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Movement and interpretation of quantifiers in internally-headed relative clauses*

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Abstract This paper addresses the semantic typology of internally-headed relative clauses using a case study of two West African languages, Atchan (Kwa) and Bùlì (Gur). Both languages exhibit syntactically-similar relatives, involving overt movement of the head. However, quantifiers on the head are interpreted differently in the two languages. In Atchan, quantifiers on the relative-clause head take the entire relative clause as their restriction; in Bùlì, quantifiers on the head take only the head noun as their restriction. I propose that the former is interpreted via NP reconstruction and Trace Conversion, the latter via DP reconstruction. The empirical difference between these two languages motivates a revision to the typology developed by Grosu (2012), which tightly links head movement and the Atchan-like quantifier interpretation pattern. This work further supports a a modular view in which languages can adopt different strategies to interpret movement-involving structures.

Keywords: relative clause, quantification, syntax-semantics interface, African languages

1 Introduction

In internally-headed relative clauses (IHRCs), the relative clause head is pronounced low inside of the relative clause. As a consequence, quantified IHRC heads present a nontrivial problem for compositionality. Consider the following pseudo-English IHRC in (1), taking 'every chicken' to be the quantified IHRC head:

(1) [$_{\text{IHRC}}$Julianne sold every chicken] is white.

Based on the surface word order alone, it is not immediately obvious what this IHRC should mean: rather, a few possibilities present themselves.

One conceivable possibility is that the IHRC in (1) has the same meaning as English *every chicken Julianne sold*: that is, the quantifier *every* takes the entire

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relative clause as its restriction. Taking this as the IHRC meaning, we then predict the sentence in (1) to have the same truth conditions as English *every chicken Julianne sold is white*: the set of chickens sold by Julianne is a subset of the set of white things. Throughout this paper, I will call this possible meaning of an IHRC with quantified head the *high-restriction* meaning, since more linguistic material feeds into the quantifier's restriction than we would expect from the surface constituency. On this view, the problem that quantified IHRC heads present relates to how the quantifier comes to have this high restriction, given the surface syntax.

A second possibility, which I will call the *low-restriction* meaning, is that the head NP yields the quantifier's restriction. That is, the restriction of the quantified head in (1) is just the set of chickens. On this approach, it is straightforward to determine the quantifier's restriction, but determining its scope (and, consequently, the sentence's overall meaning) is more complicated. One possible solution here would be an approach like that of Shimoyama (1999), where the IHRC is effectively interpreted as a separate sentence, conjoined with the matrix clause. (Shimoyama's approach will be discussed in more detail in §4.) This yields a set of truth conditions paraphrasable in English as 'Julianne sold [every chicken]$_i$, and they$_i$ are white.' On this approach, it follows that the relative-clause property must hold of every individual in the domain of the quantifier: that is, for this sentence to be true, there cannot exist any unsold chickens.

Grosu (2012) develops a theory that links quantifier interpretation (high or low restriction) to other properties of the IHRC. Specifically, we focus here on the sub-type of IHRCs that he terms restrictive, following his earlier work in Grosu 2002. Restrictive relatives can be distinguished from another type, maximalizing relatives, based on three diagnostics: stacking (only restrictive relatives can have multiple stacked IHRCs with the same head), indefinite interpretations of the head (these interpretations are only available in restrictive relatives), and island-sensitivity (restrictive relatives are not island sensitive).

Within restrictive relatives, Grosu (2012) claims that the interpretation of quantifiers in IHRCs can be linked to (covert) movement of the head. He proposes that the "default" interpretation of quantified IHRC heads is a low-restriction meaning. However, quantified IHRC heads have the high-restriction meaning specifically when the head undergoes covert movement out of the relative clause. Grosu's example of this phenomenon comes from Navajo, with examples like the following:[1]

(2) [John Bill chidí t'áá ałtso yaa nayiisnii' ęę] t'éiyá nizhónígo nidaajeeh
John Bill car 3 all from 3.3.buy P.REL only well da.3.run.1

1 Note that Bogal-Allbritten & Moulton (2017) show that Navajo 'ałníí'dóó 'half' does not exhibit this same pattern and show that the empirical picture with táá ałtso 'all' is more complex than (2) suggests.

'All the cars that John bought from Bill – and only those – run well.'
(Grosu 2012:(48), citing Faltz 1995:(107))

This is the high-restriction meaning: the universal quantifier evidently takes as its restriction the whole relative clause (i.e., the set of cars that John bought from Bill), asserting that that set is a subset of the set of well-running things.

