Relative constructions with partial labels. ¹

This paper argues that the syntactic operation Merge is sensitive to lexical category information and semantic type information of its input and output. I propose a model where the label of a syntactic object \( l \) is a two membered set \( l = \{c, s\} \) consisting of an element identifying lexical category information \( \{c\} \), and of an element identifying semantic type \( \{s\} \). Such ideas have been explored before (Bach 1979), albeit in a different framework. The current proposal is couched in the Phase-Spell out Bare Phrase Structure approach, and more broadly within the research program known as the Minimalist Program. Within such a system syntactic computation is sent to the interfaces in phases. This excludes the possibility that semantic composition applies at every instance of Merge (Heim & Kratzer 1998), unless semantics is allowed to decompose and then reintegrate syntactic structures. Instead, in order to minimize possible type mismatch crashes, it will be proposed that semantic type compatibility is computed on-line in the syntax.

Following the intuitions in Donati & Cecchetto 2011, Adger (2011) and Chomsky (2012) that the output of Merge can be unlabeled I argue that there is a specific set of conditions when label assignment on an XP can postponed until spell out. Labeling is sensitive to: (i) the type of semantic composition (Functional Application vs. Predicate Abstraction), (ii) position within the...

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tree (phase-edge vs. phase internal), (iii) the trigger for Merge (feature checking vs. non feature checking, like cyclic movement).

Evidence for such a system will come from relative clause constructions where I argue that the clause modifying the nominal receives its category label only after it has Merged with the extended nominal projection. The analysis adopts proposals in Zamparelli (2000) and Cinque (2010) that there is a set of extended projections of the nominal element that are closed off by a DP. These functional projections host specific nominal modifiers, including clausal ones.

Building on approaches in Cinque (2008, 2010) and Krapova (2009), I adopt a novel unified derivation of restrictive relative clauses. I propose that RRC's underlingly always have two nominal elements, and one of them deletes under identity. I derive head noun raising (Vergnaud 1974, and recently Kayne 1994, Bhatt 2002) and head noun matching (Chomsky 1965, and recently Sauerland 1998) properties of RRC's from one structure, thus reducing differences in the properties of matching and raising RRC's to which Nominal raises to a position where it can delete its copy. External nominal raising and deletion of the internal nominal via Topic Drop (Huang 1984) exhibit properties attributed to a matching derivation. Internal nominal raising and deletion of the external nominal gives rise to a set of RRC properties attributed to a head noun raising analysis. I show that the algorithm assigning a label to the clausal modifier gives two different outputs depending on the derivation. In the case of matching the clausal modifier will be an AP, in the case of raising a CP.

Evidence for the dual nature of the clausal modifier will come from Degree/Amount relative clauses (Carlson 1977, Heim 1987, Herdan 2008, Szczegielniak 2012), and Functional Relative Clauses (Sharvit 1999). It will be shown that degree modification can only be achieved if the clausal modifier is an AP, which is only possible in matching structures).

The paper is organized as follows. In section 1, I discuss the implications for the Strong Minimalist Hypothesis of assuming that Narrow Syntax (NS) operates on labels that contain not only category lexical information, but also information about semantic type. In section 2, I discuss in detail the mechanism responsible for establishing partial
labels. Section 3 proposes that restrictive relative clauses are adjectival in nature when derived via matching, and analyzes them as being derived via partial labeling. It is shown that both a head noun raising and head noun matching can be captured within the proposed framework, as well as the derivation of head internal and head external relative clauses. Section 4 briefly outlines a possible derivation of prenominal predicative adjectives as being derived via the same mechanism as restrictive relative clauses.

