Chris Worth
Department of Linguistics

July 31, 2008
The Ohio State University

A Hypothetical Proof Account of Chamorro Wh-agreement

Abstract

Chamorro is an Austronesian Language spoken primarily in Guam, which is generally taken to have VSO word order. It displays an interesting pattern of agreement in unbounded dependency constructions, whereby the verb agrees via infixation with the grammatical relationship between each verbal head and the constituent from which the element has been extracted, be it subject, object, or oblique. Convergent Grammar (CVG) is a relational, multi-modal, type-theoretic, resource sensitive grammatical framework which "can be seen as a coming together of ideas of widely varying provenances, be they transformational, phrase-structural, or categorial." (Pollard (2007a)) The question of how a verbal head can agree with an extracted element can be accounted for in this framework using a combination of lexical specification and rules of natural deduction, in particular the notion of hypothetical proof. Embedded constructions are of particular interest, as each verb's agreement morphology varies with the corresponding variance in the grammatical role of the extracted element within the verb's arguments or adjuncts. [1]

1 Overview

Chamorro is an Austronesian Language spoken primarily in Guam, which is generally taken to have primarily VSO word order. It displays an interesting pattern of agreement in certain unbounded dependency constructions, whereby "the verb ... agrees in grammatical function with the gap" (Chung and Georgopoulos (1984)), be it subject, object, or oblique. Chung (1998) revises this to agreement with a trace, but both of these are a slightly incorrect formulation, as agreement is based not on the verb's relation to the gap (or trace), but with the verb's relation to whichever of its dependents (syntactic argument or adjunct) **contains** a gap. In some cases this may be just the gap itself. The question of how a verbal head can agree with an extracted element can be accounted for in this framework using a combination of lexical specification and rules of natural deduction, in particular the notion of hypothetical proof.

[1] The ideas presented in this paper would no doubt be poorer were it not for the gracious help of Carl Pollard, David Dowty, Bob Levine, Judith Tonhauser, Scott Martin, Andy Plummer, and Lia Mansfield. Special thanks are due to the participants of the LMNLDS workshop at DGfS 30, and to Sandra Chung, whose timely email helped clarify a puzzling piece of data. Anything misleading or untrue is undoubtedly the responsibility of the author.

1.1 Convergent Grammar (CVG)

Dependencies in Convergent Grammar (CVG) are modeled with different 'flavors' of implication which have natural deduction (henceforth ND) rules associated with them. Local dependencies are modeled with implication elimination (*modus ponens*), or 'merge' rules, which are similar to right and left function application connectives in most categorial grammars. The primary difference here is that each syntactic mode of implication has its own associated ND rules. Nonlocal dependencies are modeled with flavors of implication with no elimination rule ('move'), in conjunction with hypothetical proof (implication introduction). More precise illustration of CVG mechanics follows in the 'Derivation of Selected Examples' section.

2 Examples

Morphology relevant to the wh-agreement phenomenon appears in boldface in the following examples.

2.1 Canonical Declaratives

(1) a. Ha-fa'gasi si Juan i kareta.
agr-wash UNM Juan the car
'Juan washed the car.' (Chung (1998) ch.6 ex.(52))

b. Ha-ottu i petta i patas-su.
agr-bang the door the foot-agr
'The door banged my foot' (Chung (1998) ch.2 ex.(31)a)

c. Mang-ákati i famagu'un.
agr-cry.Prog the children
'The children are crying.' (Chung (1998) ch.2 ex.(23)a)

2.2 Subject Extraction

(2) a. Hayi f**um**a'gasi ___ i kareta?
who? *WH*[nom].wash the car
'Who washed the car?' (Chung (1998) ch.6 ex.(53)a)

b. Hayi **um**-ayuda hao ___ ?
who? *WH*[nom]-help you
'Who helped you?' (Chung (1998) ch.5 ex(41)c)

c. Hayi **mu**-na'i ___ hao nu ennao na lepblu ?
who? *WH*[nom]-give you OBL that L book
'Who gave you that book?' (Chung (1998) ch.2 ex.(81)a)

Following Chung (1998), 'linker' is glossed as *L*.

2.3 Object Extraction

(3) a. Hafa f**in**a'tinas-**ñiha** i famalao'an ___ ?
what? *WH*[obj].make-agr the women
'What did the women cook?' (Chung (1998) ch.5 ex.(39)a)

b. Hafa s-**in**-angane-**nña** si Maria nu hagu ___ ?
what? *WH*[obj2].say.to-agr UNM Maria OBL you
'What did Maria tell you?' (Chung (1998) ch.6 ex.(73)a)

c. Hafa k**in**annóno'-**mu** ___ ?
what? *WH*[obj].eat.Prog-agr
'What are you eating?' (Chung (1998) ch.6 ex.(58))

2.4 Adjunct Extraction

(4) a. Hafa pära fa'gase-**mmu** ni kareta ___ ?
what? FUT *WH*[obl].wash-agr OBL car
'What are you going to wash the car with?' (Chung (1998) ch.6 ex.(53)c)

b. Hayi ma'a'ñao-**mu** ___ ?
who? *WH*[obl].afraid-agr
'Who are you afraid of?' (Chung (1998) ch.6 ex.(5)a)

