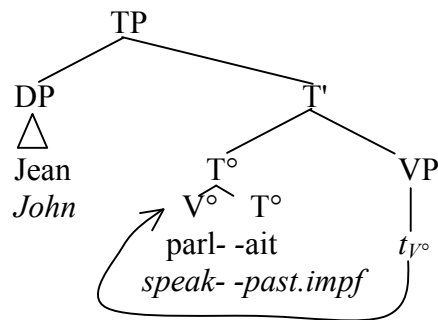
<sup>1</sup> Note that the complexity of the structure produced by head-adjunction raises a serious theory-internal difficulty for the Bare Phrase Structure approach (Chomsky 1995). For discussion and some proposed solutions, see Matushansky (2006) and Harley (2004); in the analysis here, we will continue to assume that head-adjunction which projects an  $X^\circ$  category is a theoretically straightforward and uncontentious operation.

below:

- (1) a. Structure before head-movement



- b. Structure after head-movement with left adjunction



"John was speaking."

If this were the only available mechanism for concatenating morphemes, the theory would be unable to generate any morpheme orders in which functional morphemes are prefixes to the lexical root in their extended projection.

## 2.2 Prefixation of functional material: Affix-driven adjunction

Such orders do exist, however, and so the theory must be augmented with additional assumptions or mechanisms. Below, an example from Cupeño illustrates a case in which one functional affix is prefixed to the verb stem, and another is suffixed—an underivable order if left-adjointing head movement is the only option available.

Cupeño is a head-initial language described in-depth in Hill (2004), and whose

verbal affixation patterns are analyzed in Barragan (2003). See also Newell (2008) for a treatment of the prosodic phonology in these and related verbal constructions.

In Cupeño verbs, both Tense/Agr and Aspect are affixes to the verb stem, but the Tense/Agr affix is prefixal, and the Aspect affix is suffixal, illustrated below:

- (2)    pe-ya-qál  
         3sg.past-say-Imp.Sg  
         “He was saying.” (Hill 2004 ex. 2c)

Barragan (2003), following Halle and Marantz (1993), makes the simple assumption that morphemes can individually specify whether they are prefixal or suffixal—that is, whether they precede or follow their sister constituent. Baker (1985) proposes that such prefix/suffix specification is possible on a language-wide basis; Barragan assumes it is possible for specific affixes within a language.<sup>2</sup>

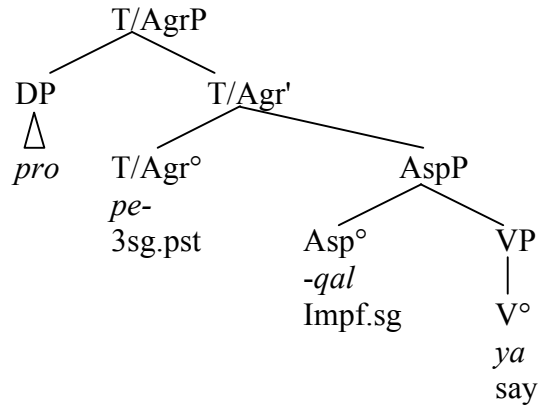
Assuming that Tense/Agr is prefixal and Aspect suffixal in Cupeño, the derivation of the example in (2) will proceed as in (3) below. In this, for simplicity, I assume that TP dominates AspP, which in turn dominates VP (simplified here, as in the French tree above, really vP + VP). This Mirror Principle-predicted order is crosslinguistically

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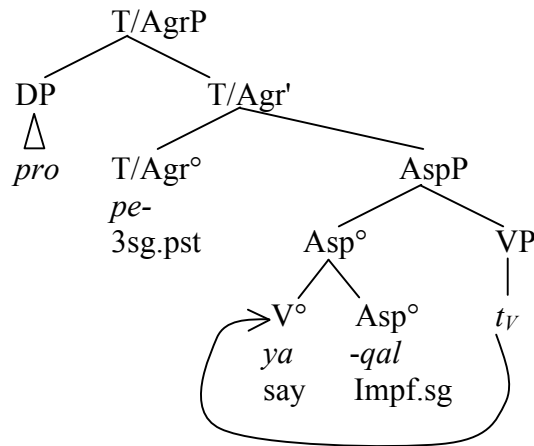
<sup>2</sup> Right-adjoining head-movement is impossible in the antisymmetric theory of Kayne 1994; we do not assume antisymmetry here. See Koopman and Szabolci (2000) for an in-depth treatment of affixation in an antisymmetric approach. They treat affixation as the result of extensive remnant movement plus a species of Merger Under Adjacency (see section 2.3).

attested as the most common one (Bybee 1985).<sup>3</sup>

(3) a. Structure before head-movement

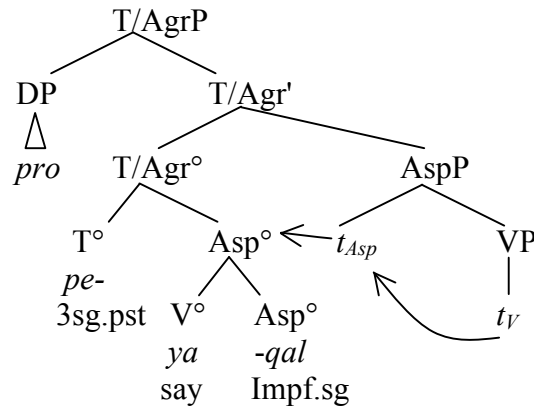


b. After the first step of head-movement: *-qal* attaches to the right of its sister



<sup>3</sup> Here, as noted, VP is shorthand for the usual vP+VP combination; the reader should assume that these verbs contain a null  $v^\circ$  morpheme, picked up by the verb as it head-moves up the tree to  $\text{Asp}^\circ$  and  $T^\circ$ . For a full representation of the derivation of this form, see the fully specified tree in (10). This will be especially important as we consider the derivation of further Cupeño forms in section 3.

c. After the second step of head-movement: *pe-* attaches to the left of its sister, the complex  $\text{Asp}^\circ$  head:



The choice of 'prefix' or 'suffix' is like a morpheme-driven variation on the Headedness Parameter. Just as the heads of phrasal syntactic projections may precede or follow their sisters, so too may the heads of  $X^\circ$  constituents. With respect to the syntactic Headedness Parameter, intra-language consistency is the typological ideal (Japanese being consistently head-final, French consistently head-initial, for example), but nonetheless certain 'mixed' systems do appear (German head-final VP, head-initial CP, e.g.). So too, we expect it to be the case that intra-language consistency is expected in word-level headedness, with e.g. English as a fairly solid example of a Right-Hand Head language at the word level,<sup>4</sup> but with Cupeño as an example of a mixed system, with certain  $X^\circ$  constituents being right-headed ( $\text{Asp}^\circ$ ) and others left-headed ( $T^\circ$ ).

