

The prosody of Bemba relative clauses: a case study of the syntax-phonology interface in Dynamic Syntax*

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1. Introduction

The central claim of Dynamic Syntax is that the structure of natural languages reflects the way hearers use natural language to construct representations of content. The DS model aims to show how information provided by words is used incrementally to build increasingly complex semantic representations, a process modelled as tree growth. Due to this incremental perspective, the linear surface order of words plays a much larger role in syntactic analysis in DS than in other models with more emphasis on hierarchical structures or conflicting constraints. Furthermore, the model reflects that on-line choices have to be made about the contribution of a particular piece of information to the overall structure to be developed, and that in some cases, the eventual contribution of some information is not yet known at the time it is encountered. In the formal model, this is reflected by the use of different forms of structural underspecification, where the final structure is only determined at a later stage in the derivation. In addition to lexical input, the structure building process is driven by pragmatic information. Contextual, pragmatic information is modelled as interacting with syntax directly, and to contribute to the structure building process in instances where structural or lexically encoded information is underspecified. The interaction between structure and context occurs throughout the derivation, and so from the DS perspective, there is no strict division between grammatical well-formedness, sentence meaning and pragmatic enrichment. Rather, both structural and contextual information together are used in the dynamic establishment of meaning, and so pragmatic information, together with lexical information, feeds into the computational system, whose output is an enriched semantic representation of content (Cann et al. 2005, Marten 2002). In this paper, we are going to propose that similar reasoning applies to the phonology-syntax interface: In contrast to models in which syntax feeds into phonology, from a DS perspective, phonological information feeds into the computational system (Kiear 2007). We will show this in more detail by providing an analysis of tonal marking of relative clauses in Bemba, where the difference between restrictive and non-restrictive readings is distinguished by different tone marking patterns of the relative clause and of the head noun. The analysis illustrates how prosodic information provides cues for the hearer in establishing appropriate semantic representation, given the lexical input and the context, and how phonological information contributes directly to the incremental building of these structures. Like for the syntax-pragmatics interface, the dynamic perspective adopted in DS thus provides a new way of thinking about the phonology-syntax interface.

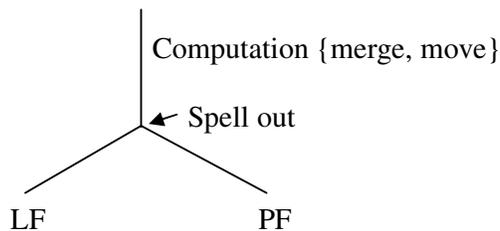
The paper is organized as follows: Section 2 discusses different conceptions of the phonology-syntax interface, while section 3 provides a brief introduction to the relevant aspects of DS. In section 4, we introduce the data; presenting the prosodic marking of relative clauses in Bemba and differentiating pronominal and tonal strategies of relativization. In section 5 we develop a DS analysis for the data presented and finally, in section 6 we present some concluding remarks.

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2. Phonology-syntax interface

The study of linguistic interfaces has attracted increasing attention in formal linguistics over the last decades. In particular the nature of human syntactic knowledge is often claimed to be related to interface conditions, in that syntactic derivations are constrained by well-formedness conditions at the interface between syntactic computation and phonological and semantic-pragmatic knowledge. Within this perspective, it is furthermore often assumed that linguistic knowledge is modularized, and that syntax and phonology constitute distinct, encapsulated modules with their own vocabularies. Communication between the modules is mediated through interfaces, at which only specific information is visible (cf. Chomsky 1995, Jackendoff 2002, Inkelas and Zec 1990, Selkirk 1984, Szendroi 2001, Truckenbrodt 1999).

(1) Chomsky (1995) t-model



Furthermore, as can be seen in (1), syntactic derivation is assumed to proceed without consideration of phonological structure until a complete derivation (or, in other models, a complete cycle, or phase) is merged at the interface. Interface conditions then determine whether the derivation is well-formed, or crashes. Although not intended to be interpreted in that way¹, the relation between syntax and phonology in the model seems to assume speaking, or language production, as the paradigm case for linguistic knowledge – hence syntactic structure is constructed first, and then sent to the phonological component which among other things translates the syntactic structure into audible sound.

From a DS perspective, in contrast, the interaction between phonology and syntax is characterized by the way in which phonological information feeds into structure building processes, following from the overall parsing-based perspective of the model. As with pragmatic and contextual information, phonological information is assumed to interact directly with syntax, so that phonological information is available at every stage of the derivation. Hence syntactic knowledge and phonological knowledge are not viewed as categorically distinct, represented as encapsulated modules, whose information flow has to be mediated by interfaces. Although both systems operate with distinct vocabulary, they interact freely in that all information available is used to construct an appropriate semantic representation for the utterance at hand. Rather than syntax feeding into phonology, DS postulates a feeding relation between phonology and syntax: Phonology provides hearers with parsing cues which are used for lexical access (Kaye 1989), and for building structured semantic representations on a left-to-right basis (Kula 2002, Kiaer 2005, 2007).

(2) sound → phonology → lexicon → syntax/pragmatics → interpretation

The role of phonology in this conception is thus two-fold. On the one hand, phonological knowledge of a given language allows the hearer to divide the continuous input stream of sound into discrete units which can be matched against lexical entries, as argued in Kaye

¹ The model is assumed to be concerned with competence, and is thus meant to be independent of and unrelated to performance factors.

(1989). On the other hand, phonological knowledge, in particular suprasegmental phonology, guides the hearer in the parsing process by providing cues indicating how lexical information is to be projected at a given stage in the parse. Kiaer (2007) shows how intonation and phonological phrasing is exploited for the construction of multiple left-dislocation in Korean: Only with the correct intonational pitch are these multiple dislocation sentences acceptable. The choice of the correct structural representation has to be made on-line, and requires appropriate prosodic information. In that sense, as Kiaer argues, phonological information feeds into syntactic structure building. Kiaer's conception of the phonology-syntax interface is confirmed by the analysis to be presented in this paper. We will show that tone plays a central role in structure building in Bemba relative clauses. Tonal information in Bemba can thus be analysed like intonation in Korean, as feeding into syntactic structure building. However, before we develop our analysis in detail, we will present a brief introduction to the relevant DS background in the next section.

3. A Dynamic Syntax perspective on Bemba structure

Before discussing the prosody in Bemba relative clauses, we will provide in this section a brief introduction to assumptions we make about the DS analysis of Bemba morphological and syntactic structure, building on previous DS analyses of related Bantu languages such as Swahili, Otjiherero or siSwati (Cann et al. 2005: Chapter 7, Kempson et al. 2010, Marten 2007, Marten et al. 2008). Bemba has morphologically complex verbs and nouns, and comparatively free word-order with unmarked SVO order. Lexical subjects, and sometimes objects, are co-indexed on the verb by agreement markers, which we analyse as pronominal clitics. In the appropriate context overt NPs can be omitted, and the inflected verb can function as a complete utterance.²

- (3) bá-ka-fúm-a
SM2-FUT-come-FV
'They will come'

The DS approach to Bemba structure, and Bantu structure more generally, is that individual morphemes of the verbal structure make their own, lexically specified contribution to tree development. For example, the subject marker projects a metavariable which can be resolved from the context, tense markers project partial tree structure in addition to temporal information, and the verb provides conceptual information about the predicate, in addition to, in the case of transitive verbs, licensing the building of an object node. Since basic predicate-argument structure in Bantu can typically be built from morphological information, overt lexical noun phrases serve in many cases to provide new information, or background information against which the main assertion is to be assessed. In DS terms, overt noun phrases are typically introduced through unfixed nodes or linked structures, and only later associated with a fixed position in the tree, or only related to the main tree through anaphoric linkage. Their function is often related to information structure, and so their contribution to the tree interacts closely with information available (or not available) from the context. In this section, we are concentrating on aspects of Bemba structure relevant to the data and analyses discussed in sections 4 and 5, and so will focus on core structure building, driven by the

² We use the following non-standard abbreviations in the glosses: numbers before nouns indicate the noun class number of the noun; FV = Final Vowel, OM = object marker; REL = relative marker; SM = subject marker; an acute accent indicates high tone, low tone is unmarked. Note also that there is vowel fusion whenever a low vowel is followed by a high vowel so that a sequence of /a-i/ as in *ka-isa* 'will come', for example, is pronounced as [e:]. We do not represent such fusions in our examples for expository reasons only.

inflected verb, as well as on the internal structure of noun phrases, as these provide the structural context in which information from the relative clause is projected.