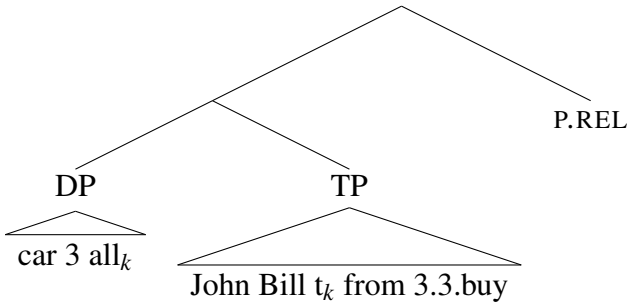
Grosu claims that this exceptional high-restriction meaning is available exactly when the relative head undergoes covert movement to facilitate that meaning. His evidence for this link comes from the presence of island-sensitivity in Navajo IHRCs. By various diagnostics including the permissibility of stacking and indefinite-interpreted heads, Navajo is a language with restrictive relatives on Grosu's typology. However, as shown in the below example, the presence of one relative clause blocks further relativization out of that relative clause:[2]

(3) * [[hastiin łééchąą'í bishxash-ęę] be'eldooh néidiitá-(n)ęę] nahał'in.
man dog bit-REL gun pick.up-REL bark
Intended: The dog such that the man that it bit picked up the gun barked.
(Grosu 2012:(49b), citing Platero 1974:(82))

Given Navajo's other typological characteristics, this is an unexpected behavior: restrictive relatives, as stated previously, are normally not island-sensitive.

Connecting the high-restriction meaning to exceptional island-sensitivity in Navajo restrictive IHRCs, Grosu sketches the idea that, in (2), the head and quantifier covertly raise as a unit, enabling the quantifier to take the relative clause and head together as its restriction. Post-movement, we would have the following structure:[3]

(4)



While the account is only sketched, it is clear that this covert movement could aid in building a high-restriction meaning, since the quantifier ends ends up outside of the relative-clause *v*P.[4]

2 This is a test for island-sensitivity, not stacking, because the two heads are different. Stacking (e.g., *the boy who I saw who likes pizza*) involves two relative clauses with the same head.

3 The syntactic position of P.REL is not crucial.

4 Grosu's account ultimately seems to posit some component to Navajo quantifiers that requires them to have high restrictions: "in Navajo, [island-sensitivity] is traceable to whatever factors require matrix

	Restrictive	Maximalizing
Permits stacking	always	—
Permits indef. interpretations	always	—
Island-sensitive (→ head movement)	if Q has high restriction	always
Island-insensitive	if Q has low restriction	—

Table 1 IHRC typological predictions on the account of Grosu (2012).

This typology, therefore, makes a cross-linguistic link between movement of the head and quantifier interpretation in IHRCs. Specifically, restrictive IHRCs are predicted to have the high-restriction meaning for quantified heads exactly when the head moves. The resulting typological predictions with regard to various relative-clause properties are shown in Table 1. In summary, restrictive IHRCs should *always* permit stacking and indefinite interpretations of (unquantified) heads. Restrictive relative clauses should be island-sensitive (i.e., involve movement of the head) when and only when quantifiers on the head have the high-restriction meaning.

Grosu's evidence for (covert) movement of the head in Navajo IHRCs is indirect, via island-sensitivity. However, the resulting typology and role of IHRC head movement is particularly interesting in light of a recent, largely syntactic line of work that questions what constitutes an IHRC. Specifically, Hiraiwa (2005) et seq., focusing on Gur (also called Mabia) languages of West Africa, argues that some languages exhibit "left-headed internally-headed relative clauses," in which the head moves within the relative clause CP but does not vacate the CP. This kind of IHRC involves overt movement of the head, so Grosu's typology makes a clear prediction for them: quantifiers in such constructions should have the high-restriction meaning. This paper uses a case study of two West African languages to show that quantifiers in left-headed IHRCs can, but need not, be interpreted high across languages. These findings motivate a greater decoupling of relative-clause head movement and semantic interpretation: I propose that syntactic movement enables but does not force high quantifier interpretation.

In the next section, §2, I address this left-headed IHRC syntax. After that, we turn to look at quantified IHRC heads in each language, first Atchan in §3 and then Bùlì in §4. Finally, §5 concludes.

scope for IHs" (p.25). The account that I will develop in this paper makes the same truth-conditional predictions as Grosu's sketched analysis, but without this stipulation.

2 Left-headed IHRC syntax in Atchan and Bùlì

This section focuses on the syntax of relative clauses in Bùlì (ISO: bwu; Gur/Mabia, Ghana) and Atchan (ISO: ebr; Kwa, Côte d'Ivoire). Both languages have been argued to exhibit a "left-headed internally-headed" relative clause structure (henceforth, left-headed IHRC), in which the head moves to but not beyond the relative-clause CP. This structure, involving overt movement of the head, will allow us to test Grosu's typology.