Even the combination of optional, morpheme-driven headedness and head-movement is inadequate to cover many important cases of word formation in familiar languages—like English. In the next subsection, I describe Bobaljik (1994)'s approach to

<sup>4</sup> Thanks to a reviewer for reminding me that even English shows some RHHR violations, e.g. *en-* is a verbalizer in words like *ennoble*.

English do-support and the affixation of tense/aspect morphology, which adapts a mechanism first proposed by Marantz (1984): Morphological Merger, aka Merger Under Adjacency.

### 2.3 *Merger Under Adjacency: Word-formation without head-movement*

Since Emonds (1976), the difference in the relative position of temporal adverbials and negation in English and French has been analyzed as resulting from head-movement of the verb out of the VP into the inflectional domain in the latter, but not the former (see, e.g. Carnie 2006 for an introduction). Head-movement of the French verb to Tense accounts for the appearance of the tense/agreement morphology attached to the verb stem. The English verb, however, is also inflected for tense, except when negated or in questions, which presents a puzzle: How does English tense inflection come to be affixed to the  $V^o$  node, if the verb does not head-move out of the VP to Tense?

Bobaljik (1994) proposes a solution to this problem that exploits the post-syntactic operation detailed in Halle and Marantz (1993), Morphological Merger, or Merger Under Adjacency (MUA).<sup>5</sup> MUA applies to adjacent terminal nodes, adjoining one to the other even across phrase boundaries, enabling the appearance of affixation of a structurally superior element to a structurally inferior one—essentially, an

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<sup>5</sup> I will use the acronym 'MUA' for this operation, rather than M-merger, since Matushansky 2006 uses 'm-merger' for a similar but slightly differently defined operation. Morphological Merger is of course not to be confused with Chomsky (1995)'s phrase-structure-building operation Merge. For further discussion and development of the MUA operation, see Embick and Noyer 2001.



implementation of Chomsky (1957)'s Affix-hopping proposal within the context of modern generative grammar. Bobaljik shows that linear adjacency is a key restriction on the process; terminal nodes cannot undergo MUA if they are not linearly adjacent.<sup>6</sup> This restriction accounts for the need for *do*-support in negative contexts, when negation intervenes between Tense and V; in question contexts, when the subject intervenes between the T+C complex and V; and in emphatic contexts, when a positive polarity item like *so* intervenes between T and V (*I did **so** file my paperwork!*).<sup>7</sup> The linear-order restriction also serves as an argument for locating the MUA operation postsyntactically. Bobaljik assumes that linearization is an operation that applies to a fully derived syntactic representation, in accordance with the Headedness Parameter. Since linearization occurs after the syntactic derivation is complete, and since MUA is restricted by linearity

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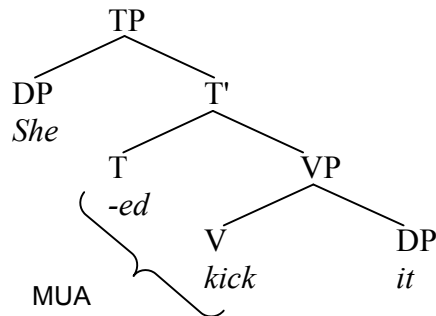
<sup>6</sup> Bobaljik excludes adverbs from intervention in the relevant sense, since Tense and V can combine despite the presumably intervening adverb in sentences like *I often walked to the store* (compare *I didn't often walk to the store*). He suggests that the failure of adverbs to intervene has a structural source in their status as adjuncts, rather than heads; apparently the MUA which applies in the English case only cares about linear adjacency relations between heads. See Embick and Noyer 2001 for further discussion and motivation for two distinct varieties of Merger Under Adjacency.

<sup>7</sup> Thanks to a reviewer for reminding me that positive polarity can also be indicated by prosodic emphasis; even this kind of non-segmental intervention can trigger *do*-support, and hence must be linearly present in the relevant sense: *I **did** finish my homework!* This is suggestive concerning the possible instantiations of Vocabulary Items, though orthodox DM proposals tend to only admit segmental VIs.

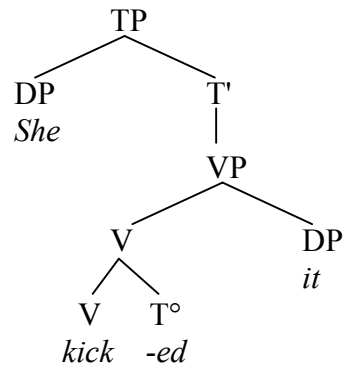
considerations, MUA must also apply after the syntactic derivation.<sup>8</sup> An MUA-like operation likely accounts for the dependent behavior of a range of affixal items and clitics, especially 'leaner' clitics like English possessive 's.

Bobaljik's proposal for MUA of English past tense is illustrated in (4) below:

(4) a. Before MUA of T to V.



b. After MUA



Note that MUA must right-adjoin T to V, rather than left-adjoin. This suggests that there could be morpheme-driven left- or right-adjunction resulting from MUA, just as there are left and right varieties of adjunction resulting from head-movement and syntactic head-adjunction. As for the head-movement case, it seems reasonable to treat this as a morphological specification—a property of the morphemes themselves, the phonological exponents that appear in each terminal node. It is a lexical property of *-ed* that it is

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<sup>8</sup> It could well be that the process of vocabulary insertion and linearization occurs in several cycles, progressively deleting syntactic structure; consider Embick and Noyer's 2001 evidence that adverbs *do* intervene in the MUA computation in comparative formation. It cannot be that linearization of terminal nodes erases hierarchical structure from the morphological representation; vocabulary item insertion often is sensitive to particular hierarchical structural contexts, not just linear ones, and VI insertion must follow (or be interleaved with) linearization phenomena.