1. Labels and the strong minimalist hypothesis

One of the tenets of Minimalism is the Strong Minimalist Thesis (SMT), it assumes that (Chomsky 2000:96):

1. Language is an optimal solution to legibility conditions

This is somewhat vague, but usually assumed to mean that Narrow Syntax (NS) is a recursive set forming operation (Merge) and, if there were no external legibility conditions (imposed by the Conceptual-Intentional (C-I) and Sensory-Motor (S-M) interfaces), Merge would be only constrained by its own internal computational efficiency constraints. For example, binary branching might be considered to be such a constraint because two membered sets (non identical and non null members) are the minimal structure needed to recursively build an XP that is compositional in structure and meaning. The null assumption is that Merge is a set forming operation: it takes two elements and forms an unordered set. Anything else that happens in NS is the minimum required in order for C-I and S-M to be able to read the output of NS. For example, Merge is sensitive to lexical category information, which is the domain of the Lexicon and Morphology. Furthermore, the assumption that phases are cut along PF and/or LF demarcation lines is also a departure from SMT. These departures are argued by Chomsky to reflect that Narrow Syntax is not just an efficient computational system, but also an optimal solution to the constraints imposed by the interfaces. I suggest that including semantic type in label information is another justified 'imperfection' that does not violate SMT. The open question is: provided we allow within SMT for 'imperfections' that are driven by the need to accommodate new empirical findings, does that mean we assume that these 'imperfections' are purely driven by the structure
of the interfaces? I suggest that this is not the case. Instead, I propose that the impact of the
Lexicon, C-I and S-M on NS is constrained by the impact of NS on C-I and S-M and the
Lexicon. This is an example of a classical feedback mechanism where the emergence of NS
changes the interfaces, which, in turn forces NS to adapt to the changes its emergence induced.
Crucially, no properties of C-I and S-M that were present before NS emerged can be directly
considered as interface conditions for Narrow Syntax.
Let me define the edges of a Narrow Syntactic system as those parts of the system that need to
come into contact with other cognitive systems. An example would be input and output of
Merge. This is in contrast to core computational properties of NS, for example recursion, set
properties, etc. The emergence of NS in human cognitive system ought to have ripple effect on
the interfaces. Functional Lexical Items would be a good candidate for such a change in the
Lexicon. A possible candidate in the C-I interface is harder to imagine, but its existence would
be predicted. Operations that interpret the denotation of sets like Functional Application (FA), or
Predicate Modification (PM) appear to be good candidates. Without Narrow Syntax their
existence is not possible.\(^2\) Thus, let me propose something that should not be controversial,
namely that the interfaces underwent change when NS was being integrated into the human
cognitive faculty. I assume NS is a *spandrel*, as the term is used in Gould and Lewontin (1979),
who propose that many cognitive faculties, including language, are by-products of evolution via
adaptation. In their approach, traits that are shaped by natural selection via adaptation \((t_{ad})\) can be
accompanied by the emergence of traits that are necessary by-products \((t_{sp})\). The relationship
between the two can be characterized as in (1).

\[^2\] The definitions of both operations crucially rely on Merge generated set structure. Let me
assume following Heim & Kratzer (1998:95) the following non-intensional definition of FA, and
of PM:
FA: If \(\alpha\) is a branching node, and \(\{\beta,\gamma\}\) the set of its daughters, then for any assignment \(a\), if
\([\beta]^a\) is a function whose domain contains \([\gamma]^a\), then \([\alpha]^a=\beta]^a(\gamma]^a)\).
PM: If \(\alpha\) is a branching node, and \(\{\beta,\gamma\}\) the set of its daughters, then for any assignment \(a\), if
\([\beta]^a\) and \([\gamma]^a\) are both functions of type \(<e,t>\), then \([\alpha]^a=\lambda x\in D. \beta]^a(x)=\gamma]^a(x)=1\).
1. a. \[ E^X \{ t_{ad} \} \Rightarrow t_{sp} \]
   - \( E^X \) is the environment in which trait \( t \) has emerged
   - \( ad = \) adaptation, \( sp = \) spandrel, \( sp^E = \) spandrel embedded in a given environment
   - the arrow represents the minimal interface requirement for \( t \) to function in \( E \).

b. \[ E^{t_{ad}} \{ t_{sp} \} \Rightarrow t_{sp}^{E_{t_{ad}}} \]