As already noted, we assume that the subject marker lexically provides a restricted metavariable and, furthermore, that subject markers require the presence of a locally unfixed node, dominated by the local root node

- (4) IF ?Ty(e), $\langle \uparrow_0 \rangle \langle \uparrow_1^* \rangle ?Ty(t)$
bá- THEN put(Fo(U_{CLASS2}), $\exists x(Fo(x))$)
 ELSE abort

The restriction on the metavariable (U_{CLASS2}) acts as a restriction on substitution, and so we assume that noun classes have semantic content. This is uncontentious for class 1 which denotes humans and class 2 which denotes human plurals or can be used for human singulars to express politeness. For noun classes in Swahili, Contini-Morava (2002) argues that they have a semantic base, and we assume that similar arguments apply to Bemba noun classes.

A parse of (4) sets out with the information from the subject marker decorating a locally unfixed node, and the metavariable being substituted by an appropriate term from the context, which we here assume is *bamayo* ‘mothers’. After parsing the subject marker, lexical information from the future tense marker *-ka-* annotates the root note with appropriate tense information which we represent somewhat simplified as Tns(FUT). However, in addition we assume that the tense marker also contributes to developing the tree by licensing the building of a fixed subject and a fixed predicate node.

- (5) *bá-ka-* ...
 SM2-FUT-
- $$\begin{array}{c} \text{?Ty}(t), \text{Tns}(\text{FUT}) \\ \swarrow \quad \searrow \\ \text{?Ty}(e), \diamond \quad \text{?Ty}(e \rightarrow t) \end{array}$$
- $\langle \uparrow_0 \rangle \langle \uparrow_1^* \rangle ?Ty(t),$
 Ty(e), Fo(*bamayo*)’

The presence of the fixed subject node allows the unfixed node to merge with the subject node, fulfilling the requirement ?Ty(e), and thus to become fixed as the logical subject of the ensuing proposition. The parsing of the subject marker and the tense marker alone is thus sufficient to construct a predicate frame with only information about the predicate outstanding.

- (6) *bá-ka-* ...
 SM2-FUT-
- $$\begin{array}{c} \text{?Ty}(t), \text{Tns}(\text{FUT}) \\ \swarrow \quad \searrow \\ \text{Fo}(\text{bamayo}), \text{Ty}(e) \quad \text{?Ty}(e \rightarrow t), \diamond \end{array}$$

- (7) IF ?Ty(e → t)
-fúm- THEN put(Fo(*fúm*), Ty(e → t))
 ELSE abort

Parsing of the verb *-fúm-* ‘come’ results in the annotation of the predicate node, and the tree can then duly be completed. It is tempting to analyse the final vowel *-a*, which follows the verb root in *bá-ka-fúm-a* ‘they will come’, as encoding some restriction on the completion of

the tree, similar to the DS analysis of TAM suffixes in head-final languages like Japanese (Cann et al. 2005: 240). However, in transitive clauses, the object normally follows the verb (and hence the final vowel), and so the final vowel cannot be analysed as requiring the completion of the tree. A more promising line of enquiry might be to relate the final vowel to valency-changing operations, as all verbal derivational suffixes ('extensions' in Bantu terms) precede the final vowel – thus the arity of the predicate has to be fixed before the final vowel is parsed, or in other words, all argument nodes have to be built, although not necessarily be decorated. However, we will leave the question open for the time being.

A potential problem with the approach taken so far is presented by perfect verbs, as in these TAM markers are not placed between the subject marker and the verb root (as in the future tense example discussed so far), but follow the verb root, replacing the final vowel.

- (8) bá-fík-íle maílo
 SM2-arrive-PERF yesterday
 'They arrived yesterday'

Since we assume that verbs like *-fík-* 'arrive' have a lexical trigger $?Ty(e \rightarrow t)$, as in the lexical entry in (7), above, the parse would abort once *-fík-* is encountered, as no fixed predicate node has been built yet. As a solution to this problem, we assume that these cases require the licensing of structure building which anticipates specific tense information. The building of a fixed subject node and a fixed predicate node is licensed after the subject marker has been parsed, but subject to a requirement at the root node that the tense be perfect.

- (9) bá- ...
 SM2-
- ?Ty(t), ?Tns(PERF)

/ \

?Ty(e), \diamond ?Ty(e \rightarrow t)

< \uparrow_0 >< \uparrow_1^* >?Ty(t),
 Ty(e), Fo(bamayo')

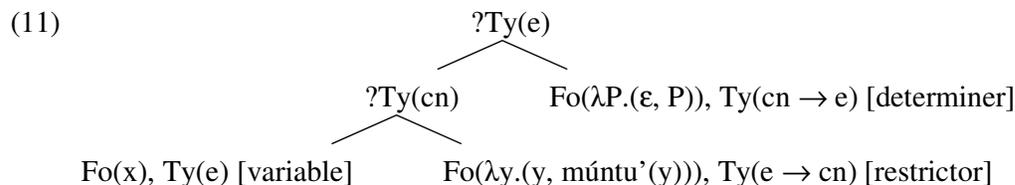
The tense requirement is fulfilled once the perfect suffix *-ile* is parsed, and so the partial tree can be completed (or further developed, for example if an object is following). If, however, the tense requirement is not fulfilled, the derivation fails. The anticipatory building of structure is thus tightly restricted to perfect forms in which tense marking appears after the verb root. For ease of exposition, however, we will restrict the discussion in the following sections to more canonical examples with TAM morphemes before the verb root.

Like verbs, Bemba nouns are morphologically complex, consisting of an augment, or pre-prefix, a noun class prefix, and a nominal stem.

- (10) u-mú-ntu
 AUG-1-person
 'a/the person'

The augment can be present or absent, depending on the context in which the noun is used. The specific criteria relevant to presence or absence of the augment provide a heterogeneous set, and are not clearly related to a particular function. Because the augment is absent in word-formation, it is often assumed that it fulfils a syntactic, rather than a morphological function, and in related Bantu languages, the augment has been argued to fulfil semantic or pragmatic functions as well (e.g. in Luganda, Hyman and Katamba 1993, Ferrari-Bridgers 2009).

However, the distribution and function of the augment in Bemba are still subject to on-going research (see Givón 1969 for an early account, and Kula 2009 for a recent update), and we will not present a detailed analysis of the morpheme. Similarly, it has been argued that noun class prefixes play a role in syntax as well as in morphology, as exponents of gender or number features (e.g. Carstens 1991), but at least for Bemba, further work is needed to ascertain this. From the DS perspective, we assume that nominals project complex structure, consisting of determiner (in the illustrative example below taken to be existential quantification, with an epsilon (ϵ) term to be created), variable, and restrictor (in the example below *múntu*, ‘person’).



This complex structure reflects the compositional semantic structure of noun phrases, in which a nominal variable is restricted by the lexical nominal predicate, and where quantification is modelled with recourse to the epsilon calculus (Blackburn and Meyer-Viol 1994). However, we will not discuss quantification in any detail, other than using epsilon (ϵ) terms for existential, and tau (τ) terms for universal quantification. We assume tentatively that the nominal root and the noun class prefix are part of one lexical representation, which decorates the restrictor node. Consistent with our earlier observation that noun classes have denotational-semantic content, we thus do not assume that noun class prefixes encode straightforwardly number or quantification. On the other hand, we assume that the augment fulfils a functional, rather than a lexical role, even though the exact function needs still to be established, and we will not provide an analysis of this here. Rather, we will assume the representation in (11), and that nominals like *umúntu* ‘person’ project this structure lexically. We also assume for the time being that the pointer is placed lexically at the variable node when the noun is parsed, but we will have reason to revise this when discussing the tone marking of nouns in section 5.

We now turn to discussing Bemba relative clauses in the following section, and to a DS analysis of the data in section 5, for which the short discussion about Bemba structure provides the background.

4. Prosodic marking of relative clauses in Bemba

Like many Bantu languages, Bemba employs different strategies for encoding relative clauses, including the use of relative markers and tone marking of both the relative clause and the head noun (Sharman and Meeussen 1955, Cheng and Kula 2006, Kula and Cheng 2007, Kula 2007). We first illustrate tone marking of the head noun of relative clauses which distinguishes restrictive and non-restrictive readings of relative clauses, then discuss the use of pronominal relative markers and tone marking of the relative clause and show how the different formal strategies are related to restrictive and non-restrictive readings. Finally we introduce headless relative clauses which are always marked by a pronominal relative marker and show that despite the absence of a head noun carrying tonal marking differentiating restrictive from non-restrictive interpretations, headless relatives always have a restrictive interpretation.

4.1. Tonal marking of the head noun

Nouns functioning as head nouns of relative clauses can be distinguished by their tone marking. A word-final high (H) tone is found with restrictive relatives (12), while a final low (L) tone is found with non-restrictives (13). In both cases, the predicate of the relative clause is marked as being in a relative clause, as will be discussed in the following section.