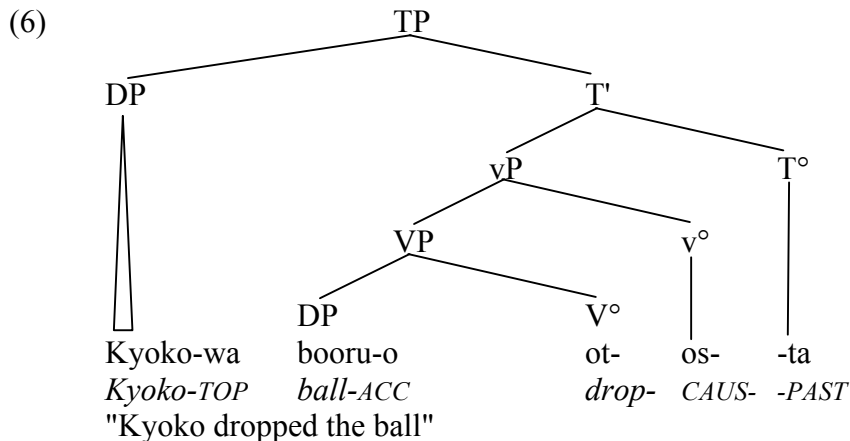
suffixal, similarly of *-ais* in French; these specifications, I will assume, drive the left- or right-attachment of the affix to its host, provided they are sisters under an  $X^\circ$  terminal node, regardless of whether that sisterhood relationship is derived via MUA or true syntactic head-movement.

#### 2.4 *Summary: Three tools*

To summarize, we have outlined three mechanisms which can affect the formation of complex words in the syntax. These mechanisms are outlined in (5) below:

- (5) A. Head-movement (Combines morphemes under one mother node in the syntax)
- B. Affix-specific linearization requirement (Morpheme is a suffix/prefix with respect to its sister constituent)
- C. Merger under adjacency (Combines morphemes which are adjacent but not under one mother node at the end of the syntax)

It is perhaps worth observing that given the availability of both A and C as morphological concatenation mechanisms, the correct analysis of complex surface forms in certain cases will be underdetermined without further syntactic investigation, as famously is the case of English *He walked*—we can see there is concatenation of *-ed* and *walk*, but without further data we cannot be sure whether the V *walk* has raised to T, or whether T *-ed* has undergone postsyntactic MUA with V (Emonds 1976 provided that further data). The problem is especially acute in head-final languages, where all the ingredients in the extended verbal projection, even without head-movement, are straightforwardly adjacent to each other and correctly ordered after the head-final headedness parameter is applied, as illustrated in (6).



Given the possibility of MUA, it requires quite sophisticated testing to determine whether head-movement has occurred or not. See Koizumi (1995) for an example of an analysis which applies testing along these lines for Japanese.

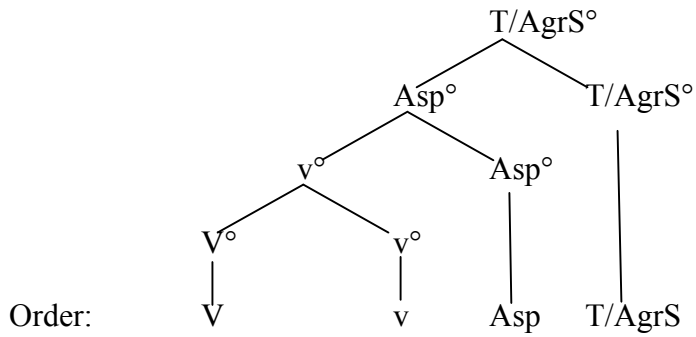
We now turn to a consideration of how and whether these three independently-motivated mechanisms can interact, proposing that it is precisely their interaction that leads to the derivation of certain apparent Mirror-Principle-violating morpheme orders in the polysynthetic languages Cupeño and Navajo. In particular, we will see that no special morphological or syntactic operations other than these are necessary to account for some extremely complex patterns.

### 3. Mirror Principle Violations I: Cupeño

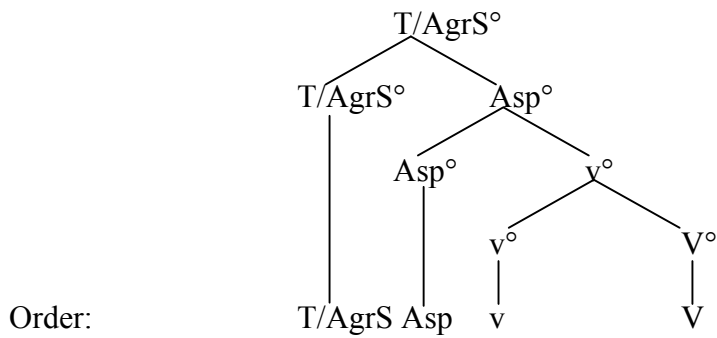
As shown in Speas 1991, using just the first two of our three mechanisms, we can already derive several different morpheme orders, all of which respect the Mirror Principle—that is, morpheme orders in which the linear arrangement of morphemes will respect the hierarchy of syntactic embedding. Imagine a complex head produced by head-movement of V up through three functional projections,  $v^\circ$ ,  $\text{Asp}^\circ$  and  $T^\circ$ . If each of these projections can be specified as a prefix or a suffix, we predict the existence of eight

Mirror-Principle-respecting possible morpheme orders. These orders are illustrated in (7) below:

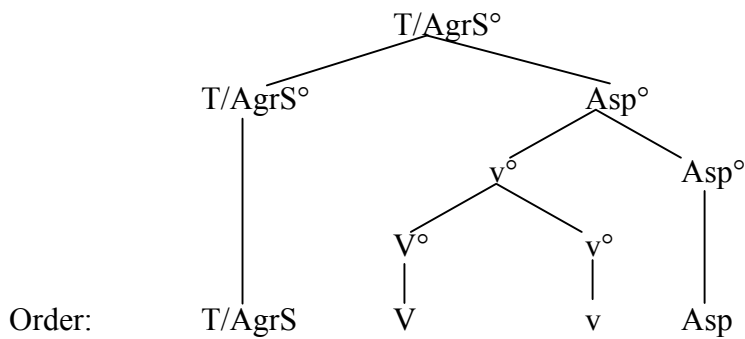
(7) a. Everything suffixal



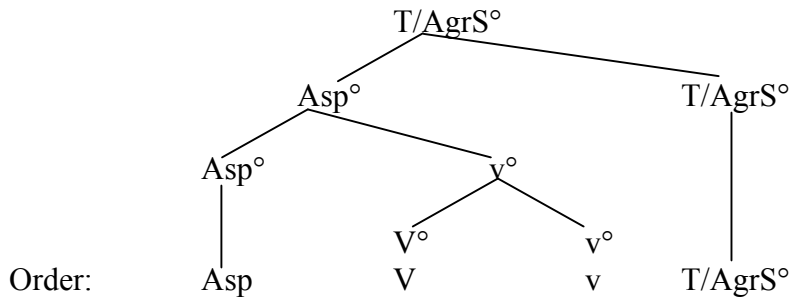
b. Everything prefixal



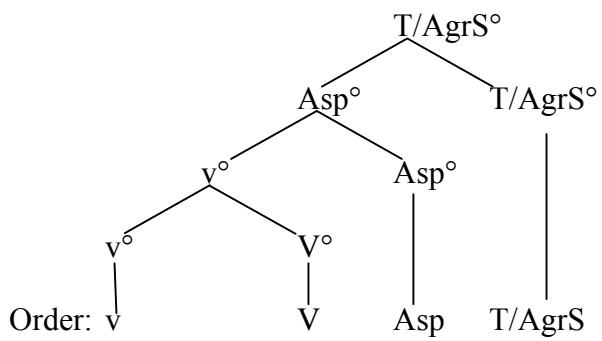
c. Everything except T/AgrS suffixal, T/AgrS prefixal