Let me examine the equation in (1a). I suggest that \( NS = t_{sp} \). \( NS \) is a by-product of the emergence of some cognitive capacity \( C = t_{ad} \), and its need to be embedded into the human cognitive faculty = \( E^X \). The analogy used by Gould and Lewontin (1979) is that biological traits can be just like a spandrel in a cathedral, a by-product of the need for the roof not to collapse. I suggest that just like real spandrels impact the design of a cathedral, so does \( NS \) impact the interfaces. \( NS \) arose because of the need to integrate an unrelated cognitive capacity \( C \) into the human mind. The core properties of \( NS \) must be a perfect solution to the task of integrating/supporting \( C \). These will be the combinatorial properties of Merge. However, the edge properties of \( NS \), the way it interacts with other systems, are not part of the (1a) equation. This is where the second equation (1b) comes in. I propose that that a given spandrel, \( t_{sp} \), has to be embedded in the environment modified by the trait \( t_{ad} \) that \( t_{sp} \) is a spandrel of. Hence, I assume that the set of edge properties will allow an \( NS \) operation like Merge to be sensitive to input that contains lexical category information, as well as the semantic type. It could be said that \( NS \) has customized itself to mitigate the impact it has created at the interfaces. The level of adjustment is limited by \( NS \) core properties. This provides a backdrop as to why \( NS \) is somewhat schizophrenic in its nature. On one hand, it exhibits a set of core properties that appear to be a perfect solution to whatever cognitive capacity it serves as support of. This would be its spandrel role defined by (1a). On the other hand, \( NS \) appears to have 'imperfections' or add-ons. I propose that the ability to have 'imperfections' is built into \( NS \) in order for it to be able to mitigate its impact on its adjacent systems. This would be equation (1b). We can even venture to say that \( NS \) is still a perfect system. It is an optimal solution; it is just not a solution to one set of design factors, but two. The first is support for \( C \), this is achieved via its core computational properties. The second set of design factors is the requirement to maximally mitigate the impact of its own emergence on other systems (to the extent it does not change its core properties). This could be considered an inherent property of spandrels – mitigate impact. The most optimal solution to the second
requirement is to take the resulting changes in the Lexicon and C-I interface and put them to use as if the whole thing was by design. In other words, the way NS impacts C-I and the Lexicon determines the shape of NS itself.

Let me assume that the emergence of NS with its core property of recursive pair Merge triggered a cascade of changes in C-I and Lexicon. For example, NS triggered the emergence of semantic composition operations like Functional Application (FA) and Predicate Modification (PM) in C-I.\(^3\) This change in C-I in turn forced the emergence of Semantic Type information \(<S>\) in the Lexicon. This is because once you have the ability to create sets of words you need to be able to interpret them. Finally, the emergence of FA and PM, as well as \(<S>\) triggered in the Lexicon the emergence of Lexical Categories \(<C>\), which in turn allowed for the emergence of Functional Lexical Items (FLI), also in the Lexicon. These changes were required to interpret sets of sets of Lexical Items. Otherwise, we would be limited to binary word predicates. Of course, all this is just conjecture. However, I think the intuition behind this story is more than that. If we treat SMT seriously then either we assume that NS was an emergent property that adapted to the interfaces, in which case imperfections should be messy, like in any other compromise via adaptation (the Panda thumb argument, Gould 1980). Conversely, we assume that NS is spandrel with an inherent ability to adapt to the effects of its emergence on adjacent systems. In which case, these adaptations in NS, triggered by its impact on C-I and the Lexicon, will be part of the NS architecture, and thus optimal in as much as spandrel design is.

2. Self-adjustment of NS to mitigate its impact on C-I and the Lexicon. Dashed arrows indicate the feedback loop between C-I and the Lexicon triggered by the emergence of NS at points of contact. Solid arrows indicate the expansion of NS to accommodate the changes it triggered in the Lexicon and C-I.