- (12) abá-ntú ábá-ka-ís-a bá-ka-fúm-a ku-Lusaka
2-people REL.SM2-FUT-come-FV SM2-FUT-come-FV 17-Lusaka
'The people who will come will come from Lusaka' (restrictive)
- (13) abá-ntu ábá-ka-ís-a bá-ka-fúm-a ku-Lusaka
2-people REL.SM2-FUT-come-FV SM2-FUT-come-FV 17-Lusaka
'The people, who will come, will come from Lusaka' (non-restrictive)

The difference in tone marking of relative clause head nouns in Bemba has first been noted by Sharman (1956), who relates the tone marking to a similar tonal alternation on verb forms, often called a distinction between conjoint and disjoint verb forms (e.g. Meeussen 1959, Creissels 1996). We will return to the relation between nominal and verbal tone marking in section 5. In any event, the data so far show that Bemba restrictive and non-restrictive relatives are formally distinguished through tonal marking of the head noun. In the next section we will show that further formal distinctions are found within the relative clause.

4.2. Pronominal and tonal marking of the relative clause

In addition to tonal marking of relative clause head nouns, tone marking of the predicate of the relative clause is sensitive to the distinction between restrictive and non-restrictive readings. There are two basic different strategies for relative clause marking in Bemba: a pronominal strategy and a tonal strategy. The pronominal strategy of relativization uses a relative marker in the form of a relative concord in subject relatives and a demonstrative based relative pronoun in non-subject relatives. The two pronominal forms allow for both restrictive and non-restrictive readings as shown in (14-17) below.

- (14) abá-ntú á-bá-ka-ísa bá-ka-fúma ku-Lusaka (pronominal)
2-people 2REL-SM2-FUT-come SM2-FUT-come 17-Lusaka
'The people who will come will come from Lusaka' (restrictive)
- (15) abá-ntu á-bá-ka-ísa bá-ka-fúma ku-Lusaka (pronominal)
2-bantu 2REL-SM2-FUT-come SM2-FUT-come 17-Lusaka
'The people, who will come, will come from Lusaka' (non-restrictive)
- (16) abá-ntú ábo Chisanga á-mwééne maílo na-bá-ya (pronominal)
2-person 2REL Chisanga SM1-see.PERF yesterday TNS-SM2-go
'The people that Chisanga saw yesterday have gone' (restrictive)
- (17) abá-ntu ábo Chisanga á-mwééne maílo na-bá-ya (pronominal)
2-person 2REL Chisanga SM1-see.PERF yesterday TNS-SM2-go
'The people, that Chisanga saw yesterday, have gone' (non-restrictive)

The first two examples show the pronominal strategy in subject relatives expressing restrictive and non-restrictive readings, as can also be seen from the tonal marking of the head nouns. The second pair of examples shows object relatives formed with the demonstrative-

based class 2 relative marker *ábo*, which agrees with the head noun, with both restrictive and non-restrictive readings.

The second relative clause coding strategy is the tonal strategy which is only available to subject relatives. In this strategy no segmental relative marker is used, but the subject concord of the relative predicate is marked with a low (L) tone.³

(18) abá-Bembá bà-ikala mu-Zambia bá-li-shipa (tonal strategy)
 2-Bembas 2REL.SM2-live 18LOC-Zambia SM2-PROGR-be.brave
 ‘The Bembas who live in Zambia are brave’ (restrictive)

(19) *abá-Bemba bà-ikala mu-Zambia bá-li-shipa (tonal strategy)
 2-Bembas 2REL.SM2-live 18LOC-Zambia SM2-PROGR-be.brave
 Intd.: ‘The Bembas, who live in Zambia, are brave’ (non-restrictive)

The tonal strategy always gives rise to a restrictive reading. Therefore it cannot be used with non-restrictive marked head nouns as shown in (19). Furthermore, the tonal strategy is only available for subject relatives, while non-subject relatives have to be formed with the pronominal strategy. If there is an overt lexical subject in the relative clause it has to be inverted so as to follow the predicate, and cannot intervene between the head noun and the tone-marked predicate.

Thus the two relative strategies shown here differ in that the pronominal strategy can be used for both subject and non-subject relatives, and allows both restrictive and non-restrictive readings, while the tonal strategy is restricted to subject relatives with restrictive reading. Accordingly, the pronominal strategy can be used with both kinds of head nouns, while the tonal strategy can only be used with the H tone marked, restrictive head noun. Before presenting an analysis of the data, we will briefly discuss headless relatives in the following section.

4.3. Headless relatives

Bemba allows relatives to be built without an overt nominal head. Headless relatives can only be formed with the pronominal strategy.

(20) á-bá-ikala mu-Zambia bá-li-shipa
 2REL-2SM-live 18LOC-Zambia 2SM-PROGR-be.brave
 ‘Those who live in Zambia are brave’

(21) úo á-mwééne Chisanga maílo, na-á-fika
 1REL 1SM-see.PERF Chisanga yesterday TNS-1SM-arrive
 ‘The one who Chisanga saw yesterday has arrived’

Headless relatives normally require appropriate contextual support and refer (anaphorically) to a given or inferred antecedent, as in (22), where the person who opened the door is inferred from the information provided by the preceding sentence:

³ To fully show the contrast between the normal subject concord (with H) and the relative subject concord (with L), we mark the L tone here with an grave accent. However, there is no difference between this L tone, and other L tones which by convention we do not mark.

- (22) Ici-ibi cá-ali-isuka. Á-bá-iswiile bééne ba-nganda.
 7-door 7SM-PAST-open 2REL-2SM-open.PERF 2owner 2GEN-house
 ‘The door opened. (The one) who opened (it) was the owner of the house’

The tonal strategy cannot be used with headless relatives as the following examples show.

- (23) *bà-ikala mu-Zambia bá-li-shipa (tonal strategy)
 2REL.2SM-live 18LOC-Zambia 2SM-TNS-be.brave
 Intd.: ‘Those who live in Zambia are brave’
- (24) *à-mwééne Chisanga maílo, na-á-fika (tonal strategy)
 1SM-see.PERF Chisanga yesterday TNS-1SM-arrive
 Intd.: ‘(The person) who Chisanga saw yesterday has arrived’

The absence of headless relatives with the tonal relative strategy shows a further restriction on the availability of the construction, which is only found with restrictive subject relative clauses with an overt lexical head.

After surveying the relevant examples of relative clause constructions in Bemba, we will show in the following section how the different restrictions and marking patterns can be explained within DS. In doing so, we will show how tone marking of both relative clauses and relative heads interacts with processes of structure building formalized in the DS model.

5. Analysis

Our analysis follows the standard analysis of relative clauses in DS (Kempson et al. 2001, Cann et al. 2005), employing a Link structure to relate the head noun and the relative clause, with a copy of the formula value required to be part of the structure induced by the relative clause. We will propose that the relative pronoun introduces such a copy of the formula value of the head noun in the pronominal strategy. In the tonal strategy, the tonal marking of the relative clause requires not only a copy but more specifically that the copy be a variable, thus interacting with DS noun phrase analyses and ensuring a restrictive reading. Headless relatives are analysed as building a skeletal antecedent for the pronominal relative marker from the context. Since the constructed head is semantically severely underspecified, its interpretation rests largely on information provided by the relative clause. The effect of this is that, even though headless relatives are technically not restrictive, the interpretation is seemingly restrictive. Since in the tonal strategy, no pronominal element is involved, the tonal strategy cannot be used in headless relatives. Finally, the tone marking on head nouns is analysed as distinguishing between completed Ty(e) tasks, thus resulting in a non-restrictive reading, and incomplete Ty(e) tasks, which leads to a restrictive interpretation. All in all, we will show that tonal marking in Bemba relatives closely interacts with, and contributes to, structure building. The analysis thus supports the DS conception of the phonology-syntax interface as essentially hearer-based. In the following sections, we will develop our analysis in more detail.

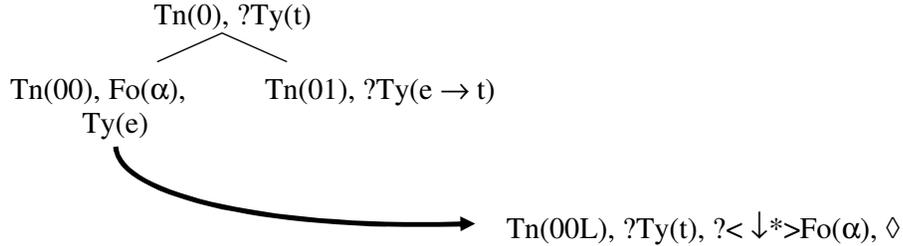
5.1. Link and noun phrase structure

Our analysis is based on previous DS analysis of relative clauses and noun phrase structure (e.g. Kempson et al. 2001, Cann et al. 2005). Relative clauses are analysed in DS as a conjunction of two trees, linked by a shared term. Formally, a Link structure is built from a Ty(e) node to a new ?Ty(t) node, based on the transition rule in (25) which results in a schematic partial tree like (26).