2.5 Embedded Constructions

(5) a. Hafa s**in**angan-**ã** si Juan pära godde-**tta** ni
what? *WH*[obj].say.his-agr UNM Juan Fut *WH*[obl].tie.our-agr OBL
chiba ___ ?
goat
'What did Juan say that we should tie up the goat with?' (Levine & Hukari (2006) ch.3 ex.(63))

b. Hafa malago'-**ña** si Magdalena pära **ta**-chuli' ___ ?
what? *WH*[obl].want-agr UNM Magdalena Fut *WH*[obj].agr-bring
'What does Magdalena want us to bring?' (Chung (1998) ch.6 ex.(84)a)

3 The Wh-agreement Paradigm

Adapted here from Hukari and Levine (1995):

If the argument dominating the gap is:	Then the verb is marked as follows:
Nominative (Subject)	Replace ergative agreement with *-um-*
Object	Optional nominalization; if the verb is transitive, insert *-in-*
Oblique (= neither of the above)	Nominalization; if the verb is unaccusative, optionally insert *-in-*

It is worth noting that the morphological case requirements of nouns are specified by the verbs themselves. In a declarative sentence, subjects and first (direct) objects appear in the unmarked case, while second (indirect) objects and instruments appear in the oblique case. When verbs are nominalized, this has the effect of forcing all of the verb's complements to be marked as oblique (Chung, p.c.).

4 The Central Issue

The marking of extraction on items along the extraction path has been well documented, notably by McCloskey's work on Irish complementizer alternation. As noted by Levine and Hukari (2006), Irish complementizers exhibit the same patterns regardless of whether the extractees are arguments or adjuncts. Chamorro presents a subtly different problem. While verbal agreement with various complements is certainly not a rare phenomenon, the issue of agreement with adjuncts is somewhat more problematic. If adjuncts are taken to adjoin at the VP level, then by what mechanism can the verbal head 'see' the adjunct? It is noteworthy that the Irish complementizers mark entire clauses, and as such, may be immediately sensitive to adjunct material. But this is not the case with Chamorro – how is it possible that a verb can be required to agree with material that does not appear to be accessible by the verb itself? Additional complications are presented by the fact that the agreement paradigm is based on the grammatical relationships between each verb and its **own** particular dependents, rather than the relationships between the verb and and the gap itself.

5 Basic Strategy

Since the cases we are examining are ones where wh-agreement is morphologically marked on the verbs, it is possible to think of the differing verb forms as having slightly different lexical specifications. Each verb must be sensitive to which one of its arguments has something 'missing' and must in turn report that fact that to 'higher' material, in order to preserve the informational pathway between filler and gap.

Of course, this still fails to address the issue of adjunct extraction. Chamorro's system for nominal case marking provides a tantalizing hint of how the empirical phenomenon may be captured. We have already noted that nominalized verbs force their complements to be marked with oblique case. It is a fairly small step to assume, then, that the difference between argument and adjunct in extracted contexts is less than one initially expects. If verb forms bearing wh-agreement morphology actually select for syntactic elements that are generally taken to be adjuncts in garden-variety sentences, then the issue becomes moot. While it may initially seem counterintuitive to treat a verb as selecting for an adjunct, I note that the wh-extracted adjunct agreement morphology in Chamorro appears in exactly these contexts, indicating that effectively, the verbs **do** require that an adjunct be present. As such, there is nothing terribly odd about analyzing adjuncts as arguments in these specific cases.

Take, for example, the following lexical entry for the verb *godde-tta* 'tie (up)':

(6) $_{\text{SL}} : e : A \vdash \mathsf{godde-tta} : (\text{Unm} \circ \text{Obl} \circ (\text{Obl} \multimap_{\text{SL}} \text{Obl})) \multimap_{\text{C}} \text{Fin}$

From the right of the turnstile, we read this as '*godde-tta* takes, as its complement list, an unmarked NP (Unm - corresponding to a subject), fused with an oblique NP (Obl, corresponding to a direct object) fused with an oblique argument gap (Obl $\multimap_{\text{SL}}$ Obl), and yields a (hypothetical) finite sentence'. Here, (Obl $\multimap_{\text{SL}}$ Obl) represents the extracted instrument.

The issue of filler-gap connectivity is also addressed in a partially lexical manner. Verb forms which select for extracted material must contain the information that 'something is missing'. I propose to treat this as a lexical specification: the verb forms themselves maintain the 'gappy' nature of their argument structure. This is represented in the lexical entry (6) above by the 'slashed' variable *e* appearing as a hypothesis to the left of the turnstile.

6 The Role of Hypothetical Proof

The use of hypothetical proof allows us to distinguish phrases with gaps from 'intact' phrases in our syntactic typing, and it is possible to write lexical entries for the wh-agreeing verbs that effectively select for phrases with gaps of the requisite type.