\(^3\) Or modified existing semantic interpretation operations.
3. Labeling

Labeling of syntactic output has been recently extensively debated in the literature (see among others: Donati 2006, Mayr 2007, Boeckx 2008, Cecchetto & Donati 2010, Donati & Cecchetto 2011, Adger 2011, Chomsky 2012). The consensus is that current Bare Phrase structure algorithms have trouble establishing the label of a syntactic object \(SO = \{\alpha, \beta\}\) based solely on the properties of \(\{\alpha\}\) or \(\{\beta\}\). The Bare Phrase approach in Chomsky (1995, 2004) assumes that Lexical Items and Syntactic Objects that are inputs/outputs of Merge have category labels. Thus, for every structure \(SO = \{\alpha, \beta\}\) we can compute the label based on the labels of its elements \(\{\alpha\}\) and \(\{\beta\}\). Chomsky (2008) for example proposes the following label assigning algorithm.

   a. In \(\{H, \alpha\}\), \(H\) an LI [LI=Lexical Item], \(H\) is the label
   b. If \(\alpha\) is internally merged to \(\beta\), forming \(\{\alpha, \beta\}\) then the label of \(\beta\) is the label of \(\{\alpha, \beta\}\)

The algorithm in (3) inherently assumes that certain structures will not be generated, or not labeled, for example an SO composed of two lexical items, for a discussion see Adger (2011). What is interesting for this paper is (3b). It assumes that the label carries the history of the derivation, making distinctions between external Merge and internal Merge (formerly known as Move). Another solution is to identify the trigger of Merge based on location of uninterpretable
features located on the probe. For example, Donati (2006), Donati & Checchetto (2011) have proposed a more general principle:

4. Probing Algorithm: The label of a syntactic object \( \{\alpha, \beta\} \) is the feature(s) which act(s) as a Probe of the merging operation creating \( \{\alpha, \beta\} \).

The formulation in (4) appears to be more elegant than Chomsky's proposal in (3). The definition is not disjoint, nor does it differentiate types of Merge or the type of input (head vs. syntactic object). I will assume (4) over (3). This conclusion is based not so much on a comparison of cases that are covered by each condition, but rather based on cases that are not covered by these conditions. I suggest that (4) gives the right predictions as far as which structures remain unlabeled.\(^4\)

This might at first sight look peculiar since the goal was to provide an unambiguous and clear labeling algorithm. However, I will argue that the advantage of (4) is that in the cases it does not cover we see the effects of labeling ambiguity. One such example will be cyclic movement. I will argue that in cases when a given XP moves via a phase edge as part of long distance A'-movement there is no feature checking involved during intermediate steps (see Szczegielniak 1999).\(^5\) Note that the condition in (3) does not have a problem since it does not rely on feature

\(^4\) Recent proposals in Chomsky (2012) take a different approach by arguing that the goal to always label two merged XP's is actually misguided, because the representation does have unlabeled SO's = \{XP, YP\}. For example, a DP in Spec-TP will be unlabeled, and result from DP raising from vP to allow the labeling of SO = \{DP, vP\}. I agree with the sentiment. I would argue that rescuing via Internal Merge is possible because the semantic type of the moved XP is changed. Thus, DP raises out of vP so that DP label information does not interfere with labeling the structure as vP.

\(^5\) Another possible case is Merger triggered by \( \theta \)-role assignment and sub-categorization. In both cases it is not clear if there is a probe-goal relationship. If \( \theta \)-role assignment and sub-categorization are derived in the same way as any other probe-goal relation then it is not clear why they are subject to more stringent structural restrictions, why is there no covert \( \theta \)-role movement, etc? These issues will have to be addressed in future research.
checking, but on structural relations (see: Adger 2011 for an overview, as well as for proposals to integrate labeling within a cartography approach. I will not address these issues here).

Before discussing the conditions required for a given structure to be partially labeled, let me address in detail what is a label. Following the intuition in Bach (1979), I assume that labels of syntactic objects (SO) are not only based on lexical category information, but also on semantic type. In the spirit of the proposals in Rooth & Partee (1983) Partee (1986), let me also adopt the idea that semantic type is not constant for given lexical category. In other words, a label \( l \) is a set of two elements, the syntactic category \( c \) and semantic type \( s \), thus \( l = \{c, s\} \) and \( s \) is not fixed for \( c \).