(25) Link Adjunction (for relatives) (Cann et al. 2005: 88)

$$\frac{\{n \dots Fo(\alpha), Ty(e) \dots \diamond\}}{\{n \dots Fo(\alpha), Ty(e) \dots\}, \{nL \dots ?Ty(t), ?<\downarrow*>Fo(\alpha) \dots \diamond\}}$$

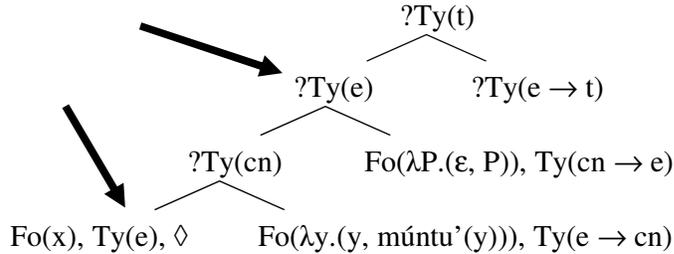
(26)



The linked node will be further developed through information from the relative clause, and before it is completed, somewhere in the structure $Fo(\alpha)$ needs to be included so as to fulfill the requirement holding at the root node of the linked tree. The copy of the formula value of the head noun is often introduced through a pronominal element, either a relative pronoun, or a resumptive pronoun within the relative clause. After completion of the relative clause, the main tree will be developed further with information from the matrix clause.⁴

The Link rule interacts with the noun phrase structure introduced in section 3. Since both the node decorated by the variable, and the top node of the representations of nominals are of $Ty(e)$, a Link structure can be launched from either – with attendant differences in interpretation.

(27) NP representation and possible nodes for launching a Link structure



These two alternatives are freely available, and depend on at which stage in the derivation the Link relation is launched, thus giving a formal means to distinguish restrictive and non-restrictive relatives. The Link relation may be launched at the stage in the derivation at which the nominal variable is introduced, so that the Link relation modifies/restricts the variable, leading to a restrictive reading. But a Link relation may also be launched after the semantic representation of the head noun has already been completed, so the Link relation is launched from the $Ty(e)$ node representing the full, completed information from the head noun. This results in a non-restrictive reading.

We will exploit this interaction between Link structures and noun phrase structure in our analysis of Bemba relatives in the next section.

⁴ The illustration here is of head-initial relatives. Variation in relative clauses is discussed in Cann et al. (2005).

5.2. Pronominal strategy: The pronominal form provides a copy of the head noun

In relative clauses formed with the pronoun strategy, a placeholder is provided by the pronoun which ensures that a copy of the formula value of the head noun is part of the linked tree. The placeholder is provided by the H toned *á-* relative marker which is prefixed to the subject marker of the predicate in subject relatives, and to the independent relative agreement marker in object relatives. The relative marker agrees in class with the head noun, in this case with *bakafúndisha* ‘teacher’ in (28) and with *abántu* ‘people’ in (29)

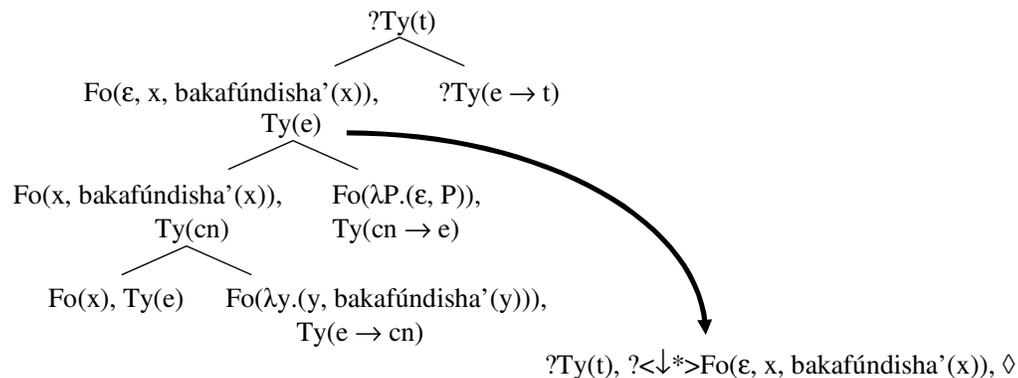
(28) *ba-kafúndisha á-bá-léé-lolesha pansé bá-la-péép-a*
 2-teacher 2REL-SM2-TNS-look 16outside SM2-PRES-smoke-FV
 ‘The teacher who is looking outside smokes’

(29) *abá-ntu ábo Chisanga á-mwééne maílo na-bá-ya*
 2-person 2REL Chisanga SM1-see.PERF yesterday TNS-SM2-go
 ‘The people who Chisanga saw yesterday have gone’

The following snapshots of a derivation of (28) show how computational and lexical actions interact in the construction of representations of relative clauses in Bemba. For the moment, we are not concerned with the tone marking on head nouns, to which we will return to later. We will start by illustrating the non-restrictive construal, in which the link structure is launched from Ty(e) node decorated with the complete Ty(e) expression, with a requirement for a copy of the formula value at the root node of the linked tree. As the Link structure is launched from a completed Ty(e), it is the complete, quantified term of which a copy is required to be part of the new linked tree. We will see below that in restrictive relatives, it is only the variable which is copied, and so any information from the linked tree will be used when the fully quantified term is built.

(30) Pronominal strategy 1: Building of Link structure with requirement for copy

ba-kafúndisha
 2-teacher



The next steps in the derivation are based on lexical information from the following morpheme *á-* which we analyse as a relative prefix providing a copy of the head noun.