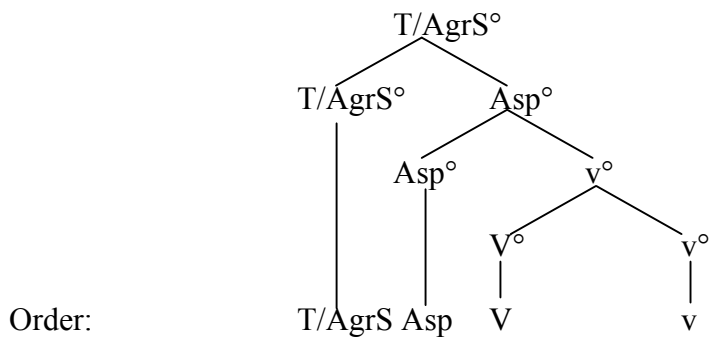
- d. Everything except Asp suffixal, Asp prefixal



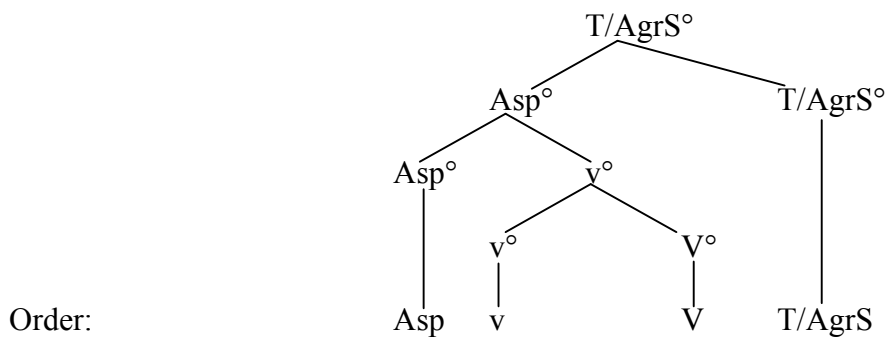
- e. Everything except v° suffixal, v° prefixal



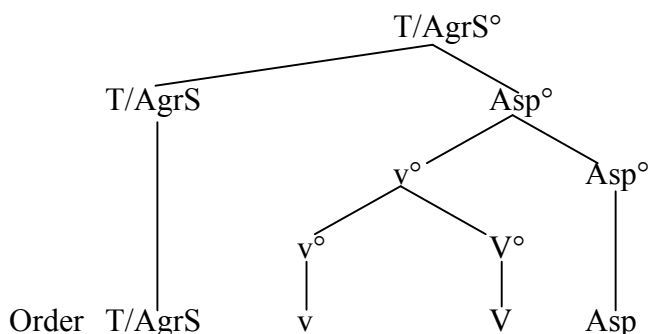
- f. Both T/AgrS and Asp prefixal, v° suffixal



- g. Both Asp° and v° prefixal, T/AgrS suffixal



h. Both T/AgrS and  $v^\circ$  prefixal, Asp suffixal:



Despite the flexibility allowed by combining affix-specific linearization with head-movement, certain morpheme orders are still predicted to be impossible—that is, the Mirror Principle is still a robust prediction, albeit somewhat lessened in force compared to a left-adjunction-only approach.<sup>9</sup> No morpheme order in which a higher morpheme like  $Asp^\circ$  or T/Agr intervenes between  $v$  and  $V$  is possible, for example; similarly, no higher morpheme like T/Agr could intervene between  $v^\circ$  and  $Asp^\circ$ , between  $v^\circ$  and  $V^\circ$ , or between  $Asp^\circ$  and  $V^\circ$ .

However, this kind of intervention is exactly what is observed with two large subclasses of Cupeño verbs—that is, these Cupeño verbs represent true violations of the Mirror Principle. Below, I present the data and analysis first proposed in Barragan (2003). An example of a fully inflected Cupeño verb of the *in*-class is given in

- (8) Túku='ep      mi-**wíchax**-ne-**n**-qal      temá-t'a-yka  
yesterday=R    3PL.OB-**throw**-1sg.Pst-**v**<sub>AGT</sub>-Imp.Pst.Sg    ground-ACC-TO  
"Yesterday I was throwing them to the ground."

<sup>9</sup> Speas 1991 doesn't appear to notice that certain orders remain impossible even assuming affix-specific ordering specifications; she states that in principle "any order at all can be derived." (p. 183)

Here we see a complex verb form in which the verb root is separated from a  $v^\circ$  element by T/Agr $^\circ$  morphology—exactly the type of structure which head-movement and affix-driven linearization, by themselves, cannot generate. However, if we allow affix-driven head-movement and Merger Under Adacency to apply to different parts of the same structure, this order can be syntactically generated in a relatively straightforward manner.