Categories are a finite fixed set \( C = \{A, N, V, C, D, P\ldots\} \). The set of semantic type \( S \) is closed under an operation that combines two basic types \( <t> \) and \( <e> \) (truth values and entities). Each semantic type \( s \in S \) is a two membered set \( \{i, o\} \), where both \( \{i\} \) and \( \{o\} \in S \). This is a reflex of the Fregean approach to semantics treating syntactic objects as functions. A function has a domain (set from which the function's input comes) = \( \{i\} \), and a codomain (set into which the function's output has to fall) = \( \{o\} \). A type of a given \( \{\alpha\} \) is a set containing the domain and

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\[ \text{It has to be noted that the proposal here is different from Bach (1979) in some crucial aspects. I assume labels can be established in the derivation.} \]

\[ \text{I do not dismiss the possibility that there is a relation between } c \text{ and } s \text{ limiting the possible combinations of the two. My intuition is that in order to address this issue the notions of a syntactic head, and semantic function have to be re-assessed, and both have to be treated in a more unified way.} \]

\[ \text{I assume the standard based on a slightly modified version from Montague (1974). Type primitives:} \]

\[ \text{- } t \text{ is a type ( set } D_t \text{ is } \{0,1\} \text{ (truth values)} \]

\[ \text{- } e \text{ is a type (set } D_e \text{ is A (all entities))} \]

\[ \text{Closure under composition:} \]

\[ \text{If } \alpha \land \beta \text{ are types, then } <\alpha, \beta> \text{ is a type} \]

\[ \text{- if } \alpha \text{ is a type, then } <\alpha, \tau> \text{ is a type.} \]

However, it has to be noted that any coherent type system that constrains the domain and codomain of functions in semantic composition will be compatible with this approach.
codomain that \{α\} would have as a function: \(s = \{i, o\}\). Thus, a label of a given SO is \(l = \{c, \{i, o\}\}\). In a phase-based approach, Functional Application (FA), as well as any other semantic interpretation algorithms, like Predicate Modification, have to be delayed until Spell-Out. Otherwise, we would have to assume that structures are not interpreted at the interface, but during the syntactic derivation. In order to keep syntax and semantics separate, we have to adopt a model where an NS operation like Merge at the moment of its application fulfills the minimal requirements for semantic interpretation, namely type specification compatibility.

Another possibility is that we allow syntax to over-generate within a given phase, creating sets that cannot be assigned an interpretation by semantics triggering all sorts of recovery mechanisms. Chomsky (p.c.) has suggested this over-generation is as a possible source of ungrammaticality. It is true that over-generation would yield a set of non-well-formed expressions. That is by definition. However, it is not true that the set of non-well-formed expressions has to be generated via over-generation. It is far from clear that any given subset of the set of non-well-formed structures has the characteristics that one would associate with an over-generated NS output. Production errors appear to be grammar constrained (Mackay 1970, Fromkin 1973, Shattuck-Hufnagel 1979, Garrett 1980), which suggests that they are triggered by other mechanisms and grammar attempts to recover the output. It is true that linguists can produce all sorts of ungrammaticality. However this is far from evidence that they can tap into the set of over-generated structures by a given system. Far more likely is an approach where creating ungrammatical structures is based on the manipulation of well-formed structures. One piece of evidence comes from an asymmetry in production vs. comprehension. The set of non-well-formed structures in production does not appear to overlap significantly with the set of non-well-formed representations in comprehension. For example, it is very hard, even for a seasoned linguist, to generate adjunct island violations in comprehension. Considering that we have a

\[\text{\textsuperscript{9}}\] I am simplifying the picture here, for detailed account see: Heim and Kratzer (1998), Partee (1986) I am also distorting existing approaches by assuming that when \(\alpha\) is not a function its semantic type is also a two-membered set, with one element, the codomain being an empty set \(\{\alpha\} = \emptyset\). However, it has to be noted that for cases that are discussed here, these distinctions do not play a role because the relevant cases involve \(\alpha\) as a possible function. Thus the simplified model of types adopted here is sufficient for my purposes.
model where both comprehension and production share the same grammar, it would be surprising to find significant error asymmetries if a sizable portion of the errors where generated by the grammar. Additionally, if we assume that keeping tabs on semantic type in NS deprives us of the ability to generate ill-formed structures, then we should apply the same logic to lexical category information. We can generate structures that violate c-selection. That does not mean that there are no category labels in NS. Consequently, I find arguments based on the need for the grammar to generate non-well formed structures unconvincing.