(31) Lexical entry for *á-*

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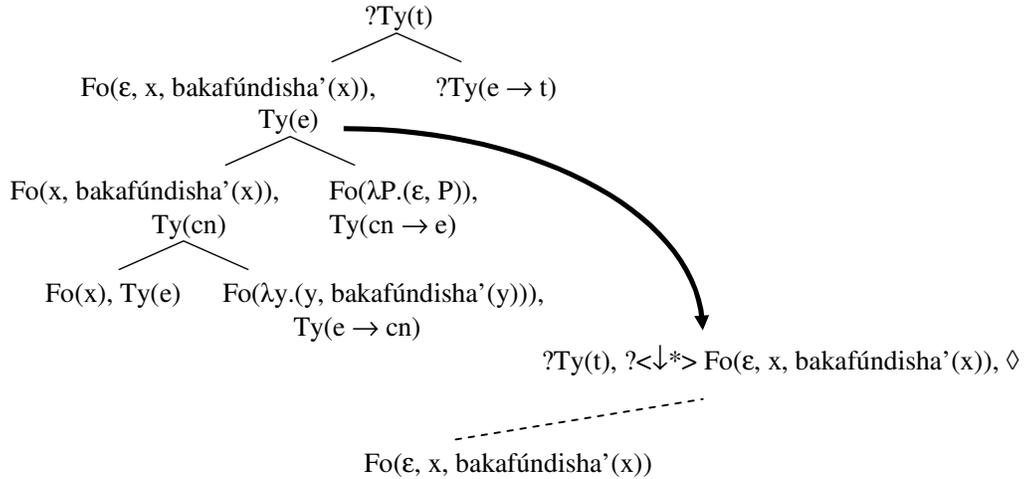
IF      ?Ty(e), <↑*>( ?Ty(t), ?<↓*>Fo(αClass2))
THEN   put Ty(e), Fo(αClass2)
ELSE   abort

```

The lexical entry for *á-* requires a ?Ty(e) task at the current node, and furthermore that this node be unfixed with respect to some higher node with the requirement of <↓*>Fo(α_{Class2}), that is, a formula value whose referent is of noun class 2. The lexical information of the relative maker thus requires that an unfixed node be built before the information can be used. This ensures that both subject and object relative clauses can be coded with the pronominal strategy.

(32) Pronominal strategy 2: relative pronoun provides copy

ba-kafúndisha á-
2-teacher 2REL

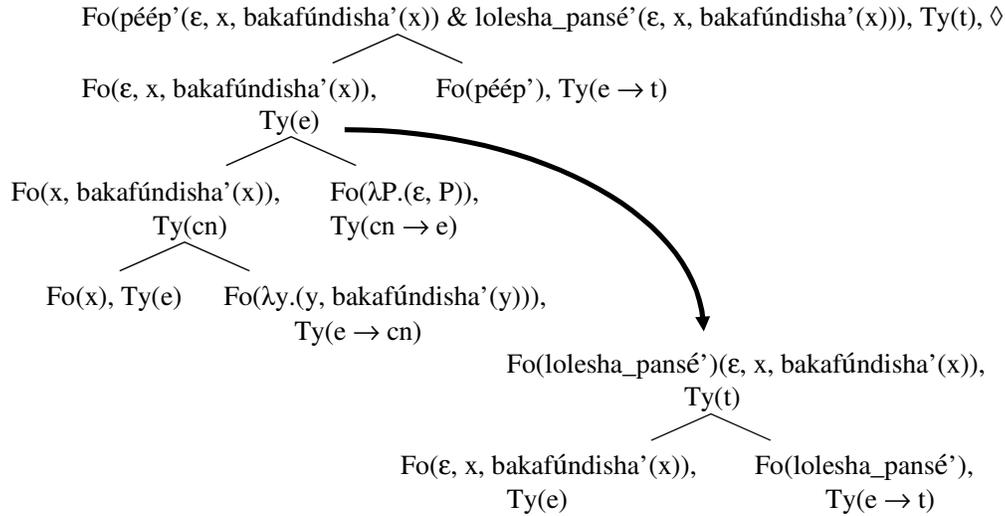


The following steps build the linked tree through computational and lexical actions. The subject marker *bá-* decorates a locally unfixed node, which merges with the unfixed node decorated with $Fo(\epsilon, x, bakafúndisha'(x))$. The following tense marker *-léé-* licenses the building of fixed subject and predicate nodes, and the locally unfixed node can merge with the former, thus ensuring that a copy of the formula value of the head noun is in a fixed position within the linked tree. Finally, parsing the verb and the adjunct of the relative clause, *-lolesha pansé* ‘look outside’ (for which we omit internal representation here) results in decoration of the predicate node.

After the relative clause is parsed, information from the linked tree is built into the main tree. Since the subject $Ty(e)$ has already been compiled when the Link structure was launched, information from the Link structure has no effect on the interpretation of the subject, as it would have in restrictive relatives. Rather, information from the link structure is provided in addition to the information independently established at the subject node.

(33) Pronominal strategy 3: Final tree

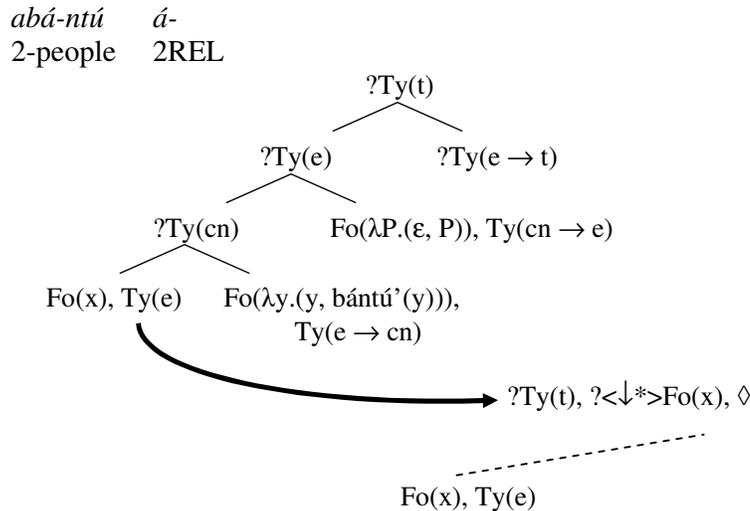
ba-kafúndisha á-bá-léé-lolesha pansé bá-la-péép-a
2-teacher 2REL-SM2-TNS-look 16.outside SM2-PRES-smoke-FV



As noted earlier, the pronoun strategy is also available for restrictive relatives. The difference between non-restrictive and restrictive relatives in DS terms is that in the former, the Link relation is launched after the Ty(e) expression has been completed, as in the example just discussed. In the latter, the Link relation is launched from the Ty(e) node decorated by the variable x, that is before all the information of the eventual Ty(e) node has been compiled.

- (34) abá-ntú á-bá-ka-ísa bá-ka-fúma ku-Lusaka (pronominal)
 2-people 2REL-SM2-FUT-come SM2-FUT-come 17-Lusaka
 'The people who will come will come from Lusaka' (restrictive)

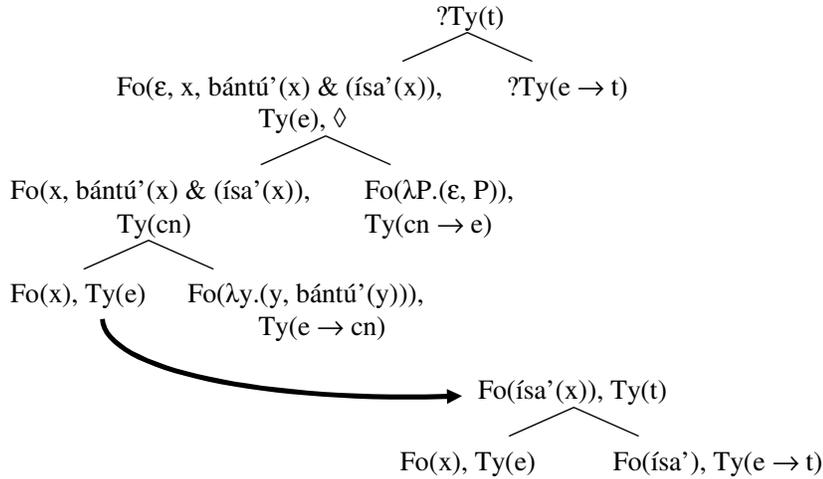
- (35) Pronominal strategy with restrictive reading 1



This means that the information from the relative clause restricts the nominal variable in the same way that the information provided by the restrictor node Ty(e → cn) restricts it. Information from both sources contributes to the construction of the eventual Ty(e) term.

(36) Pronominal strategy with restrictive reading 2

abá-ntú á-bá-ka-ís-a
 2-people 2REL-SM2-FUT-come-FV



As we will see later, it is only this second tree growth process, leading to a restrictive reading, which is available for the tonal relative strategy.

In the pronoun strategy of Bemba relative clauses a copy of the formula value of the head noun is this provided by the agreeing relative marker. Since the copying of the formula value of the head noun is achieved through the anaphoric properties of the relative marker, resumptive pronominal object markers in object relatives are only marginally acceptable in Bemba.

(37) *icí-puna íco umu-ánakashi á-mweene ...*
 7-chair REL7 1-girl SM1-see.PERF
 ‘The chair which the girl saw ...’

(38) **icí-puna ico umu-anakashi a-ci-mweene ...*
 7-chair REL7 1-girl SM1-OM7-see.PERF
 Intd.: ‘The chair which the girl saw ...’

The pronoun strategy as discussed so far proceeds like relative clause formation in many other head-initial languages with pronoun-like relative markers. In the following section, we will show how relative clauses marked by the tonal strategy can be analysed.

5.3. Tonal strategy

In contrast to the pronominal relative strategy, no relative marker is used in the tonal strategy. The relative clause is only marked by a L tone on the subject marker of the verb of the relative clause. The tonal strategy is only possible for subject relatives, and any overt lexical subjects have to follow the relative predicate. The effect of this is that the verb of the relative clause always immediately follows the head of the relative. Furthermore, only restrictive readings are possible with relatives marked with the tonal strategy.

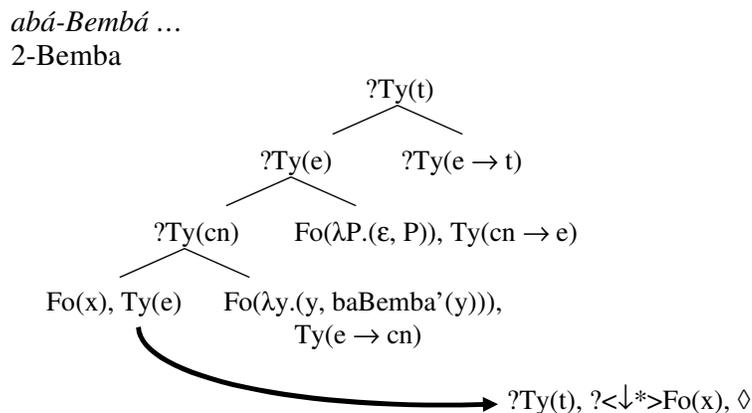
In terms of the DS analysis of noun phrase structure and relative clauses, the fact that only a restrictive reading is available for relatives marked with the tonal strategy can be

represented by restricting tonal relatives to a Link relation build from the embedded $Ty(e)$ node which is decorated with a variable $Fo(x)$. Since the variable and any restrictor associated with it enter the evaluation process of the eventual $Ty(e)$ expression, when information at the terminal nodes is passed up the tree to compute the semantic representation of the mother node, this will lead to a restrictive reading. We propose that this restriction is lexically encoded in the lexical information of the L toned relative subject marker, which can only be used in a tree context where a link relation has been built from the internal $Ty(e)$ expression. The restrictive reading is also encoded by the tone marking of the head noun, but we will postpone discussion of this to a later section.

- (39) abá-Bembá bà-lee-ikala muZambia bá-li-shuupa (tonal strategy)
 2-Bembas 2REL.2SM-TNS-live 18-Zambia SM2-TNS-be.difficult
 ‘The Bembas who live in Zambia are difficult’ (restrictive only)

The initial steps in the derivation are similar to the preceding example, but in this case, the Link relation is launched from the $Ty(e)$ node decorated with $Fo(x)$, the nominal variable.

- (40) Tonal strategy step 1: Link structure is built



The following relative subject marker provides lexical information similar to the pronominal relative marker. However, there are significant differences. First, the first IF clause of the lexical entry for *bà-* in (41) requires the presence of a locally unfixed node, rather than an unfixed node. This reflects the fact that *bà-* is a subject marker, and as such is projected unto a locally unfixed node, as discussed in section 3. Secondly, the second IF clause requires that the formula at the node from the which the Link structure is launched should be dominated by $?Ty(cn)$. It is this condition which ensures that the only formula value which can be copied in tonal relatives is the quantificational variable, as this is the only formula value dominated by $?Ty(cn)$. This ensures that only a restrictive reading is possible with tonal relatives. Finally, the third IF clause requires that the restrictor of the linked $Ty(e)$ node be of class 2, thus ensuring agreement between the head and the relative marker. In contrast to the lexical requirements of the pronominal relative marker, in the present case it is not the copied formula itself which is of class 2, this being merely a variable, but class information comes from the restrictor of the variable, hence the need for a more complex restriction here. If all lexical conditions are fulfilled, the lexical entry licences the decoration of the node with an expression of $Ty(e)$ and a copy of the nominal variable as formula value.

(41) Lexical entry for *bà-*

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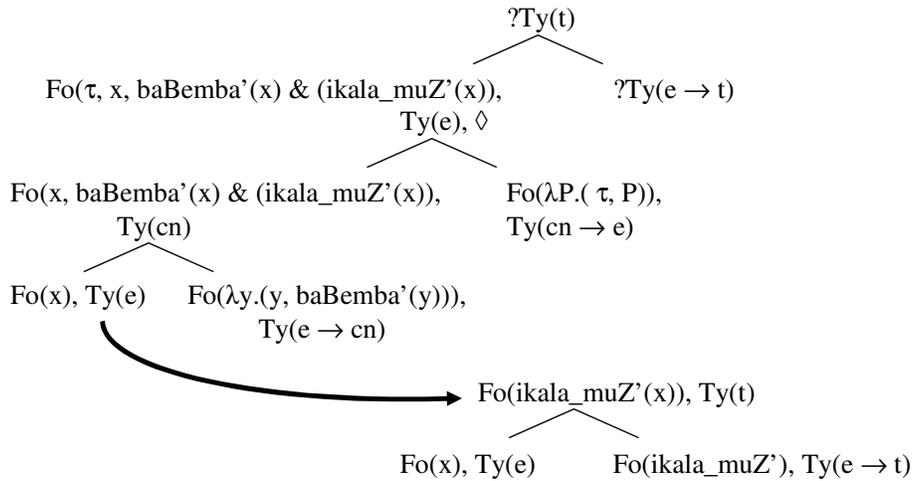
IF      ?Ty(e), <↑0><↑*><?Ty(t)>
THEN   IF      <↑0><↑*><L-1>(Fo(α) & <↑0>?Ty(cn))
      THEN   IF      <↑0><↑*><L-1><↑0><↓1> Fo(UClass2)
            THEN   put Ty(e), Fo(α)
            ELSE   abort
      ELSE   abort
ELSE   abort