First, we need a little more background on the Cupeño verb, to justify the analysis of the *-n-* in the structure as a realization of a  $v^\circ$  terminal node. There are three major classes of Cupeño verbs described in Hill (2005). The first class are monomorphemic, like *ya-* 'say', which we saw exemplified in (2) above. The other two classes are bipartite, consisting of a root element, which occurs initially in the complex verb word, and a light-verb element which specifies the agentive status of the verb. *In-* class verbs have an Agent, while *yax-* class verbs do not. This is consistent with the analysis of these morphemes as realizations of  $v^\circ$ , since the  $v^\circ$  projection is associated with the appearance or absence of an external argument (e.g. Miyagawa 1994, 1998, Travis, 2000).<sup>10</sup>

In any verb with a  $v^\circ$  morpheme, the problematic pattern from (8) above appears, where the T/Agr morpheme intervenes between the  $V^\circ$  morpheme and the  $v^\circ$  morpheme. In the monomorphemic class, as illustrated in (2), the T/Agr morpheme simply appears as a prefix on the  $V^\circ$ , an order which poses no mirror principle problems, as described above. Data illustrating the affixation patterns of the three classes of verbs are given

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<sup>10</sup> As might be expected, inchoative/causative alternations in Cupeño often involve changing a *-yax-* for a *-in-*: *céne-in* is the basis for a sentence expressing 'x rolls y'; *céne-yax*, is the basis for 'y rolls'.



below:

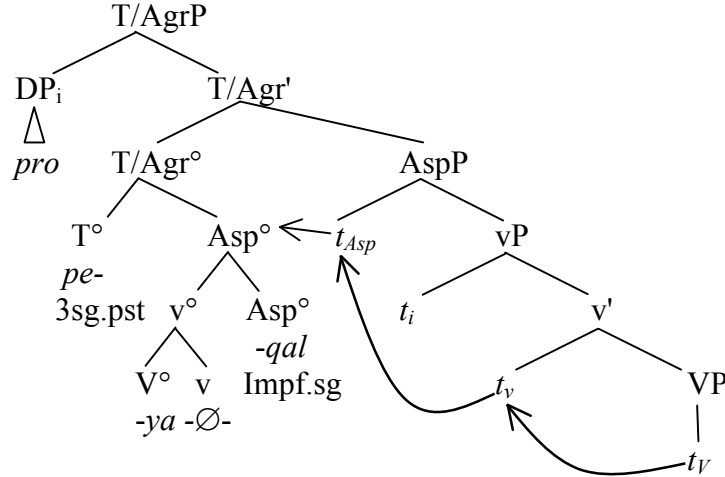
- |     |    |   |   |
|-----|----|---|---|
| (9) | a. | pe- <b>ya</b> -qál<br>Pst.3sg-say-Imp.Sg<br>“He was saying.”  | Ø-class verbs<br>Monomorphemic                    |
|     | b. | mi= <b>wíchax</b> -ne- <b>n</b> -qal<br>3PL.OB= <b>throw</b> -Pst.1sg- <b>vAGT</b> -Imp.Sg<br>“I was throwing them” | <i>in</i> -class verbs<br>Bipartite: Agentive     |
|     | c. | <b>nám</b> -pem- <b>yax</b> -wen<br><b>cross</b> -Pst.3pl- <b>vNonAg</b> -Imp.Pl<br>“They used to cross”            | <i>yax</i> -class verbs<br>Bipartite: Nonagentive |

Recall Barragan's derivation of the morpheme order of monomorphemic verbs like *pe-ya-qál*, in (2) and (9)a. Above, we saw that head-movement drove the affixation of  $(v+)V^\circ$  to  $\text{Asp}^\circ$  and then to  $T/\text{AgrS}^\circ$ , and that affix-specific linearization requirements resulted in prefixal  $T/\text{AgrS}^\circ$  and suffixal  $\text{Asp}^\circ$ . The proposed structure for the final complex head in (3)c above is reproduced more fully, below, as a reminder. In this tree, the full structure of the VP is represented, with a null morpheme occupying the  $v^\circ$  head and being carried along to  $\text{Asp}^\circ$  and  $T^\circ$  as the  $V^\circ$  head raises. The null  $v^\circ$  is represented as a suffix, though nothing hinges on this.<sup>11</sup> The subject is assumed to undergo A-movement from its base-generated position in  $\text{spec-vP}$  to  $\text{spec-TP}$ .

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<sup>11</sup> The illustrated morpheme order is that in the hypothetical case illustrated in (7)c above; if the null  $v^\circ$  were prefixal, then it would be like that in (7)h.

(10)



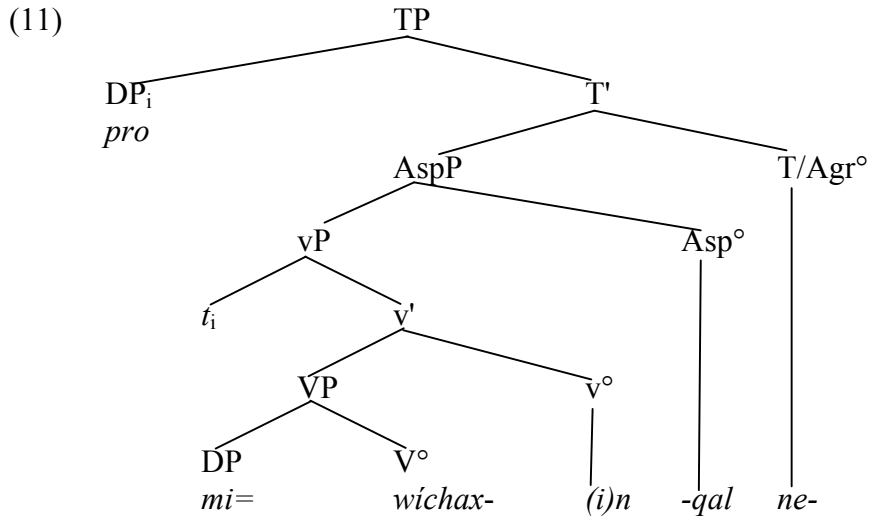
In order to derive the Mirror Principle-violating morpheme order with bipartite verbs, Barragan carries this analysis over wholesale to the other classes of verbs, with one small adjustment: In the bipartite verbs,  $v^\circ$ , rather than  $V^\circ$ , head-moves to  $T^\circ$ . In a sense, the pattern is exactly like that in a V2 language. There, a main verb will head-move to T except when there is an overt, intervening auxiliary verb, in which case the auxiliary moves to T, and the main verb remains *in situ* in the verb phrase. In the identical way, in Cupeño, V moves up to T iff there is no overt  $v^\circ$  morpheme, i.e. when the verb is a member of the  $\emptyset$ -class. When there is an overt  $v^\circ$  morpheme, as in the bipartite class,  $v^\circ$  moves to T, stranding the main V.