Let me return to the labeling algorithm and examine a case when a full label is assigned.

5. Full label application

Merger forms SO = {α, β}. SO is assigned a category label {c_{so}} based on the probe-goal algorithm in (4). For example, let us assume that {α} is the probe. The algorithm in (4) makes {α} element that projects its category information. This establishes the first element of SO's label, c_{so} = {c_α}. The element {α} is inspected for its semantic type specification {s}. Merge has to establish as to whether {α} is compatible to semantically combine with {β}. In most cases, this will involve checking if {β} is typed to be in {α} domain/input (establishing for example if: s_b = i_α). If it is, the derivation proceeds and assigns the label of SO, l = {c_α, s_{so}}, where {s_{so}} is the codomain/output element of the set {s_α}, in other words: s_{so} = i_α. It has to be noted that overt syntax does nothing more than check type compatibility, crucially overt syntax does not compute any semantic values. Processes like Functional Application or Predicate Modification apply after Spell-Out.10

10 One crucial simplification will need to be undone later. In the system adopted here (following Partee 1986, Rooth & Partee 1983), a given lexical category {c} is associated with more than
This proposal is not uncontroversial. It entails that a syntactic operation, Merge, has access to semantic information. Merge cannot compute semantic properties, but they are manipulated in the syntax. The alternative is to assume that syntactic derivation grossly over-generates structures by ignoring type mismatch until Spell-Out, or to abandon a phase-based approach.\footnote{11} The position taken here is compatible with SMT, where Merge is sensitive to interface conditions. Merge cannot compute meaning, however, it is sensitive to minimal requirements of semantic convergence. This minimum requirement will be that every application of Merge can be potentially interpreted at the interface.

What happens when (4) fails to apply? Let me propose that under specific conditions we can have partial labels in the derivation that only specify the semantic type information \(\{s\} \), \(l' = \{c_{lw} s\} \), where \(c_{lw} \) is underspecified. Partial labels are limited to a specific configuration and have to be completed at the time the structure containing them is sent to Spell-Out. The existence of partial labels is a by-product of Narrow Syntax interfacing with semantic interpretation on phase by phase basis, and not, as was assumed in previous models (Heim and Kratzer 1998), at every instance of Merge. Consider a derivation where \(SO=\{\alpha, \beta\} \) and neither \(\{\alpha\} \) nor \(\{\beta\} \) is a head:

\[
\text{one unique semantic type } \{s\}. \text{ This means that a label will consist of } c \text{ and } s', \text{ where } s' \text{ is set of } n\text{-amount of semantic types } s \text{ that are themselves two member sets consisting of the pair } \{i, o\}. \quad s' = \{ \{i_1, o_1\}, \{i_2, o_2\}, \{i_3, o_3\} \ldots \{i_n, o_n\} \}. \text{ However, for expository purposes, I have assumed that } n=1 \text{ when discussing the full labeling algorithm.}
\]

\footnote{11} I refrain from discussing at this point the nature of QR. Treating QR as a semantically driven operation that fixes type mismatch is incompatible with the approach taken here. However, it is compatible with an approach where the Quantifier is overtly raised to a phase edge, thus creating an \(<e>\) type trace. The issue to be addressed is why the Quantifier is interpreted in situ at PF, but moved at LF. I believe that has to do with the non-feature checking nature of the movement, which differs from vacuous raising in that it has semantic impact. Obviously the nature of QR has to be addressed in this framework.
Let me suggest that the above configuration allows SO to have an undefined category \( \{c_{so}\} = \{c_b\} \lor \{c_a\} \), provided that \(<s_a> = <s_b>\), that is that the semantic type of both \(\{\alpha\}\), \(\{\beta\}\) is the same. When both \(\{\alpha\}\), \(\{\beta\}\) are of the same type then, regardless which is selected as the function, the output will be of the same type by virtue of the fact that semantic type is binary set containing both input and output information.\(^{12}\)