Hiraiwa (2005) first proposes the left-headed IHRC structure for relative clauses in Bùlì. Bùlì has both canonical IHRCs with in-situ heads (5a) and relative clauses in which the head surfaces at the left edge of the clause (5b):

(5) a. Àmɔ̀ak ɲà [$_{CP}$ Àtìm àlī sʷà **nāː-būy** lá]
Àmɔ̀ak saw Àtìm COMP own cow-REL DEM
'Àmɔ̀ak saw the cow which Àtìm owns.'

b. Àmɔ̀ak ɲà [$_{CP}$ **nāː-būy** àtì Àtìm sʷà lá]
Àmɔ̀ak saw cow-REL COMP Àtìm own DEM
'Àmɔ̀ak saw the cow which Àtìm owns.' (Hiraiwa 2005:218 (70))

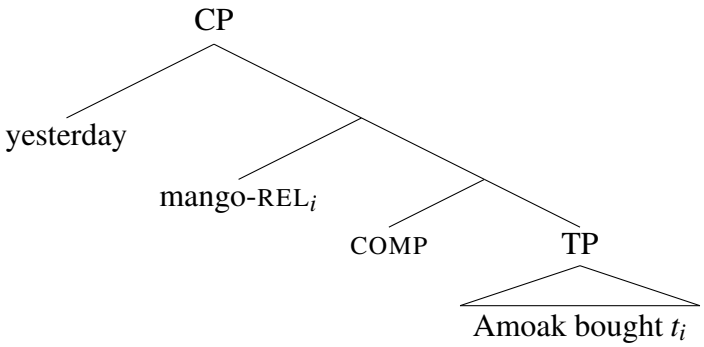
Hiraiwa (2005) argues that relative clauses like (5b) are left-headed IHRCs, where the head moves to the edge of and does not vacate the relative-clause CP. The most direct evidence for this structure comes from the possibility of positioning relative-clause adverbs before the head (6):

(6) Àtìm dɛ̃ [$_{CP}$(dīem) mángò-tūː àtì Àmɔ̀ak dà lá]
Àtìm ate yesterday mango-REL COMP Àmɔ̀ak bought DEM
'Àtìm ate [the mango that Àmɔ̀ak bought yesterday].'
(Hiraiwa 2005:219 (73b))

Hiraiwa argues that the adverb placement in (6) can most easily be captures if the relative-clause head remains within the CP, permitting the adverb to also remain inside the CP. He further shows that other diagnostics like postposition pied-piping and possessor relativization, among others, point to a similar conclusion.

The left-headed IHRC structure that Hiraiwa arrives at is illustrated in the tree below:

(7)



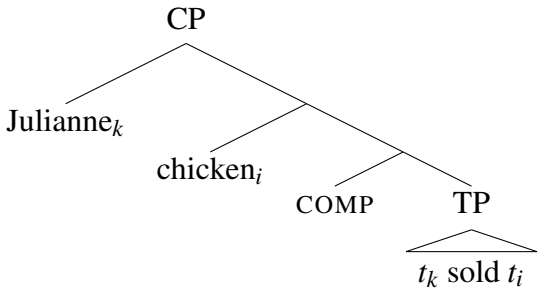
Here, the head and relativizer move to the clausal periphery, remaining inside the CP.[5] This structure blurs the distinction between raising relatives (in the style of Kayne 1994) and "traditional" in-situ IHRCs. Note that Hiraiwa argues that *all* non-in-situ relative clauses in Bùlì are left-headed IHRCs (regardless of, e.g., overt presence of an adverb). Later examples will not have high adverbs.

Based on primary fieldwork data, I argue in Jarvis 2023 that this structure also occurs in Atchan. Some Atchan relative clauses involve dislocation of the subject to a pre-head position, as shown in the following example:

(8) [$_{CP}$ ʒulian kɔsɔ k^{h}ɛ́ a p^{h}ɛdi] tɛ́ p^{h}op^{h}o
J. chicken COMP 3.PFV sell COP white
'A/the chicken that Julianne sold is white.'

In Jarvis 2023, to appear, I argue that in relative clauses like (8), both the dislocated subject and head undergo movement to but not beyond the CP periphery, as illustrated below:

(9)



This is the same left-headed IHRC syntax that we saw for Bùlì.