Let us consider Barragan's proposal for the derivation of the form (9)b above. Cupeño is in fact head-final, like most Uto-Aztecan languages, so the derivations below are represented in head-final trees.<sup>12</sup>

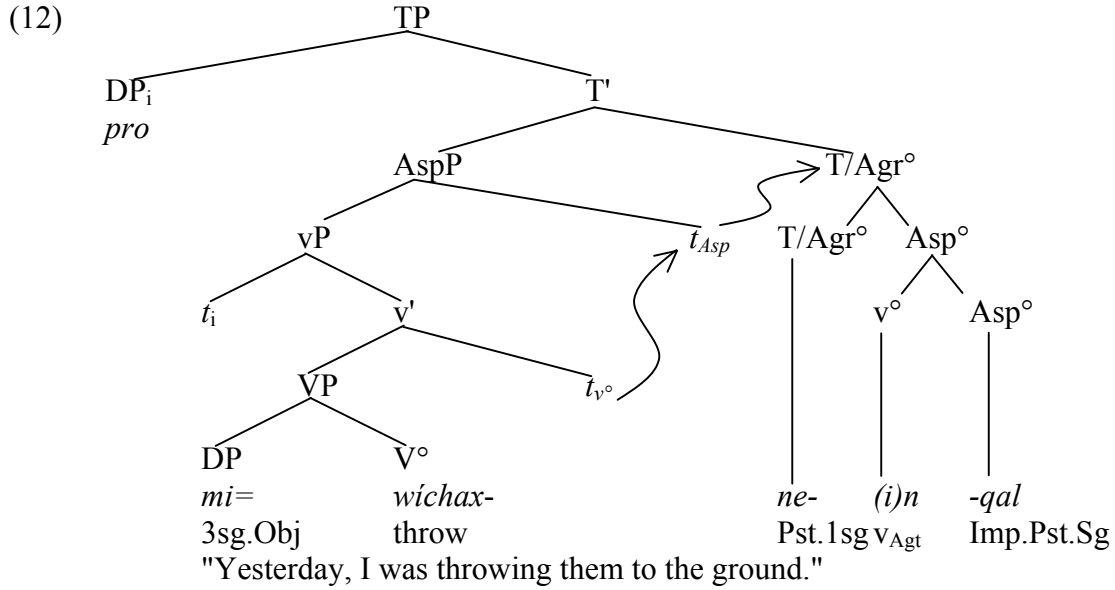
We begin with a tree containing the subject pronoun (*pro*), an object clitic

<sup>12</sup> Nothing relevant would change about the initial discussion of (2) in a head-final structure; the structures in (2) are represented head-initially above just for ease of exposition and comparison with French and English.

pronoun (*mi=*), and the verbal affixes in their base positions, V, v, Asp and T/Agr°, illustrated in (11)



The  $v^\circ$  morpheme is *-in-*, a non-null light verb which can behave like an auxiliary and support affixation, so the  $V^\circ$  stays *in situ*. The  $v^\circ$  raises by head-movement up through  $Asp^\circ$  and  $T^\circ$ , which linearize according to the morpheme-specific prefix/suffix specifications that we observed above in the derivation of the zero-class form in (2). In particular, the  $Asp^\circ$  morpheme *-qal* suffixes to the light  $v^\circ$  *(i)n*, and the  $Tense^\circ$  morpheme *ne-* prefixes to the complex  $Asp^\circ$  head *(i)n-qal*. This results in the structure below:



This structure is the output of the narrow syntax. Notice that the main verb, which has remained *in situ*, is adjacent to the T/Agr° complex to its right. Consequently we can then perform Merger Under Adjacency of the T/Agr° complex with V° to create the final complex V° form.<sup>13</sup> When v° is a zero-morpheme, all of the above operations still occur, but the V° itself must move, first through v° and then to Asp° and T/Agr°, as illustrated in (10).

In short, by exploiting the logical possibilities inherent in the three independently motivated word-formation techniques—head-movement, affix-driven linearization, and Merger Under Adjacency—Barragan is able to derive the puzzling patterns of the inflected Cupeño verb in a principled manner. Note the diachronic plausibility of the account, as well: It seems likely that the v° affixes originally had their source as

<sup>13</sup> We can perform the same operation to add the base-generated object clitic to the entire complex verb form, or that clitic could be positioned by some other syntactic clitic-movement operation; I leave the question unresolved here.

freestanding zero-class auxiliary-like verbs, patterning exactly like them and selecting perhaps some kind of nominalized or other nonverbal contentful complement. Over time, the complement itself was reanalyzed as V or  $\sqrt{\text{ }}$ , the auxiliaries lost their free-standing status, and the result was the peculiar hybrid pattern presented above.

Next, we turn to another, more famous, example of a Mirror Principle puzzle: the derivation of morpheme order in the Athapaskan verb.

#### 4. Mirror Principle Violations II: Navajo

Some of the most famously intractable morphological systems are those of the Athapaskan languages, most often represented by Navajo (Speas 1990, 1991, Rice 2000, Hale 2004, Den Dikken 2003, Travis 2008, this volume, among others). Among their many other morphological complexities, these languages present a Mirror Principle problem similar to that of Cupeño, except even more elaborate in nature. Athapaskan verbal cores typically contain two or three 'lexicalized' parts which are separated by a host of inflectional material, occurring in a fixed order. I will argue that even these difficult systems are amenable to analysis with the same morphological tools we have introduced to date, and that no other novel word-building mechanisms need to be posited, despite many proposals to the contrary (see, e.g., Hale 2001, 2004, Travis 2008, this volume, as well as the family of templatic proposals argued against by Rice 2000).

In (13) below I present a sample Navajo verb, taken from Young and Morgan 1987:283, as cited in Hale 2001:

- |      |  |                    |
|------|--|--------------------|
| (13) | Ch'ishidiniłdązh   | Surface form       |
|      | <b>ch'i-</b> <b>sh-</b> <b>d-</b> <b>n-</b> <b>ł-</b> <b>dązh</b>                    | Morphemic analysis |
|      | <i>out-</i> <i>1sgO</i> <i>limb-</i> <i>Perf-</i> <i>Trans-</i> <i>move</i>          | given in Hale      |
|      | <i>horizontally</i> <i>related (3sgO)</i> <i>jerkily</i>                             |                    |
|      | "He jerked me" (from a sentence translated <i>The policeman jerked me outdoors</i> ) |                    |

The bolded portion of the example above constitute a single semantic unit, an example of the way in which the core Navajo verb is frequently morphologically bipartite, separated by considerable inflectional material, but semantically unified—here, the combination of *ch'i-* and *-dazh* are interpreted as 'jerk'. The combination of the prefixal and root portions of the lexical verb can be perspicuously thought of as similar to Germanic verb-particle constructions (e.g. *look up* 'find entry in a reference work'), where the initial element corresponds to the particle and the root at the right of the complex verb word corresponds to the verb.