This is a minimal requirement for semantic convergence if SO is to have a partial label. However, the restriction does not safeguard against subcategorization mismatches. Thus type identity is not sufficient for the derivation to continue. Even when the semantic type of SO is unambiguously established, it is not clear how to Merge \(\{\gamma\}\) with SO when it is missing category information. In the current system of Bare Phrase (Chomsky 1995), in order to proceed, Merger requires category information as its input. In other words, \(\{\gamma\}\) has a sub-categorization frame that specifies the types of arguments based on category that it can take. The derivation will crash, unless \(\{\gamma\}\) is a probe that can search inside SO. If both \(\{\alpha\}\) and \(\{\beta\}\) have a compatible category feature with the sub-categorization frame of \(\{\gamma\}\), and if \(\{\gamma\}\) can probe SO, then the derivation can proceed with a partial label until Spell-Out. In essence, if the probe establishes that regardless whether \(\{\alpha\}\) or \(\{\beta\}\) projects, its sub-categorization frame is satisfied, Merge can proceed. Only under such conditions can SO have an incomplete label that states that \(c_{so}\) is either \(c_a\) or \(c_b\).

\(^{12}\) This rules out \(\{s_a\}\) or \(\{s_b\}\) having a null set as one of its members, since then neither \(\{\alpha\}\) nor \(\{\beta\}\) would be a function (see footnote 9).
Conditions for partially labeled structures:
For a given \( \{SO\} = \{\alpha, \beta\} \) to be Merged with \( \{\gamma\} \) all the following conditions have to be met in order for \( \{SO\} \) to receive a partial label \( l' = \{c_{u}, s\} \), where \( c_{u} \) is underspecified as either the category \( \{\alpha\} \) or \( \{\beta\} \), the following conditions have to be met:

A. The semantic type of \( \{\alpha\} \) has to equal the semantic type of \( \{\beta\} \), and both have to be functions: \(<s_{a}> = <s_{b}>\)

B. For a given \( \{\gamma\} \) that is merged with \( \{SO\} \), the sub-categorization frame of \( \{\gamma\} \) has to be compatible with the category of both \( \{\alpha\} \) and of \( \{\beta\} \). \( \{c_{a}\} \in \{\text{Subcat } \gamma\} \), and \( \{c_{b}\} \in \{\text{Subcat } \gamma\} \)

C. \( \{\gamma\} \) has to have a full label, cannot be a phase head, or its projection.

The set of conditions for partial labeling is complex. This is because partial labeling is an unintended consequence of the syntax-semantics interface. It is not part of what Chomsky (1995) would call as 'optimal design'. Note that (7) makes labeling a two-step process: condition (7a) refers to the formation of SO, whereas conditions (7b) and (7c) refer to the Merger of SO with the next element in the derivation. Partial label assignment requires two Merger applications, not one. This implies that whenever two elements with identical semantic types are Merged, labeling will be postponed until the next Merger in order to check for conditions (7b) and (7c).

3. Relative clause structure

Cinque (2008) and Krapova (2009) propose an interesting system where relative clauses are always derived via two NP’s – one internal, the other external.\(^{13}\) I will not go into the details of

\(^{13}\) It has to be noted that I will not discuss proposals in (Donati & Cecchetto 2011). In their approach relative clauses are re-labeled as NP's via head movement. I believe this is a possible derivation for free relatives. However, for reasons of space I have to postpone for future work the discussion of their claims that restrictive relative clause formation can be reduced to head movement plus re-labeling. For a preliminary criticism of the approach see Chomsky (2012).
their arguments for such a structure, but will adopt its basic assumption that restrictive relative clauses are derived with two nominal elements. In constructions like (8) head noun raising is generated via movement of the internal NumP to C1 (C2 heads the complementizer *that*). The external NumP is c-commanded by the internal NumP and deleted under identity. A matching analysis also involves raising of the internal NumP, but this time it is to C2. This if followed by raising of the external NumP to C1. In such a configuration, the external NumP C-Commands the internal and the latter is deleted. The proposal is novel in that it assumes the presence of two CP's in the extended projection of the noun. This means that the XP that is adjoined to modify the external nominal element is not a CP but an IP.