Since the logical formalism on which CVG is based is one which contains logical rules of hypothetical proof, it is possible to model wh-extraction using the introduction of hypotheses and their subsequent withdrawal via ND move rules analogous to implication introduction. The strategy is to treat a trace as a variable hypothesis of a certain syntactic type which is stored in the field of the variable context labeled SL[2].

(7) If $\text{SL} : t : A, \Gamma \vdash s : B$, then $\Gamma \vdash \lambda_t^{\text{SL}} s : A \multimap_{\text{SL}} B$.

It is precisely this mechanism that allows phrases with gaps to be subcategorized for. We now have a syntactic type, $A \multimap_{\text{SL}} B$, which represents a syntactic term of type B that contains a gap of type A. However, it is important to note that the hypothesis no longer exists as a hypothesis – it is entirely contained within the type system. As in most categorial grammars and versions of HPSG, once a slashed element is 'cashed out' it is no longer accessible. That is, once the 'gappy' phrase is taken as an argument we no longer have knowledge that it has a gap.

The question remains: how may this information be passed up? The final step is to specify that the lexical entries for wh-agreeing verbs contain hypotheses of their own, allowing for selection from and embedding within higher material. This is illustrated, as previously noted, by the material to the left of the turnstile in (6). Verbs which subcategorize for slashed material themselves carry hypotheses **different** from those present in the selected material. This has the nice benefit of providing a straightforward account of how multiple verbs along an extraction path may have differing agreement morphology. Since each verb which subcategorizes for a gap has its own hypothesis, it is possible to subsequently withdraw **that** hypothesis as well, etc. Now we can see that the agreement relation between verbs and arguments containing gaps can easily and naturally be described by this iterative hypothesis introduction and withdrawal strategy. Once the hypothesis is withdrawn for the first time, it is no longer important what type it is, since the filler in all of these cases will just be a wh-word which is not marked for specific grammatical function. What is important to maintain is the knowledge that somewhere down the line, there is a gap. We now have everything we need to account for (5a). A line-by-line derivation follows in the next section.

[2]As argued by Pollard (2007a), this field is subject to the structural rule of contraction, thereby licensing parasitic gaps.

7 Derivation of Selected Examples

7.1 Notes

The exact status of oblique noun phrases is unclear – for the time being, I take Obl to abbreviate (Unm $-\circ_{\mathrm{SU}}$ Fin) $-\circ_{\mathrm{AD}}$ (Unm $-\circ_{\mathrm{SU}}$ Fin), in a manner similar to a categorial grammar-style treatment of VP adjuncts. This is not to say that all oblique NPs are adjuncts; the type system will allow for them to be selected for as verbal complements if necessary. The connective $-\circ_{\mathrm{AD}}$ is an implication-type connective for adjuncts.

7.2 Rules

Fusion: If $\Gamma \vdash a : A$, and $\Gamma' \vdash b : B$, then $\Gamma, \Gamma' \vdash (a \cdot b) : A \circ B$.
This rule schema allows the creation of ordered lists. This will be useful with respect to certain types of verbs (ditransitives, for example) which, following Pollard (2007a), I treat as taking all of their complements concurrently.
Complement Merge (C–Merge):
If $\Gamma \vdash v : A -\circ_{\mathrm{C}} B$, and $\Gamma' \vdash o : A$, then $\Gamma, \Gamma' \vdash (v\ o\ ^{\mathrm{C}}) : B$.
This is a simple *modus ponens* (implication elimination) rule schema that is specifically relative to the $-\circ_{\mathrm{C}}$ connective. This will be used to allow verbs to take their complements.
Case Merge (CA–Merge):
If $\Gamma \vdash m : A -\circ_{\mathrm{CA}} B$, and $\Gamma' \vdash n : A$, then $\Gamma, \Gamma' \vdash (m\ n\ ^{\mathrm{CA}}) : B$.
As above, but relative to the $-\circ_{\mathrm{CA}}$ connective. This will allow case marking of NPs.
Specifiee Merge (SP–Merge):
If $\Gamma \vdash n : A -\circ_{\mathrm{C}} B$, and $\Gamma' \vdash d : A$, then $\Gamma, \Gamma' \vdash (^{\mathrm{SP}}\ d\ n) : B$.
As above, but relative to the $-\circ_{\mathrm{SP}}$ connective. This will allow for the combination of nouns and determiners.
Trace: $_{\mathrm{SL}}\ : t : A \vdash t : A$
This rule schema introduces syntactic hypotheses, which we conceive as typed variables.
Move: If $_{\mathrm{SL}}\ : t : A, \Gamma \vdash s : B$, then $\Gamma \vdash \lambda_t^{\mathrm{SL}} s : A -\circ_{\mathrm{SL}} B$.
This rule schema is a rule of hypothetical proof (implication introduction), relative to the SL (SLASH) flavor of implication, for terms of type A, where A represents a metavariable ranging over the set of type {Unm, Obl} (unmarked or oblique case NPs, respectively).
Wh- Question Rule: If $\vdash w$: Wh, and $\vdash s : A -\circ_{\mathrm{SL}}$ Fin, then $\vdash q(w, s)$: Q.
This is a non-logical rule (or term constructor) schema allowing the formation of Wh-questions.