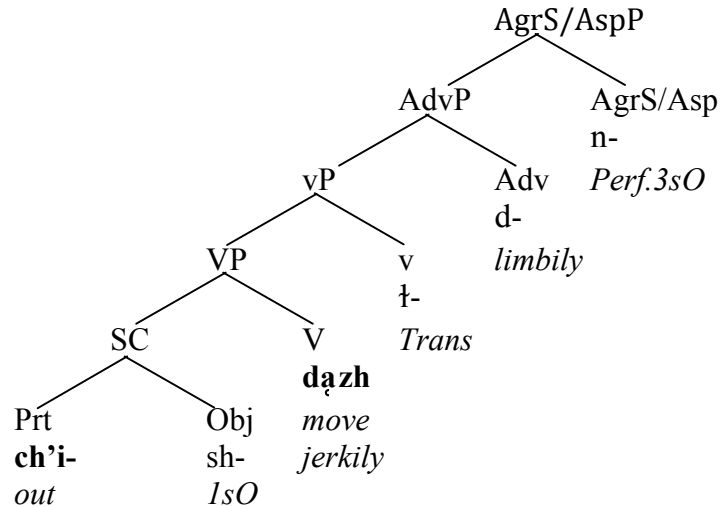
Following the initial particle is a range of more productive inflection-like markers, which occur in the following order: Object Agreement, Adverbial, Aspect, Subject Agreement, Transitivity. Following all of the above is the syllabic verb root.

I will begin by making the following assumptions concerning the general extended verbal projection in the Athapaskan verb, modelling the basic format on a version of that motivated for the Germanic verb word. The overall structure, indicating the assumed base-positions for the morphemes in (13) are illustrated below<sup>14</sup>:

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<sup>14</sup> I have omitted a *pro* DP in the specifier position of the AgrS/Asp projection for ease of exposition, though I assume it is present. I am assuming that the object morpheme is pronominal and clitic-like, occupying an argument position; adjusting that assumption to include an object *pro* and an object-agreement head position would not affect anything crucial about the analysis, as long as the AgrO projection occurred low enough in the structure, crucially below V°.

(14)



The key assumptions are the following:

- (15)
- a. Prt+Obj start out in a small-clause-like configuration (as for Germanic particles)
  - b. Verb root and v projected above that
  - c. Aspectual, tense, and other inflectional-domain material projected above that as usual

Certain of these assumptions may be controversial in their specifics (for example, the assumption that a small clause contains both the particle and the object), but the overall architecture is quite familiar; perhaps the most unusual element is the inclusion of an AdvP containing the element denoting the instrumental manner in the extended verbal projection. However, this is in line with the proposal of Cinque (1999) that adverbial projections do form part of the inflectional spine. Here, the adverbial element is assumed to be realized in the head of the AdvP projection, consistent with its status as an affixal element within a verb-word; in languages where adverbs are generally phrasal, like English, Cinque assumes that they occupy the specifier of AdvP. Positioning the adverbial affix *-d-* in the head position of AdvP should not affect the core ordering predictions of Cinque's proposal, however; presumably AdvPs, like other XPs, can exhibit spec-head agreement, such that specific adverbial features are present in both the

head and the specifier. Whether a language chooses to realize the head  $\text{Adv}^\circ$  position or the specifier of  $\text{AdvP}$  position or (perhaps) both could be a parametric property related to polysynthesis generally.<sup>15</sup> The overall picture is consistent with Rice (2000)'s assertion that morpheme order in Athapaskan verbs respects semantic scope.

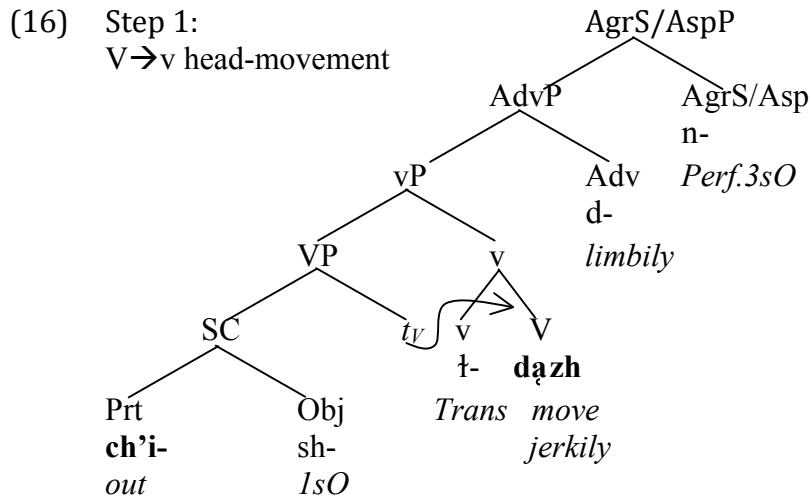
The three phrasal domains outlined in (15) correspond to the three general domains of the Athapaskan verb-word: the initial preverb+object domain, the central inflectional domain and the root+transitivizer domain. Considered independently, none of these groups of morphemes violate any aspect of the Mirror Principle; it is only as a whole that the entire verb-word poses such significant problems. However, given the tools introduced above, we can easily assemble the entire complex verb—we need only assume two (syntactic) head-movement operations in combination with a pair of Merger Under Adjacency operations, conditioned by affixal preferences. The derivation, starting from the base-position illustrated in **Error! Reference source not found.**, is illustrated in (16)-(18) below.

First, V head-moves to  $v^\circ$ , right-adjoining to it, as Navajo  $v^\circ$  is specified as a prefixal element:

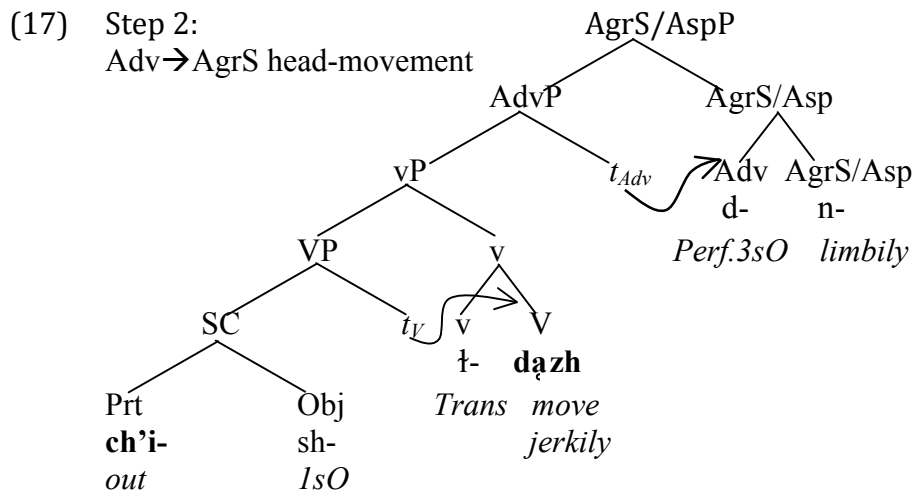
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<sup>15</sup> Perhaps a language cannot choose to fill both the specifier and head positions of  $\text{AdvP}$ , if something like a generalized Doubly-Filled Comp Filter is in effect for A-bar positions generally.