```

The entry reflects that *bà-* is a class 2 subject marker, while at the same time ensuring that it only occurs in restrictive relative contexts. The lexical actions of *bà-* then result in a locally unfixed subject marker, decorated with $Fo(x)$, and the subsequent information from the tense marking provides a fixed subject and predicate node, at which the locally unfixed node can merge. After the verb is parsed and the predicate node annotated, the information from the linked tree can be compiled and serve as an annotation of the root tree.

(42) Tonal strategy step 3: Information from the Link structure is build into the subject node

abá-Bembá *bà-lee-ikala* *muZambia ...*
 2-Bembas 2REL.2SM-TNS-live 18-Zambia



Since the information from the Link structure is included in the information of the nominal variable, this information constitutes part of the nominal interpretation and is within the scope of nominal quantification, and thus a restrictive reading results.⁵

The difference then between the pronominal and the tonal relative strategies in Bemba is thus that in the pronominal strategy, an overt anaphoric element is introduced into the parse through the pronominal relative marker, and thus the pronominal strategy can be used for both restrictive and non-restrictive readings, while in the tonal strategy, the relative marker requires that the copy be a nominal variable, thus ensuring exclusively restrictive readings. In the following sections, we will extend this analysis to headless relatives, and to the tonal marking of head nouns.

⁵ The formal analysis is in some respects similar to the analysis of empty relativisers in English proposed in Cann et al. (2005: 114), and so has applications beyond the specific case discussed here.

5.4. Headless relatives

In this section, we will extend our analysis to headless relatives. Headless relatives are only available with the pronominal strategy, and not with the tonal strategy. Furthermore, headless relatives refer anaphorically to a given or inferred antecedent:

- (43) iciibi cá-ali-isuka. Á-ba-iswiile bééne ba-nganda.
7-door SM7-PAST-open 2REL-SM2-open 2owner 2GEN-house
'The door opened. (The one) who opened was the owner of the house'

Headless relatives by themselves cannot be used as fully quantified terms, and in order to express such quantified structures, an overt quantifier such as *bonse* 'all' must be used as overt head:

- (44) B-onse á-bá-iswiile iciibi bá-léé-péépa.
2-all 2REL-SM2-open door SM2-TNS-smoke
'Anyone/everyone who opened the door was smoking.'

This means that clearly restrictive readings as in (44) are not possible with headless relatives, even though the reading in (43) does not present a typical non-restrictive reading either: the inferred antecedent in (43) – glossed as 'the one' – is not unambiguously identifiable from the context, as the following relative provides essential information for the identification of the head. With respect to this blurring of the restrictive/non-restrictive distinction, the fact that only the pronominal strategy is available for headless relatives supports the idea that the construction of headless relatives in Bemba involves the anaphoric interpretation of a maximally weakly specified head provided by the context.

In our analysis of headless relatives, we are building on the DS analysis of head-final relatives in Japanese (Kempson and Kurosawa fcmg). Kempson and Kurosawa note that in Japanese head-final relatives, similar to Bemba headless relatives, restrictive and non-restrictive readings cannot be clearly distinguished, and that their interpretation blurs this distinction. This results, according to Kempson and Kurosawa, from the fact that Japanese head-final relatives involve the construction of a maximally weak unrestricted epsilon term, of the form ($\epsilon, x, P(x)$), before the relative clause and the head are parsed. The term serves as structural anticipation for the subsequent provision of the head, so that the relative clause can be projected against some existing structure, however weakly defined. For Bemba headless relatives, we assume, along similar lines, the construction of a weakly specified $Ty(e)$ expression, which serves as antecedent for the subsequent relative clause. Note that, as Kempson and Kurosawa point out, variables as used in restrictive relatives do not have any existence by themselves, without the term which binds them, making it implausible that a variable should be inferred in context. In contrast, $Ty(e)$ expressions as term denoting expressions, can be inferred and constructed in context to enter anaphoric relationships, and we thus assume that headless relatives are constructed against a contextually supplied $Ty(e)$ expression. However, the expression merely provides a skeletal structure without any content, and depends for its interpretation on the information supplied by the subsequent relative clause. While this implies that headless relatives are not restrictive, in the sense of restricting a predicate variable, they nevertheless have a sense of restrictiveness because the constructed $Ty(e)$ expression merely has an underspecified predicate value, and thus the expression depends on further input for its interpretation. The Link structure for the headless relative can be launched from the anticipatory $Ty(e)$ node, and it is only with the information from the relative, that the predicate variable P is resolved. Our analysis of the relative pronoun used in the pronominal strategy provides a copy of the formula value of the $Ty(e)$ node from which

the Link structure is launched, and this is also true of headless relatives, even though in these cases, the copy does not contain any conceptual information, which is provided only from the information from the relative clause. In contrast, the unavailability of the tonal strategy for headless relatives follows from the fact that a copy of the variable has to be provided through lexical actions for the tonal strategy to be possible, and no such copy of a variable can be provided in headless relatives.