7.3 Subject Extraction:

(8) Hayi f**um**a'gasi — i kareta?
who? *WH*[nom].wash the car
'Who washed the car?' (Chung (1998) ch.6 ex.(53)a)

Wh-agreement is marked on the verb via the infix *-um-*, corresponding to a subject dependent containing a gap.

Axioms (Lexical Entries)
$\vdash$ Hayi : Wh
SL : $e : A \vdash$ fuma′gasi : ((Unm $-\circ_{\text{SL}}$ Unm) $\circ$ Unm) $-\circ_{\text{C}}$ Fin
$\vdash$ i : Det
$\vdash$ kareta : Det $-\circ_{\text{SP}}$ Unm

For purposes of legibility, these tree-style proofs contains only the numbers which correspond to the line numbers of the line-by-line derivation below.

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{}{10}}{11}\text{Wh-Rule}}{\dfrac{\dfrac{}{8}}{9}\text{Move}}}{\dfrac{}{7}\text{C-Merge}}}{\dfrac{\dfrac{}{4}}{5}\text{Move}\qquad\dfrac{\dfrac{}{2}\qquad\dfrac{}{1}}{3}\text{SP-Merge}}\text{Fusion}}{6}$$

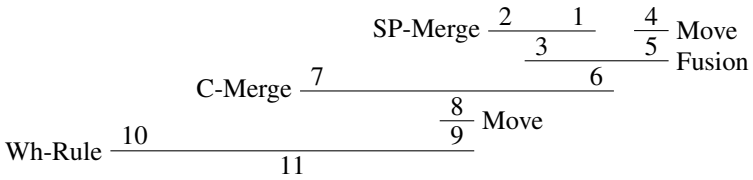
1. $\vdash$ i : Det (**Lexical**)
2. $\vdash$ kareta : Det $-\circ_{\text{SP}}$ Unm (**Lexical**)
3. $\vdash$ ($^{\text{SP}}$ i kareta) : Unm (**SP–Merge**)
4. SL : t : Unm $\vdash t$: Unm (**Trace**)
5. $\vdash \lambda_t^{\text{SL}} t$: Unm $-\circ_{\text{SL}}$ Unm (**Move**)
6. $\vdash (\lambda_t^{\text{SL}} t \cdot (^{\text{SP}}$ i kareta)) : ((Unm $-\circ_{\text{SL}}$ Unm) $\circ$ Unm) (**Fusion**)
7. SL : $e : A \vdash$ fuma′gasi : ((Unm $-\circ_{\text{SL}}$ Unm) $\circ$ Unm) $-\circ_{\text{C}}$ Fin (**Lexical**)
8. SL : $e : A \vdash$ (fuma′gasi $(\lambda_t^{\text{SL}} t \cdot (^{\text{SP}}$ i kareta)) $^{\text{C}}$) : Fin (**C–Merge**)
9. $\vdash \lambda_e^{\text{SL}}$(fuma′gasi $(\lambda_t^{\text{SL}} t \cdot (^{\text{SP}}$ i kareta)) $^{\text{C}}$) : $A -\circ_{\text{SL}}$ Fin (**Move**)
10. $\vdash$ Hayi : Wh (**Lexical**)
11. $\vdash q$(Hayi, λ_e^{SL}(fuma′gasi $(\lambda_t^{\text{SL}} t \cdot (^{\text{SP}}$ i kareta)) $^{\text{C}}$)) : Q (**Wh-Question Rule**)

7.4 Object Extraction:

(9) Hafa f**in**a'tinas-**ñiha** i famalao'an __ ?
what? *WH*[obj].make-agr the women
'What did the women cook?' (Chung (1998) ch.5 ex.(39)a)

Here, wh-agreement is marked with the infix *-in-*, and the verb is nominalized by the possessor-noun agreement morpheme *-ñiha*, glossed as *-agr*. This indicates that the gap site is (in) an object dependent. Note that the Wh-word itself does not take agreement morphology.

Axioms (Lexical Entries)
$\vdash$ Hafa : Wh
SL : $e : A \vdash$ finatinas – ñiha : (Unm $\circ$ (Obl $-\circ_{\mathrm{SL}}$ Obl)) $-\circ_{\mathrm{C}}$ Fin
$\vdash$ i : Det
$\vdash$ famalao'an : Det $-\circ_{\mathrm{SP}}$ Unm