Given this similar syntax, relative clauses in Bùlì and Atchan give us a chance to explicitly investigate the link between quantified heads and movement of the head

5 This type of structure, with movement of the head to the edge of the CP and not beyond, has been argued to exist in other Gur languages (Hiraiwa 2005; Bodomo & Hiraiwa 2010; Hiraiwa, Akanlig-Pare, Atintono, Bodomo, Essizewa & Hudu 2017), in Koryak (ISO: kpy; Chukotko-Kamchatkan, Russia; Abramowitz 2021)and in Nuntajiiyi (ISO: poi; Mixe-Zoque, Mexico; López Márquez 2022, 2023).

that Grosu posits: we can explicitly examine the role of (overt) head movement on the meaning of IHRCs with quantified heads.

3 IHRCs and quantifiers in Atchan: The interpretive possibilities of movement

In this section, I argue that Atchan displays the high-restriction pattern: quantifiers on left-headed IHRC heads take the entire relative clause as their restriction. In this way, Atchan behaves like an overt-movement counterpart to Navajo. I show how standard Trace Conversion machinery, used in the interpretation of raising relatives (Bhatt 2002) and other A'-constructions, can be applied to capture the Atchan data.

The high-restriction and low-restriction meanings diverge in the following way. Consider a left-headed-IHRC-containing sentence of the schematic form in (10):

(10) [$_{\text{LH IHRC}}$ head *Q* RC_predicate] MC_predicate

The high-restriction meaning will be true when *Q*(head∩RC_predicate)(MC_predicate) holds. With a universally-quantified head, for example, we predict truth whenever every individual in the intersection of the denotation of the head and that of the relative-clause predicate is also in the denotation of the matrix predicate.

By contrast, a low-restriction meaning requires quantification over all individuals in the set denoted by the head NP. On an analysis like that of Shimoyama (1999), for instance, this sentence comes out to be true exactly when (1) *Q*(head)(RC_predicate) holds and (2) roughly, head∩RC_predicate ⊆ MC_predicate. In the following sections, we will rely on the fact that the truth of this low-restriction meaning, unlike the high-restriction meaning, requires that the relative-clause predicate hold of every individual in the denotation of the head noun.

3.1 Data

Data in this section comes from the Atchan quantifiers *k^{h}úúmbrɛ̃* 'all' and *bɛ̃* INDF.[6] The crucial observation that we can make is that to evaluate the truth value of a sentence containing a left-headed IHRC with quantified head, it is not necessary to consider every individual in the denotation of the head NP. Rather, only individuals meeting the entire relative-clause description must be evaluated to determine whether the universal/existential claim is true.

To see this, we first turn to the universal quantifier *k^{h}úúmbrɛ̃*. In quantified left-headed IHRCs, we see that the existence of individuals in the head noun denotation

6 Note that Atchan does not have a negative existential quantifier (e.g., *no one*) or proportional quantifiers (e.g., *half*), which, as noted by Bogal-Allbritten & Moulton (2017), would be ideal for distinguishing the two meanings at play here.

that do not meet the relative-clause description does not automatically render the sentence false. We will discuss all four scenarios below in turn:

(11) [$_{CP}$ ʒulian [kɔsɔ k^{h}úúmbrɛ̃] k^{h}ɛ́ a p^{h}ɛdi] tɛ́ p^{h}op^{h}o
J. chicken all COMP 3.PFV sell COP white
'All chickens that Julianne sold are white.'
✓ Scenario A: J. had 3 white chickens and sold all of them.
✗ Scenario B: J. had 1 white and 1 black chicken and sold both of them.

(12) mɛ̃ mp^{h}ɛ [$_{CP}$ kati [kɔsɔ k^{h}úúmbrɛ̃] k^{h}ɛ́ a ŋwɛ̃]
1.SG buy K. chicken all COMP 3.PFV kill
'I bought every chicken that Katie killed.'
✓ Scenario C: K. had 10 chickens and killed 6; I bought 6 killed chickens
✗ Scenario D: K. had 10 chickens and killed 8; I bought 6 killed chickens

The data from (11) provide useful control examples. Scenario A is predicted to be true on either a low-restriction or high-restriction meaning, since every chicken (i.e., every individual in the head noun denotation) also has both the relative-clause property of being sold by Julianne and the matrix-clause property of being white. Similarly, Scenario B is predicted to be false on either meaning, since there exists a chicken meeting the relative-clause property that does not meet the matrix-clause property.

To distinguish between the low-restriction and high-restriction meanings, it is Scenarios C and D in (12) that are crucial. In both scenarios, there are (multiple) chickens in the domain that are not killed: on the low-restriction meaning, in which we quantify purely over chickens, the existence of still-living chickens (i.e., chickens not meeting the relative-clause property) should render the sentence false. That this is not the case is illustrated in Scenario C; note also in Scenario C that individuals not meeting the relative-clause property (i.e., still-alive chickens) are not relevant for determining the truth of this sentence—i.e., this sentence is true even if the speaker does not buy any live chickens. Finally, Scenario D shows that this sentence is judged false if it is not the case that all individuals meeting the relative-clause property do not meet the matrix-clause property—i.e., this sentence is judged false in Scenario D because the speaker did not buy all killed chickens. These data suggest that we have the high-restriction meaning: we consider only whether every individual chicken bearing the relative-clause property also bears the matrix-clause property.