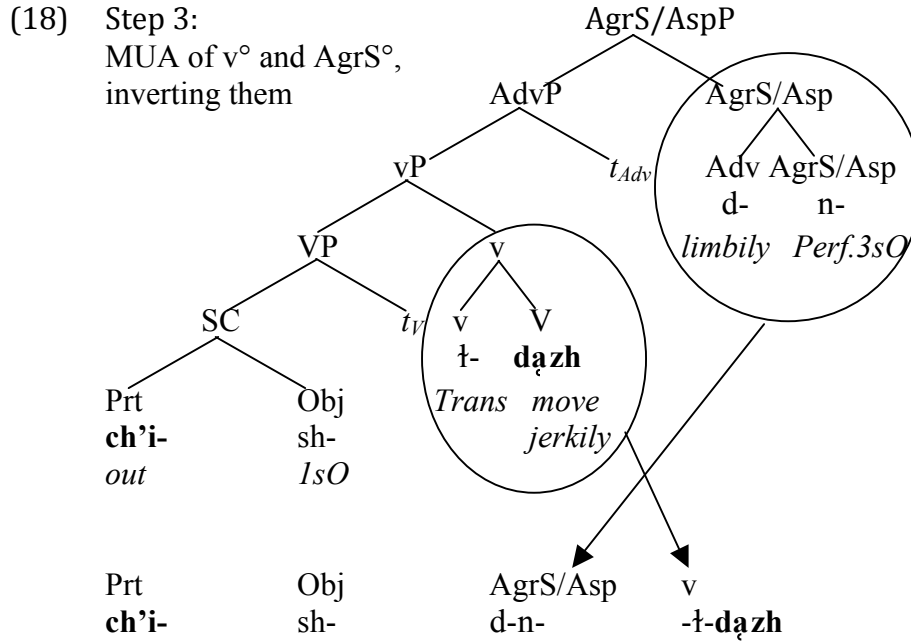
Next, Adv<sup>o</sup> head-moves to AgrS/Asp<sup>o</sup>, this time left-adjoining to it, as Adv<sup>o</sup> is specified as a prefixal element:



Note that these two movements, which I assume must take place in the syntactic component, could occur in separate phases; nothing adverse would result if the syntactic derivation proceeded stepwise, sending each separate domain to spell-out as it is formed. However, it is crucial that all three spelled-out domains are accessible in the morphological component simultaneously, for the next steps.

In the post-syntactic domain, the v+V complex and the AgrS/Asp complex undergo Merger Under Adjacency—Affix-Hopping of complex X<sup>o</sup> constituents. The

former suffixes to the latter, as we assume that Adv<sup>o</sup> is listed as prefixal:



All the morphemes in (18) are now in the correct order. The particle and object can undergo MUA/cliticization with the remainder of the verb "*in situ*", as it were, and the complex morphophonological processes that derive the final surface form of the Navajo verb-word can be implemented.

## 5. Conclusions

In the above, following Speas 1991, I have simply drawn on extant, eminently reasonable proposals concerning affixation in various languages to spell out the notion that in addition to head-movement, our arsenal of tools for coping with affixation must include both Merger Under Adjacency and a recognition that morphemes are inherently specified for their prefixal and suffixal selectional restriction (along with other specific selectional restrictions which it is clear that morphemes are subject to).

I have demonstrated that relaxing the assumptions surrounding affixation from

strict left-adjoining head-movement to allow for the occasional application of these other operations allows us to derive morpheme orders as complex as need be. Certain orders are predicted to be impossible in very complex contexts, given that syntactic head-movement must precede Merger Under Adjacency, but for most purposes, pretty much any morpheme order could be generated with these quite simple mechanisms.

One could conclude, then, that in fact the Mirror Principle has been robbed of its predictive power entirely, and that it is never valid to draw conclusions about the order of syntactic projections from morpheme order. In fact, I would argue (following Rice 2000) that this is not so. Certain kinds of Mirror Principle violations have important implications for clausal syntax—in particular, situations in which morpheme orders clearly *respect* semantic scope, yet where the syntactic derivation seems to be at odds with that morpheme order in important ways. In other work (Harley 2007, in prep), I have argued that the interaction of Hiaki applicative and causative morpheme are such a case, where we are entitled to draw robust conclusions about the syntactic architecture because of scopally significant interactions depending on the order of these two morphemes.

It is only in cases like Cupeño, or Navajo, then, that appeal to these postsyntactic ordering mechanisms need be made. Indeed, in such cases that the acquiring child could have positive evidence that such additional mechanisms have applied. Let us assume that the child's default assumption is that complex heads are derived by head-movement, and that the hierarchical Mirror Principle applies. If the general order of the extended projection is provided by UG, interacting with conceptual structure, and assuming the child can identify morphemes in the input via a combination of morphophonological co-

occurrence analysis and semantic deduction, mismatches between morpheme order and the extended projection can motivate the application of these limited additional mechanisms.<sup>16</sup> Economy constraints will dictate that as little use as possible should be made of such language-specific processes. The typological rarity of the Cupeño and Navajo patterns, then, is predicted; they require a complex combination of distinct affixation mechanisms to derive. Each mechanism by itself may well occur relatively frequently, and in familiar languages (Merger Under Adjacency in English verb tense specification, prefix/suffix specification in e.g. Swahili). Only in rare cases, however, will they interact with each other and with syntactic head-movement simultaneously—hence the comparative markedness of the type of pattern analyzed here.

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<sup>16</sup> This type of consideration is key in any theory of these phenomena; for example, in Den Dikken's 2003 checking theory, involving a parameter for inside-out or outside-in mirroring, the choice between inside-out or outside-in for the acquiring child would also have to be driven by an observed mismatch of this type. However, the Cupeño pattern, where the mirror seems to apply in two different directions at once, seems potentially difficult for the restricted checking theory to account for.

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