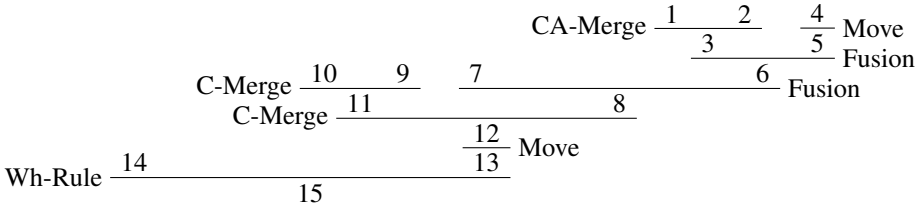
1.	$\vdash$ i : Det	(**Lexical**)
2.	$\vdash$ famalao'an : Det $-\circ_{\mathrm{SP}}$ Unm	(**Lexical**)
3.	$\vdash$ ($^{\mathrm{SP}}$ i famalao'an) : Unm	(**SP–Merge**)
4.	SL : t : Obl $\vdash t$: Obl	(**Trace**)
5.	$\vdash \lambda_t^{\mathrm{SL}} t$: Obl $-\circ_{\mathrm{SL}}$ Obl	(**Move**)
6.	$\vdash$ (($^{\mathrm{SP}}$ i famalao'an) $\cdot \lambda_t^{\mathrm{SL}} t$) : (Unm $\circ$ (Obl $-\circ_{\mathrm{SL}}$ Obl))	(**Fusion**)
7.	SL : $e : A \vdash$ finatinas – ñiha : (Unm $\circ$ (Obl $-\circ_{\mathrm{SL}}$ Obl)) $-\circ_{\mathrm{C}}$ Fin	(**Lexical**)
8.	SL : $e : A \vdash$ (finatinas – ñiha (($^{\mathrm{SP}}$ i famalao'an) $\cdot \lambda_t^{\mathrm{SL}} t$) $^{\mathrm{C}}$) : Fin	(**C–Merge**)
9.	$\vdash \lambda_e^{\mathrm{SL}}$(finatinas – ñiha (($^{\mathrm{SP}}$ i famalao'an) $\cdot \lambda_t^{\mathrm{SL}} t$) $^{\mathrm{C}}$) : $A -\circ_{\mathrm{SL}}$ Fin	(**Move**)
10.	$\vdash$ Hafa : Wh	(**Lexical**)
11.	$\vdash q$(Hafa, λ_e^{SL}(finatinas – ñiha (($^{\mathrm{SP}}$ i famalao'an) $\cdot \lambda_t^{\mathrm{SL}} t$) $^{\mathrm{C}}$)) : Q	(**Wh-Question Rule**)

7.5 Adjunct Extraction:

(10) Hafa pära fa'gase-**mmu** ni kareta ___ ?
what? FUT *WH*[obl].wash-agr OBL car
'What are you going to wash the car with?' (Chung (1998) ch.6 ex.(53)c)

In this case, wh-agreement is marked by the nominalizing morpheme *-mmu* glossed as *-agr*, corresponding to an instrument gap.

Axioms / Lexical Entries
$\vdash$ Hafa : Wh
$\vdash$ pära : $(C \multimap_{\mathrm{C}} \mathrm{Fin}) \multimap_{\mathrm{C}} (C \multimap_{\mathrm{C}} \mathrm{Fin})$
$_{\mathrm{SL}}$: $e : A \vdash$ fa′gase – mmu : $(\mathrm{Unm} \circ (\mathrm{Obl} \circ (\mathrm{Obl} \multimap_{\mathrm{SL}} \mathrm{Obl}))) \multimap_{\mathrm{C}} \mathrm{Fin}$
$\vdash$ *pro* : Unm
$\vdash$ ni : $(\mathrm{Det} \multimap_{\mathrm{SP}} \mathrm{Unm}) \multimap_{\mathrm{CA}} \mathrm{Obl}$
$\vdash$ kareta : $\mathrm{Det} \multimap_{\mathrm{SP}} \mathrm{Unm}$