Data from *bɛ̃* is consistent with this conclusion. Consider the data below:

(13) [$_{CP}$ ʒulian [kɔsɔ bɛ̃] k^{h}ɛ́ a p^{h}ɛdi] tɛ́ p^{h}op^{h}o
J. chicken INDF COMP 3.PFV sell COP white
'A chicken that Julianne sold is white.'
✓ Scenario E: J. had 2 white chickens and sold 1 of them.

✓ Scenario F: J. had 1 white chickens and 1 black chicken, and she sold the white chicken.
✓ Scenario G: J. had 2 white chickens and 1 black chicken, and she sold 1 white and 1 black chicken.

Scenarios E and F show that unsold chickens of any color are consistent with the truth of this existentially-quantified sentence. This is unsurprising on either the high- or low-restriction meaning. The notable data here, which provides evidence for the high-restriction meaning, comes from Scenario G. In Scenario G, we see that there can exist individuals meeting the relative-clause description that do not bear the matrix-clause property (i.e., Julianne could also have sold a black chicken); the sold white chicken witnesses the truth of the quantification. This is completely expected on the high-restriction meaning, less so on the low-restriction one.

Based on these data, I conclude that quantified heads in Atchan left-headed IHRCs have the high-restriction meaning. The judgments that we have seen here parallel the judgments of the provided English translations, and also parallel the Navajo data that Grosu provides.

3.2 Analysis: NP reconstruction

The left-headed IHRC structure in Atchan, and the corresponding interpretation of quantified heads, strongly parallels the syntax and semantics of raising relatives in languages like English. However, the analysis of the Atchan (and Navajo) high-restriction meaning is slightly more complex than that of English raising relatives, since the quantifier in an English raising relative is standardly assumed to be base-generated outside the relative-clause CP (Bhatt 2002). By virtue of its base-generated position outside the relative clause, it is automatically predicted to take the entire relative clause as its restriction. In Atchan and Navajo, by contrast, surface word order shows that the quantifier is situated within the relative-clause CP. In this analysis of Atchan left-headed IHRCs, I assume that (a) the quantifier and head form a DP constituent and (b) that DP undergoes movement (i.e., raises) from an in-situ position to Spec,CP. These assumptions are consistent with Grosu's (2012) suggestion about the analysis of the Navajo pattern.

To capture the high-restriction meaning in Atchan, I propose that the interpretation of quantified heads in left-headed IHRCs relies on NP-only reconstruction of the head N back into the relative clause. This is schematized below, where uninterpreted copies are marked via strikeout (for convenience, I assume that the dislocated subject also reconstruct):

(14) [$_{CP}$ ʒulian [kɔsɔ k^{h}úúmbrɛ̃] k^{h}ɛ́́ a p^{h}ɛdi] tɛ́ p^{h}op^{h}o
J. chicken all COMP 3.PFV sell COP white

'All chickens that Julianne sold are white.'

(15) $[\![\text{J}_i\ [\text{chicken all}]_k\ \text{COMP}\ \text{J}_i\ \text{sell}\ [\text{chicken all}]_k]\!]$ all copies in (14) shown
$= [\![\text{J}_i\ [\sout{\text{chicken}}\ \text{all}]_k\ \text{COMP}\ \text{J}_i\ \text{sell}\ [\text{chicken}\ \sout{\text{all}}]_k]\!]$ reconstruction

This approach has several precursors in the literature. Bhatt (2002) proposes that the head noun reconstructs in the interpretation of English raising relatives (though, as noted above, he assumes that quantifiers and determiners have no RC-internal representation). More broadly, the operation of NP-only reconstruction is familiar from other constructions like English *wh*-questions (see, e.g., Chomsky's (1993) principle of minimizing restrictors in operator positions): on my analysis, Atchan simply exploits this machinery in a different A'-construction.