It follows from the analysis that headless relatives, even though not restrictive in the technical sense, still have restrictive appearance, since the information from the relative is essential for identifying the Ty(e) term constructed, as this is constructed just as a skeleton term without conceptual content. However, this effect results from the interaction of the constructed node and subsequent information, and not from the copying of the nominal variable, as can be seen from the absence of truly quantified headless relatives.

5.5. Marking on head nouns

In the final part of our analysis, we will turn to the marking of the head noun in headed relatives. The two different marking patterns found with head nouns interact directly with the analysis of restrictive and non-restrictive relatives developed earlier, and in our analysis are sensitive to the presence or absence of a link structure at the time the Ty(e) node is compiled. However, we will show at the end of the section that in light of similar data in the verb phrase, ultimately a more general analysis of tonal head marking might be preferable.

Recall that head nouns in relatives are marked with two different tone patterns, which are related to restrictive vs. non-restrictive readings.

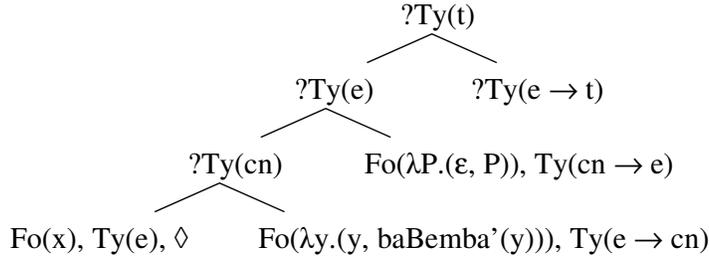
(45) abá-Bembá ábá-shipa bá-ikala mu-Zambia
 2-Bemba SM2.REL-be.brave SM2-live 18-Zambia
 ‘The Bembas who are brave live in Zambia’ (and those who are not live abroad)

(46) abá-Bemba ábá-shipa bá-ikala mu-Zambia
 2-Bemba SM2.REL-be.brave SM2-live 18-Zambia
 ‘The Bembas, who are brave, live in Zambia’ (i.e. all Bembas are brave and live in Zambia)

In (45), the head noun is marked with a final high tone, sometimes called the conjoint tone pattern (Sharman 1956), and the reading of the relative is restrictive. In (46) there is a final L tone (the disjoint pattern), and the reading is non-restrictive. Given our discussion of restrictive and non-restrictive relatives above, one analysis is that the conjoint tone pattern (with final H) on the head noun indicates that a Link relation has to be built immediately, before the value of the Ty(e) expression is computed, while the disjoint tone pattern (with final L) indicates that any Link relation has to be built after the semantic value of the head noun has been computed.

This idea can be implemented by making use of the complex nominal structure we have argued Bemba nouns project. So far, we have not discussed in detail how the eventual semantic value of the nominal is computed, and it is this process which we now turn for an analysis of the tone patterns on head nouns. To start with, we assume with Cann et al. (2005: 108) that when the complex nominal structure is built, the pointer is at the variable node. From this node, either the information of this and the sister node can be combined to annotate the mother node and fulfil the requirement ?Ty(cn) holding at the node through computational rules (Completion and Elimination), or a Link relation can be built, as we have seen in the examples of restrictive relatives above.

(47) Tonal marking of head nouns



However, in contrast to, for example, English nominals, Bemba nouns include another lexical action. For H toned nouns, inducing a restrictive relative, we assume that they contain the lexical instruction to build a Link structure. In the schematic lexical entry in (48), this is encoded in the last THEN statement, $\text{make}(\langle L \rangle)$.

- (48)
- | | | |
|------------------|------|---------------------------------------|
| <i>abá-Bembá</i> | IF | ?Ty(e) |
| | THEN | make(...), go(...),
make(<L>) |
| | ELSE | abort |

The entry implies that H toned nouns are always followed by some linked structure, although not necessarily one hosting a relative clause. Although further empirical evidence is needed, Sharman (1956) notes that H toned nouns are found when followed by conjunctions, adjectives or possessives. If our analysis is correct, all these modifiers project a Link structure.

L toned nouns, on the other hand, encode to the contrary that no Link structure can be built from the variable node. The schematic lexical entry in (49) encodes this through the final statement of the THEN clause, $\text{go}(\langle \uparrow_0 \rangle)$, $\text{put}(\text{Fo}(x, \text{baBemba}'(x)), \text{Ty}(cn))$.

- (49)
- | | | |
|------------------|------|---|
| <i>abá-Bemba</i> | IF | ?Ty(e) |
| | THEN | make(...), go(...),
$\text{go}(\langle \uparrow_0 \rangle)$, $\text{put}(\text{Fo}(x, \text{baBemba}'(x)), \text{Ty}(cn))$ |
| | ELSE | abort |

The lexical instruction pre-empts the computational actions of Completion and Elimination. The requirement for ?Ty(cn) at the mother node is fulfilled through the lexical action encoded in the THEN statement. This means that the pointer moves away from the variable node as part of the lexical actions, and so with L tones nouns, there is never a situation in which a Link structure could be built from the variable node. Any Link structure with L toned nouns has to be built from the completed Ty(e) nominal node, and will thus be non-restrictive.

This lexical analysis accounts for the relation between the tonal marking on head nouns and the interpretation of any following relative as restrictive or non-restrictive. However, as briefly mentioned above, there is in fact a more general pattern. Conceptually the distinction between the two noun forms seems to be not so much related to the presence or absence of a restrictive relative, but rather to whether a given nominal form provides enough information to construct a complete Ty(e) term in the context, or whether for doing so, further lexical input is required. Thus, *abá-Bemba* with a final L tone says that all information to construct the Ty(e) term is provided from the lexical information and the context, while *abá-Bembá* with final H says that the construction of the term is not yet complete. From this perspective,

the tonal marking acts as a instruction about how the hearer is meant to process a given piece of information (here the noun), whether further relevant information is still to come, or whether the relevant term is meant to be constructed from the information provided by the noun alone. A very similar opposition is also found with verbs – in fact the alternation is probably better known with respect to verbs (e.g. Sharman 1956, Creissels 1996, Buell 2006, van der Waal 2009). Thus in Bemba, the tone marking of a past verb differs according to whether it is followed by a true object as part of the verb phrase (50), or by a right-dislocated topic (51):

(50) tu-álí-lóndól-á Mutale (conjoint verb-form)
 SM1PL-Past4-find-FV Mutale
 ‘We found Mutale’

(51) tu-álí-mú-lóndol-a Mutale (disjoint verb-form)
 SM1PL-Past4-OM1-find-FV Mutale
 ‘We found him, Mutale’

In (50) the verb stem is H toned, and the following NP is part of the verb phrase. In contrast, in (51) the verb stem is L toned (the H on the first syllable of the verb stem is likely to result from spreading of the H tone from the preceding object marker), and the following NP is a right-dislocated topic, co-referential with an object marker on the verb form. The parallel between the tone marking in the nominal and verbal domain is that in both cases, when the information introduced after the head – the restrictive relative clause or the direct object – makes a central contribution to the establishment of the interpretation of the head, conjoint marking is found on the head. On the other hand, if the following information is non-central – a non-restrictive relative or a dislocated topic – then disjoint marking is found. To bring out this parallelism between tone marking in the nominal and verbal domain, a more abstract analysis is needed, which does not make reference to the specific tree nodes involved. In the schematic rules in (52) and (53) we propose that the relevant information is about fulfilling the requirement of the mother node.

(52) L tone IF Ty(X), <↑>(Ty(Y))
 THEN go(<↑>), put (Ty(Y))

(53) H tone IF Ty(X), <↑>(Ty(Y))
 THEN ¬(go(<↑>), put (Ty(Y)))

The rule in (52) relates to a L tone in the context of a completed requirement, with an outstanding requirement at the mother node.⁶ In this case, the requirement at the mother node can be fulfilled. In the nominal domain, this means, as we have seen above, that from the variable node, the pointer moves upwards and annotates the mother node with Ty(cn). For verbs, this means that the pointer moves from a predicate node of Ty(e → (e → t)) as in (51), to the mother node, fulfilling the requirement for Ty(e → t), thereby precluding any further development of the verb phrase.⁷ In contrast, H tone signals that this move is not allowed, that is, that the pointer should not move to the mother node, as this is not yet completed. The

⁶ The exact characterization of the relevant L (and H) tone remains to be refined, as not any L (H) tone triggers these rules, but only those which are found at the right edge of a noun or verb.