1.	$\vdash$ ni : $(\mathrm{Det} \multimap_{\mathrm{SP}} \mathrm{Unm}) \multimap_{\mathrm{CA}} \mathrm{Obl}$	(**Lexical**)
2.	$\vdash$ kareta : $\mathrm{Det} \multimap_{\mathrm{SP}} \mathrm{Unm}$	(**Lexical**)
3.	$\vdash$ (ni kareta $^{\mathrm{CA}}$) : Obl	(**CA–Merge**)
4.	$_{\mathrm{SL}}$: $t : \mathrm{Obl} \vdash t : \mathrm{Obl}$	(**Trace**)
5.	$\vdash \lambda_t^{\mathrm{SL}} t : \mathrm{Obl} \multimap_{\mathrm{SL}} \mathrm{Obl}$	(**Move**)
6.	$\vdash ((\text{ni kareta}\ ^{\mathrm{CA}}) \cdot \lambda_t^{\mathrm{SL}} t) : \mathrm{Obl} \circ (\mathrm{Obl} \multimap_{\mathrm{SL}} \mathrm{Obl})$	(**Fusion**)
7.	$\vdash$ *pro* : Unm	(**Lexical**)
8.	$\vdash (\mathit{pro} \cdot ((\text{ni kareta}\ ^{\mathrm{CA}}) \cdot \lambda_t^{\mathrm{SL}} t)) : (\mathrm{Unm} \circ (\mathrm{Obl} \circ (\mathrm{Obl} \multimap_{\mathrm{SL}} \mathrm{Obl})))$	(**Fusion**)
9.	$_{\mathrm{SL}}$: $e : A \vdash$ fa′gase – mmu : $(\mathrm{Unm} \circ (\mathrm{Obl} \circ (\mathrm{Obl} \multimap_{\mathrm{SL}} \mathrm{Obl}))) \multimap_{\mathrm{C}} \mathrm{Fin}$	(**Lexical**)
10.	$\vdash$ pära : $(C \multimap_{\mathrm{C}} \mathrm{Fin}) \multimap_{\mathrm{C}} (C \multimap_{\mathrm{C}} \mathrm{Fin})$	(**Lexical**)
11.	$_{\mathrm{SL}}$: $e : A \vdash$ (pära fa′gase – mmu $^{\mathrm{C}}$) : $(\mathrm{Unm} \circ (\mathrm{Obl} \circ (\mathrm{Obl} \multimap_{\mathrm{SL}} \mathrm{Obl}))) \multimap_{\mathrm{C}} \mathrm{Fin}$	(**C–Merge**)
12.	$_{\mathrm{SL}}$: $e : A \vdash ((\text{pära fa′gase – mmu}\ ^{\mathrm{C}}) (\mathit{pro} \cdot ((\text{ni kareta}\ ^{\mathrm{CA}}) \cdot \lambda_t^{\mathrm{SL}} t))\ ^{\mathrm{C}}) : \mathrm{Fin}$	(**C–Merge**)
13.	$\vdash \lambda_e^{\mathrm{SL}}((\text{pära fa′gase – mmu}\ ^{\mathrm{C}}) (\mathit{pro} \cdot ((\text{ni kareta}\ ^{\mathrm{CA}}) \cdot \lambda_t^{\mathrm{SL}} t))\ ^{\mathrm{C}}) : A \multimap_{\mathrm{SL}} \mathrm{Fin}$	(**Move**)
14.	$\vdash$ Hafa : Wh	(**Lexical**)
15.	$\vdash q(\text{Hafa}, \lambda_e^{\mathrm{SL}}((\text{pära fa′gase – mmu}\ ^{\mathrm{C}}) (\mathit{pro} \cdot ((\text{ni kareta}\ ^{\mathrm{CA}}) \cdot \lambda_t^{\mathrm{SL}} t))\ ^{\mathrm{C}})) : \mathrm{Q}$	(**Wh-Question Rule**)

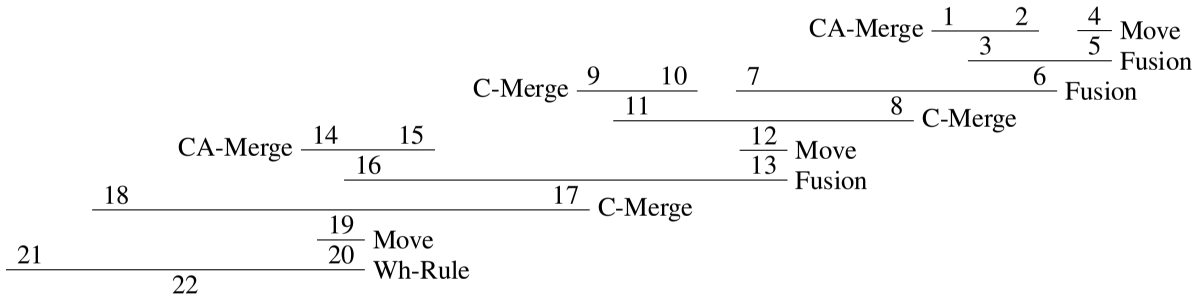
7.6 Embedded Constructions:

(11) Hafa s**in**angan-**ã** si Juan pära godde-**tta** ni chiba
what? *WH*[obj].say.his-agr UNM Juan FUT *WH*[obl].tie.our-agr OBL goat
__ ?

'What did Juan say that we should tie up the goat with?' (Levine & Hukari (2006) ch.3 ex.(63))

This example exhibits extraction across more than one verb. The lower verb, *godde-tta*, is nominalized (by *-tta*), but the infix *-in-* is absent, indicating that the agreement pattern is for an extracted oblique (an instrument, in this case). The higher verb *sinangan-ã* bears the *-in-* infix as well as nominalization (*-ã*). This is the agreement pattern for an extracted object. The object, in this case, is the clausal complement headed by the lower verb.