From here, interpretation proceeds via Trace Conversion of the noun (Fox 2002). To render (15) interpretable, we must add to the lower copy two typeshifters, †ident and †the, with the following denotations (terminology following Heim 2018, though this choice is not crucial):

(16) a. $[\![\dagger\text{ident}]\!] = \lambda x_e.\lambda y_e.x = y$
b. $[\![\dagger\text{the}]\!] = \lambda P_{\langle et\rangle}.\iota y[P(y)]$

These typeshifters are inserted in the lower copy. At the same time, we insert a variable x and binder λ_x (which I assume is inserted at C):

(17) $[\![\text{J}_i\ [\text{chicken all}]_k\ \text{COMP}\ \text{J}_i\ \text{sell}\ [\text{chicken all}]_k]\!]$
$= [\![\text{all}\ \lambda_x\ \text{J sell}\ [\dagger\text{the}\ \dagger\text{ident}\ x\ \text{chicken}]]\!]$

Applying the denotations in (16), we obtain the following denotation for the full sentence:

(18) $[\![\text{all}\ \lambda_x\ \text{J sell}\ [\dagger\text{the}\ \dagger\text{ident}\ x\ \text{chicken}]\ \text{be white}]\!]$
$= [\![\text{all}]\!](\lambda x.\text{sell}([\![\dagger\text{the}\ \dagger\text{ident}\ x\ \text{chicken}]\!])(j))\ [\![\text{be white}]\!]$
$= [\![\text{all}]\!](\lambda x.\text{sell}(\iota y[y = x \wedge \text{chicken}(y)])(j)\ [\![\text{be white}]\!]$
$= \forall x[\text{sell}(\iota y[y = x \wedge \text{chicken}(y)])(j)) \rightarrow \text{white}(x)]$

The first argument to the quantifier is the set of chickens sold by Julianne: we have derived the high-restriction meaning. Overall, we can see that the operation of NP-only reconstruction offers a way to reconcile the high-restriction meaning of quantifiers on left-headed IHRC heads with their lower syntactic position, in which they appear on the surface to form a constituent only with the head noun.

This account predicts that quantifiers on left-headed IHRC high restriction will scope over material in the relative clause.[7] Initial data suggests that this is a correct prediction. Consider the data below, with negation inside the left-headed IHRC:

7 I thank Nick Fleisher for dicussion of this point.

(19) [$_{CP}$kati [kɔsɔ k^{h}úmbrɛ̃] k^{h}ɛ́́ a le p^{h}ɛ] tɛ mru
K. chicken all COMP 3.PFV NEG buy COP black
'Every chicken that Katie didn't buy is black.'
✓ Scenario H: 8 black and 2 white chickens at the market; K. bought 2 white and 2 black (6 black remaining at the market)
✗ Scenario I: 5 black and 5 white chickens at the market; K. bought 2 white and 2 black (3 white and 3 black remaining at the market)

This data is at least consistent with the quantifier 'all' outscoping relative-clause-internal negation: here, we seem to quantify over chickens not bought by Katie.[8]

In many ways, the interpretation of quantified heads in Atchan left-headed IHRCs is perhaps unsurprising, given its cross-linguistic parallels both in in-situ IHRCs in languages like Navajo, and in raising relatives in languages like English. However, the existence of this interpretation in Atchan highlights the interpretive possibilities that syntactic movement creates: by opening up the possibility of selective, NP-only reconstruction, syntactic movement of the quantified IHRC head allows for the existence of the high-restriction meaning in both Atchan and Navajo. This account predicts, consistent with Grosu's (2012) typology, that the high-restriction meaning will only be available in island-sensitive IHRCs (i.e., ones involving movement of the head), which is consistent with the data in both Atchan and Navajo.

4 IHRCs and quantifiers in Bùlì: Non-semantically-motivated head movement

In this section, I show that quantifiers in left-headed IHRCs in Bùlì behave differently: they exhibit the low-restriction meaning. I sketch an analysis, similar to Moroney's (2020), that could capture the basic data on Bùlì.

4.1 Data

Hiraiwa (2005) argues that the interpretation of quantifiers on Bùlì relative-clause heads provides evidence for the left-headed IHRC structure in Bùlì. He shows this interpretation through examples like the following:

(20) Àtim dɛ̀ [$_{DP}$ [$_{CP}$ mángò-tīː méːná àtì Àmɔ̀ak dà] lá]
Atim ate mango-REL.PL all COMP Àmɔ̀ak bought DEM
H.'s translation: 'Àmɔ̀ak bought all (of the) mangos and Àtìm ate them.'
(Hiraiwa 2005:221)
≠ 'Àtìm ate all (of the) mangos that Àmɔ̀ak bought.'