⁷ This is particularly relevant if verb phrase modifiers are analysed as Ty(e) expressions (Marten 2002), rather than as functions on expressions of Ty(e → t), since under that view, moving the pointer to the Ty(e → t) node precludes further modification.

formulation in (53) is not entirely satisfying to model this, as the negative lexical instruction does not preclude the application of computational rules to move the pointer to the mother node. However, the formulation does show the generality of the tone marking, and we will leave it as it is for the moment. The more important point is that while the tone marking on the relative clause discussed in sections 5.2 and 5.3 was analysed lexically, very much like a segmental morpheme, the tone marking on nouns is more akin to prosodic information. Like prosodic information, the H and L tones on nouns, and as we have seen on verbs, are associated with specific lexical items, but make a contribution independently of the particular lexical item they attach to. Hence our eventual analysis does not make reference to the lexical host, but aims at bringing out this contribution irrespective of lexical or indeed categorial context, by relating the tone marking to pointer movement, and thereby to the progression of the process of tree growth. Ultimately the conjoint-disjoint alternation on both nouns and verbs shows that tone marking contributes to structure building at a more abstract level, by providing hearers with information about the time-linear process of constructing semantic representations, independent of the specific representation to be built.

6. Conclusions

In this paper we have developed an analysis of Bemba relatives with specific attention to the tonal properties of relative clauses and head nouns. Bemba distinguishes two relative clause strategies, the pronominal and the tonal strategy, the latter of which is only available in restrictive subject relatives. We have proposed an analysis of this difference which turns on the two different Ty(e) positions within the DS representation of nominal structure, and the corresponding formula values copied from the two positions. While in the pronominal strategy, the pronominal element provides a copy of the formula of the head noun and can thus be used to express both restrictive and non-restrictive readings, the tonal strategy requires a lexically provided copy of a nominal variable, and can thus express only restrictive readings. In addition, Bemba has headless relatives which can only be formed with the pronominal strategy. Because headless relatives cannot be formed with the tonal strategy, which is only available to restrictive relatives, and in view of the absence of quantified headless relatives, we have argued that headless relatives are formed in the context of a contextually inferred term which serves as the host of the relative clauses, as in non-restrictive relatives. However, due to the severe underspecification of this term, the information from the relative functions as the only restriction of the head, so that even though technically not a restrictive relative, the interpretation of headless relatives often comes close to a restrictive interpretation, even though due to a different reason. Finally, head nouns are tonally distinguished, differentiating between restrictive and non-restrictive heads, and we have proposed that this reflects a prosodically marked instruction on whether the current task can be completed, or whether further lexical input is required to do so.

The analysis we have proposed is embedded in a wider argument about the relation between syntax and phonology. We have used the Bemba facts to show how phonological information can be seen as contributing to the establishment of semantic representation in a parsing model like Dynamic Syntax. The analysis shows that tonal marking can be related to the time linearity of natural language parsing, providing hearers with information about anticipated parsing steps. In particular the parallelism in tone marking between head nouns and verbs provides striking confirmation for this view. We were thus concerned in this paper not so much with providing an analysis for Bemba relatives, for which perfectly good analyses exist (Kula and Cheng 2007, Kula 2007), but rather with gauging to what extent the particular interaction between prosody and interpretation found in Bemba relatives is compatible with the DS view of linguistic knowledge as parsing oriented. We have shown that

the Bemba data provide evidence for the DS perspective, and that the analyses presented here require no independent syntactic and phonological structures to be assumed. Rather, both syntactic and phonological information contribute to the way semantic representations are built on-line.

References

- Blackburn, Patrick & Wilfried Meyer-Viol, 1994, Linguistics, logic and finite trees. *Bulletin of the Interest Group for Pure and Applied Logic* 2: 3-29
- Buell, Leston, 2006, The Zulu conjoint/disjoint verb alternation: Focus or constituency? In Laura Downing, Lutz Marten & Sabine Zerbian, eds., *Papers in Bantu Grammar and Description*, *ZAS Papers in Linguistics* 43: 9-30.
- Cann, Ronnie, Ruth Kempson & Lutz Marten, 2005, *The Dynamics of Language*. Oxford: Elsevier.
- Carstens, Vicky, 1991, *The Morphology and Syntax of Determiner Phrases in Kiswahili*, Doctoral Dissertation, UCLA.
- Cheng, Lisa & Nancy C. Kula, 2006, Syntactic and phonological phrasing in Bemba relatives. In Laura Downing, Lutz Marten & Sabine Zerbian, eds., *Papers in Bantu Grammar and Description*, *ZAS Papers in Linguistics* 43: 31-54.
- Chomsky, Noam, 1995, *The Minimalist Program*. Cambridge, Mass.: MIT Press.
- Contini-Morava, Ellen, 2002, (What) do noun class markers mean? In Wallis Reid and Ricardo Otheguy, eds., *Signal, Meaning, and Message: Perspectives on Sign-Based Linguistics*. Amsterdam/Philadelphia: John Benjamins, 3-64.
- Creissels, Denis, 1996, Conjunctive and disjunctive verb forms in Setswana, *South African Journal of African Languages* 16, 109-115.
- Hyman, Larry Michael & Francis X. Katamba, 1993, The augment in Luganda: Syntax or pragmatics? In Sam A. Mchombo, ed., *Theoretical Aspects of Bantu Grammar*, Stanford: CSLI, 209-256.
- Ferrari-Bridgers, Franca, 2009, A novel semantic and syntactic analysis of the Luganda initial vowel, ms. Iona College, New Rochelle.
- Givón, Talmy, 1969, *Studies in ChiBemba and Bantu grammar*, PhD dissertation, University of California Los Angeles.
- Inkelas, Sharon & Draga Zec, 1990, *The Phonology-Syntax Connection*. Chicago: CSLI Publications.
- Jackendoff, Ray, 2002, *Foundations of Language: Brain, Meaning, Grammar, Evolution*. Oxford: Oxford University Press.
- Kaye, Jonathan, 1989, *Phonology: A Cognitive View*. Hillsdale, NJ.: Lawrence Erlbaum.
- Kempson, Ruth & Akiko Kurosawa, fcmg., At the syntax pragmatics interface: Japanese relative clause construal. In H. Hoshi, ed., *Language, Mind and Brain*, Kuroshio.
- Kempson, Ruth, Lutz Marten & Nhlanhla Thwala, 2010, SiSwati clefts: The meeting ground of context and contrast, this volume.
- Kempson, Ruth, Wilfried Meyer-Viol & Dov Gabbay, 2001, *Dynamic Syntax: The flow of natural language*. Oxford: Blackwell.
- Kiaer, Jieun, 2005, Incremental parsing in Korean: At the syntax-phonology interface. Ms., Kings College London.
- Kiaer, Jieun, 2007, Processing and interfaces in syntactic theory: the case of Korean, PhD dissertation, King's College London.
- Kula, Nancy C., 2002, The phonology of verbal derivation in Bemba. PhD dissertation, University of Leiden. LOT dissertation series 65.

- Kula, Nancy C., 2007, Effects of phonological phrasing on syntactic structure. *Linguistic Review* 24: 201-231.
- Kula, Nancy C., 2009, The augment in Bemba, ms. University of Essex.
- Kula, Nancy C. & Lisa Cheng, 2007, Phonological and syntactic phrasing in Bemba relatives. *Journal of African Languages and Linguistics* 28:123-148.
- Marten, Lutz, 2002, *At the Syntax-Pragmatics Interface*, Oxford: OUP.
- Marten, Lutz, 2007, Focus strategies and the incremental development of semantic representations: evidence from Bantu. In Enoch Aboh, Katharina Hartmann & Malte Zimmermann, eds., *Focus Strategies in African Languages*. Berlin/New York: Mouton de Gruyter, 113-135.
- Marten, Lutz, Ruth Kempson & Miriam Bouzouita, 2008, Concepts of structural underspecification in Bantu and Romance. In Cécile de Cat & Katherine Demuth, eds., *The Romance-Bantu Connection. A comparative investigation of verbal agreement, DPs, and information structure*. Amsterdam: Benjamins, 3-40.
- Meeussen, Achille E., 1959, *Essai de grammaire Rundi*, Tervuren: Musée Royal du Congo Belge.
- Selkirk, Elisabeth, 1984, *Phonology and Syntax: the relation between sound and structure*. Cambridge: MIT Press.
- Sharman, John C., 1956, The tabulation of tenses in a Bantu language (Bemba: Northern Rhodesia), *Africa* 26: 29-46.
- Sharman, John C. & Achille E. Meeussen, 1955, The representation of structural tones, with special reference to the tonal behaviour of the verb in Bemba, Northern Rhodesia. *Africa* 25: 293-404.
- Szendroi, Kriszta, 2001, Focus and the syntax-phonology interface. PhD dissertation, University College London.
- Truckenbrodt, Hubert, 1999, On the relation between syntactic phrases and phonological phrases. *Linguistic Inquiry* 30: 219-255.
- van der Wal, Jennneke, 2009, Word order and information structure in Makhuwa-Enahara, PhD dissertation, University of Leiden.