Axioms / Lexical Entries
$\vdash$ Hafa : Wh
SL : $g : A \vdash$ sinangan – ã : (Unm $\circ$ ($A \multimap_{SL}$ Fin)) $\multimap_C$ Fin
si : Name $\multimap_{CA}$ Unm
Juan : Name
$\vdash$ pära : ($C \multimap_C$ Fin) $\multimap_C$ ($C \multimap_C$ Fin)
SL : $e : A \vdash$ godde – tta : (Unm $\circ$ (Obl $\circ$ (Obl $\multimap_{SL}$ Obl))) $\multimap_C$ Fin
$\vdash$ *pro* : Unm
$\vdash$ ni : (Det $\multimap_{SP}$ Unm) $\multimap_{CA}$ Obl
$\vdash$ chiba : Det $\multimap_{SP}$ Unm



1.	$\vdash$ ni : (Det $-\circ_{\mathrm{SP}}$ Unm) $-\circ_{\mathrm{CA}}$ Obl	(**Lexical**)
2.	$\vdash$ chiba : Det $-\circ_{\mathrm{SP}}$ Unm	(**Lexical**)
3.	$\vdash$ (ni chiba $^{\mathrm{CA}}$) : Obl	(**CA–Merge**)
4.	$_{\mathrm{SL}}$: t : Obl $\vdash$ t : Obl	(**Trace**)
5.	$\vdash$ $\lambda_t^{\mathrm{SL}} t$: Obl $-\circ_{\mathrm{SL}}$ Obl	(**Move**)
6.	$\vdash$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$) : Obl $\circ$ (Obl $-\circ_{\mathrm{SL}}$ Obl)	(**Fusion**)
7.	$\vdash$ *pro* : Unm	(**Lexical**)
8.	$\vdash$ (*pro* $\cdot$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$)) : Unm $\circ$ (Obl $\circ$ (Obl $-\circ_{\mathrm{SL}}$ Obl))	(**Fusion**)
9.	$\vdash$ pära : (C $-\circ_{\mathrm{C}}$ Fin) $-\circ_{\mathrm{C}}$ (C $-\circ_{\mathrm{C}}$ Fin)	((**Lexical**))
10.	$_{\mathrm{SL}}$: e : A $\vdash$ godde – tta : (Unm $\circ$ (Obl $\circ$ (Obl $-\circ_{\mathrm{SL}}$ Obl))) $-\circ_{\mathrm{C}}$ Fin	(**Lexical**)
11.	$_{\mathrm{SL}}$: e : A $\vdash$ (pära godde – tta $^{\mathrm{C}}$) : (Unm $\circ$ (Obl $\circ$ (Obl $-\circ_{\mathrm{SL}}$ Obl))) $-\circ_{\mathrm{C}}$ Fin	(**C–Merge**)
12.	$_{\mathrm{SL}}$: e : A $\vdash$ ((pära godde – tta $^{\mathrm{C}}$) (*pro* $\cdot$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$)) $^{\mathrm{C}}$) : Fin	(**C–Merge**)
13.	$\vdash$ λ_e^{SL}((pära godde – tta $^{\mathrm{C}}$) (*pro* $\cdot$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$)) $^{\mathrm{C}}$) : A $-\circ_{\mathrm{SL}}$ Fin	(**Move**)
14.	$\vdash$ si : Name $-\circ_{\mathrm{CA}}$ Unm	(**Lexical**)
15.	$\vdash$ Juan : Name	(**Lexical**)
16.	$\vdash$ (si Juan $^{\mathrm{CA}}$) : Unm	(**CA–Merge**)
17.	$\vdash$ ((si Juan $^{\mathrm{CA}}$) $\cdot$ (λ_e^{SL}((pära godde – tta $^{\mathrm{C}}$) (*pro* $\cdot$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$)) $^{\mathrm{C}}$)) : Unm $\circ$ (A $-\circ_{\mathrm{SL}}$ Fin)	(**Fusion**)
18.	$_{\mathrm{SL}}$: g : A $\vdash$ sinangan – ã : (Unm $\circ$ (A $-\circ_{\mathrm{SL}}$ Fin)) $-\circ_{\mathrm{C}}$ Fin	(**Lexical**)
19.	$_{\mathrm{SL}}$: g : A $\vdash$ (sinangan – ã ((si Juan $^{\mathrm{CA}}$) $\cdot$ (λ_e^{SL}((pära godde – tta $^{\mathrm{C}}$) (*pro* $\cdot$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$)) $^{\mathrm{C}}$) : Fin	(**C–Merge**)
20.	$\vdash$ λ_g^{SL}(sinangan – ã ((si Juan $^{\mathrm{CA}}$) $\cdot$ (λ_e^{SL}((pära godde – tta $^{\mathrm{C}}$) (*pro* $\cdot$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$)) $^{\mathrm{C}}$) : A $-\circ_{\mathrm{SL}}$ Fin	(**Move**)
21.	$\vdash$ Hafa : Wh	(**Lexical**)
22.	$\vdash$ q(Hafa, λ_g^{SL}(sinangan – ã ((si Juan $^{\mathrm{CA}}$) $\cdot$ (λ_e^{SL}((pära godde – tta $^{\mathrm{C}}$) (*pro* $\cdot$ ((ni chiba $^{\mathrm{CA}}$) $\cdot$ $\lambda_t^{\mathrm{SL}} t$)) $^{\mathrm{C}}$)) : Q	(**Wh-Question Rule**)

8 Summary

We have seen how a combination of natural-deduction-style hypothetical proof rules and lexical subcategorization for extraction sites can begin to model the initially puzzling facts about Chamorro wh-agreement. While it at first seems odd to treat verbs which do not ordinarily select for certain elements (say, instruments) as selecting for exactly those elements, this conclusion is motivated by the facts concerning verbal agreement morphology and extracted elements. Since the various verb forms appear with different syntactic structures, there is nothing unnatural about treating their selectional properties as different as well. A hypothetical-proof-based strategy therefore accounts effectively for the phenomenon of wh-agreement.