8 Scenario I would be predicted to be true if negation could scope out of the relative clause, over the quantifier.

Unfortunately, quantified IHRC heads in Bùlì have not been systematically investigated in the literature. However, Hiraiwa's Japanese-reminiscent translation in (20) suggests that this sentence does not have the same interpretation as a word-for-word translation into English would suggest. Hiraiwa further comments that the quantifier "indicate[s] the amount of mangos that Àmɔ̀ak bought but never indicate[s] the amount that Àtìm ate" (p. 220). Based on this translation and comment, it therefore appears that the truth of the sentence in (20) is inconsistent with the existence of un-bought mangoes in the domain (though un-eaten mangoes are consistent with the sentence's truth). This is a low-restriction meaning, since we evidently must quantify over all mangoes, not just mangoes meeting the relative-clause description. Empirically, the facts in Bùlì are most similar to what has been reported for in-situ IHRCs in Yǔn Shan (Moroney 2020) and Washo (Hanink 2020).

At this point, it becomes crucial to ask whether Bùlì left-headed IHRCs are restrictive by Grosu's (2012) diagnostics: if they are maximalizing, then a low-restriction meaning is perhaps unsurprising since Japanese, argued to have maximalizing IHRCs (Grosu 2012), has low-restriction quantifiers (Shimoyama 1999). Following Hiraiwa, and in accordance with the diagnostics in Table 1, I assume that Bùlì left-headed IHRCs are restrictive, given that they can stack:[9]

(21) [[mángò-kūːy àtì Àmʷɔk dà dīem lá] àtì Átìm dɛ̀ lă]
mango-REL COMP A. bought yesterday DEM COMP A. ate DEM
māsā
good
'The mango [that Àmɔ̀ak bought yesterday] [that Àtìm ate] was good.' (Hiraiwa 2005:295 (7.8))

Bùlì, then, serves as a challenge for Grosu's (2012) typology. Since Bùlì relatives are restrictive and involve syntactic movement of the head, the typology predicts that quantifiers on the head must have a high-restriction meaning, contrary to fact.

4.2 Analysis: DP reconstruction

More empirical work on Bùlì is certainly needed to pin down some aspects of the empirical data. However, whatever the analysis of Bùlì left-headed IHRCs is, it seems that relying on IHRC machinery will help us obtain the low-restriction meaning. Further, Hiraiwa's work suggests that quantified heads in Bùlì left-headed and in-situ IHRCs have parallel meanings. Accordingly, it seems desirable to have a unified analysis of the two kinds of relatives in the language. To unify the two, the

9 Oddly, Bùlì relatives of all stripes evidently resist indefinite interpretations. This is surprising, especially given the non-maximal flavor of (14). More empirical work on Bùlì is certainly needed to help clarify this point.

most salient analytical option is to treat the head (and quantifier, when present) in Bùlì left-headed IHRCs as undergoing full-DP reconstruction back into the relative clause:

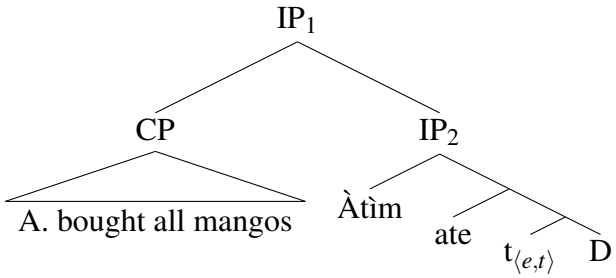
(22) ⟦[[mango all]$_k$ COMP Àmɔ̀ak bought [mango all]$_k$] DEM⟧
all copies shown

= ⟦[[~~[mango all]~~$_k$ COMP Àmɔ̀ak bought [mango all]$_k$] DEM⟧
reconstruct DP

Once this reconstruction occurs, in-situ and left-headed IHRCs in Bùlì have the same structure, making a uniform analysis of the two possible. This reconstruction also makes the low-restriction meaning eminently reasonable, since when interpreted, the quantifier on the head forms a constituent only with the head noun.

In what follows, I sketch a possible analysis of Bùlì relative clause semantics using machinery from Shimoyama 1999 and Moroney 2020.[10] On this type of account, the relative-clause CP moves to adjoin to the matrix-clause TP, leaving behind a type-$\langle e,t\rangle$ trace that will anaphorically pick up a salient property from the relative clause. An additional element (perhaps a null D or DEM) is also inserted, to obtain an individual type from this $\langle e,t\rangle$ property. The resulting tree, following adjunction of the relative-clause CP, is shown below:[11]

(23)



On this style of account, it is crucial that the "right" property is anaphorically picked up with IP_2. In this example, the "right" property is given below:

(24) $\lambda x.\text{mango}(x) \wedge \text{bought}(x)(\text{amoak})$

This is the property of mangoes bought by Amoak—that is, the property that intuitively results from removing the quantifier from within the relative-clause CP.

10 Hanink (2020) develops an account designed to capture similar data in a language with restrictive IHRCs that should derive similar interpretations, though more work is needed to flesh out how quantifiers on the head are interpreted.