9 Future Research

While this paper is intended to account only for the syntactic structure of constituent questions, the wh-agreement phenomenon also occurs in relative clauses and focus constructions. This analysis could plausibly be extended to those areas as well, although the entire paradigm for wh-agreement is more complicated than can be dealt with in the present forum. Cases where the verbal nominalization is optional, as well as unbounded dependency constructions where wh-agreement does not occur are additional topics of current research. I consider these to be relatively unproblematic, as they are most likely accounted for in a reasonably straightforward manner similar to the one described in Pollard (2007a).

It has been suggested to me (by participants at the LMNLDS workshop at DGfS 30) that the wh-agreement phenomenon is similar to the morphological voice system in other Western Austronesian languages. Chung (1998) contends that the Chamorro voice system is fairly uncomplicated by comparison to languages like Tagalog, and that wh-agreement is not simply a voicing alternation, but further examination of the Chamorro voice constructions (passive and antipassive) is necessary.

I hope in the future to develop a compositional semantics which corresponds to the syntactic analysis I have proposed here. Additionally, potential issues of lexical semantics arise with the 'nominalization' of Chamorro verbs which participate in wh-agreement, which are worthy of greater study.

One further issue is the precise nature of Chamorro NP structure. Chamorro has a complicated morphological case marking system which interacts with different categories of NPs (common nouns, pronouns, and proper names) and determiners in interesting ways. While the internal construction of NPs is beyond the scope of

this work, it is certainly of importance.

10 Appendix - Formal Issues

The way I have formalized my analysis in this paper has certain theoretical implications. Of particular interest is the choice to treat verbs as taking an argument list which has its subject first, for purposes of easy linearization. Dowty (2006) points out that doing things in this way considerably complicates the semantics with respect to the accessibility of arguments to adverbial modifiers, and prefers the strategy of defining subjects as the final argument of a 'Curried' function-type verb, necessitating the introduction of 'wrap' in some form in order to model the correct linear word order. The exact implementation of 'wrap' in CVG is a project which is currently under investigation.

I stress that the syntactic term of the CVG triple is understood to model only dependencies, with the actual linear word order represented in the 'prosodic' term. The connectives of the syntactic logic are not prosodically interpreted themselves (Pollard, p.c.), and the ultimate interpretation of the string is envisioned as a kind of 'bracket erasure'.

It is reasonably straightforward to retrofit the analysis presented here so that verbs take their arguments in a step-by-step manner, with subjects as the last argument, by taking the natural deduction rules described above to be the same, with one addition:

Subject Merge (SU–Merge): If $\Gamma \vdash v : A \multimap_{\mathrm{SU}} B$, and $\Delta \vdash s : A$, then $\Gamma, \Delta \vdash ({}^{\mathrm{SU}}\ s\ v) : B$.

This rule is similar to Complement Merge, only relative to the $\multimap_{\mathrm{SU}}$ connective.

Modified 'Curried' lexical entries for the wh-agreeing verbs from the selected examples are as follows:

$\mathrm{SL} : e : A \vdash$ fuma′gasi : Unm $\multimap_{\mathrm{C}}$ ((Unm $\multimap_{\mathrm{SL}}$ Unm) $\multimap_{\mathrm{SU}}$ Fin)

$\mathrm{SL} : e : A \vdash$ fina′gase – nña : (Obl $\multimap_{\mathrm{SL}}$ Obl) $\multimap_{\mathrm{C}}$ (Unm $\multimap_{\mathrm{SU}}$ Fin)

$\mathrm{SL} : e : A \vdash$ fa′gase – mmu : Obl $\multimap_{\mathrm{C}}$ ((Obl $\multimap_{\mathrm{SL}}$ Obl) $\multimap_{\mathrm{C}}$ (Unm $\multimap_{\mathrm{SU}}$ Fin))

$\mathrm{SL} : e : A \vdash$ godde – tta : Obl $\multimap_{\mathrm{C}}$ ((Obl $\multimap_{\mathrm{SL}}$ Obl) $\multimap_{\mathrm{C}}$ (Unm $\multimap_{\mathrm{SU}}$ Fin))

$\mathrm{SL} : e : A \vdash$ sinangan – ã : ($A \multimap_{\mathrm{SL}}$ Fin)) $\multimap_{\mathrm{C}}$ (Unm $\multimap_{\mathrm{SU}}$ Fin)

This change circumvents the problems outlined in Dowty (2006). Derivations / proofs proceed accordingly.

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