11 On Shimoyama's account, and therefore in this exposition of that account, there is no binding of the trace by a lambda-operator.

Following Shimoyama, let us assume for the time being that the null D contributes a maximalization operator. Then, we obtain the following denotation for IP_2:

(25) $[\![IP_2]\!] = \text{ate}(\text{MAX}x[\text{mango}(x) \wedge \text{bought}(x)(\text{amoak})])(\text{atim})$

Finally, CP and IP_2 are conjoined. We thus obtain the following denotation for IP_1:

(26) $[\![IP_1]\!] = \forall x[\text{mango}(x) \rightarrow \text{bought}(x)(\text{amoak})] \wedge$
$\text{ate}(\text{MAX}x[\text{mango}(x) \wedge \text{bought}(x)(\text{amoak})])(\text{atim})$

This sentence will be true if Amoak bought all salient mangoes, and Atim ate the mangoes that Amoak bought. This is a low-restriction meaning: the quantifier *all* quantifies over mangoes, excluding the possibility that Amoak bought only some salient mangoes.

At this point, it seems clear that movement of the head in Bùlì left-headed IHRCs is not done for the purpose of facilitating high quantifier interpretations. We thus need to expand the typology of quantifier interpretation in IHRCs beyond that of Grosu (2012). A natural question that might arise at this point is why the head moves at all in Bùlì relatives. On the analysis sketched in this section, movement of the head is not semantically motivated, given that the head fully reconstructs.[12] Rather, the movement seems in a sense to be "purely" syntactic. Perhaps, for instance, movement of the head makes the head easier to identify for processing purposes. In fact, such mismatches between surface syntax and semantics also occur elsewhere in Bùlì: Sulemana (2019) shows that Bùlì exhibits both overt and covert *wh*-movement. The presence of covert *wh*-movement in Bùlì is a kind of inverse of what I have proposed occurs in Bùlì relatives: in covert *wh*-movement, *wh*-items are interpreted high but pronounced low, while I have suggested that in left-headed IHRCs, the head is pronounced high but interpreted low.

One additional open question, which must be left for future empirical work, comes from Hiraiwa's note that the Bùlì sentence we have focused on here can be true if Atim ate only a subset of the mangoes that Amoak bought. This comment suggests that it is too simple to always insert a null definite D, as in the sketch above. I refer the reader to Moroney 2020 for one approach to a similar set of empirical data in Yǔn Shan; her account leverages the different kinds of typeshifts that are generally available in interpreting bare nouns in the language.

12 Note, however, that on the Shimoyama-style analysis sketched here, quantified heads will ultimately undergo CP-internal quantifier raising, regardless of whether the quantified head occurs in an in-situ or left-headed relative.

5 Conclusion

In this paper, we have explored the interpretation of quantified relative-clause heads in two West African languages, Atchan and Bùlì, which exhibit syntactically-similar IHRCs. We saw that relative-clause quantifiers in Atchan have high restrictions, similar to Navajo IHRCs and to raising relatives in other languages. By contrast, Bùlì relatives have a low restriction, similar to IHRCs in languages like Yǔn Shan and Washo. This contrast between the two languages suggests that we need to expand the typology of internally-headed relatives and their interpretations beyond that of Grosu (2012), since movement of the the head in IHRCs does not have a single semantic effect.

In many ways, this call to expand beyond Grosu's typology might be unsurprising. In recent years, there has been much empirical investigation into the semantics of IHRCs (Bogal-Allbritten & Moulton 2017; Hanink 2020; Moroney 2020; Hucklebridge 2023, a.o.). With more data, we are perhaps at a natural point where we might expect to find (many) examples that force us to expand our typology. Simultaneous cross-linguistic investigation of the semantics of free relatives (Caponigro 2021, a.o.) further adds to an emerging empirical picture of the interpretive mechanisms available in the interpretation of relative-clause-like structures with no or little clause-external material. This paper has furthered this line of research by focusing in on semantic variability in IHRCs evenin the presence of similar syntactic structure.

In this paper, the analyses presented invoke minimal novel semantic machinery, instead repurposing and reusing tools like reconstruction that are independently needed elsewhere in the semantics. Given the range of tools that have been leveraged in the analyses of internally-headed relatives (CP-internal computations [e.g., presence of an index, quantifier type [Hanink 2020]], CP-edge operations [e.g., maximalization [Grosu & Landman 1998]], and CP-external operations [e.g., existential closure [Williamson 1987], null D head [Shimoyama 1999], Heimian indefinite binding [Hanink 2020]]), we are at an exciting time for further empirical investigations of IHRCs cross-linguistically. Further investigation might help to see how, if at all, movement of the head interacts with these various kinds and locations of semantic IHRC interpretive mechanisms.

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