I will adopt a Cinque (2008) style binary nominal system. However, I depart from all the other assumptions made in that proposal. For example, I assume that a full DP is generated inside the modifying clause and not just a NumP. Indefinite readings of the internal nominal discussed in Cinque (2008) will attributed to the deficiency of the internal nominal's structure, but unlike in Cinque (2008) I will not assume that the deficiency is not the lack of a DP layer. Rather I propose that the internal DP is split into two parts during the derivation. The indefiniteness of the internal nominal is a result of deletion under identity of the lower part of the nominal complex, with the remaining 'upper' DP layer being often interpreted as the relative pronoun, or a resumptive pronoun. I also depart from the assumption that there are two CP's in the external nominal projection. Instead I adopt a classical approach where the modifying clause is headed by a C. Cinque (2008) proposes that in a raising analysis, where the nominal element is interpreted inside the modifying IP, only the internal NumP raises to Spec-CP2. A matching interpretation, according to Cinque (2008), involves raising of both NumP's to the respective Spec-CP positions, as shown in (8) below. However, the movement of the second NumP violates Relativized Minimality (Rizzi 1997), or subsequent Minimalist incarnations of the principle that say that the grammar should block raising to Spec-C1 of an identical lower NumP over the higher NumP already in Spec-C2.

In this paper I adopt a different strategy and assume that either the internal nominal (NP₁) raises yielding a head noun raising interpretation, or the external nominal (NP₂) raises giving rise to a matching interpretation. Restrictive relative clauses are always derived with two nominals, but only one of them moves to a position adjacent to the DP. Thus, we never see movement 1 and 2 combined in one derivation. This allows me to assume that there is just one dedicated landing site for the nominal. It will be argued that that site is a functional projection inside the extended domain of the external noun phrase (NP₂). This projection is a Functional head but not CP. The complementizer will be assumed to be part of the modifying phrase, as it is assumed in 'classical' accounts of relative clauses (but see: Sag 1997).
In essence, I suggest that relative clauses are always derived via matching. The difference in interpretation lies with which nominal element is deleted under identity. When the external nominal (NP₂) is deleted, it opens the window for the internal nominal to reconstruct inside the relative clause, hence a raising analysis. When we delete the internal nominal (NP₁), we can never reconstruct the external into the modifying clause because there is no movement chain, hence the interpretation of the internal noun cannot be established via a movement chain but only through ellipsis. This derivation is what is usually assumed to be a matching analysis.

There is an important limitation to any matching analysis. Ellipsis under identity, which is needed for a matching derivation, requires that the number of modifiers of the antecedent NP
match with the number of modifiers in the elided NP. This can be clearly seen in languages like Polish where Topic drop is possible with internal arguments.

10. a. Jan wziął [piłkę] i kopnął piłkę
   Jan took ball and kicked ball
   'Jan took a ball and kicked it'

b. Jan wziął [zieloną piłkę] i kopnął [zieloną piłkę]*piłkę
   Jan took green ball and kicked green ball/ ball
   'Jan took a green ball and kicked it'

c. Jan wziął [piłkę] i kopnął *zieloną piłkę/ piłkę
   Jan took ball and kicked green ball/ ball
   'Jan took a ball and kicked it'

d. Jan wziął [piłkę, która była zielona] i kopnął [niebieską piłkę]/*piłkę
   Jan took ball which was green and kicked blue ball/ ball
   'Jan took a ball which was green and kicked a blue one'

e. Jan wziął [zieloną piłkę] i kopnął [niebieską piłkę]/*piłkę
   Jan took green ball and kicked blue ball/ ball
   'Jan took a green ball and kicked a blue one'

f. Jan wziął [zieloną piłkę] i kopnął tę piłkę która była niebieska
   Jan took green ball and kicked that ball/ which was blue
   'Jan took a green ball and kicked the one which was blue'

?g. Jan wziął [piłkę] i kopnął tę piłkę która była niebieska
   Jan took ball and kicked that ball/ which was blue
   'Jan took a ball and kicked the one which was blue'

4 To account for the above facts, I suggest that in cases of a matching derivation, a phonetically null AP modifies the internal NP in order to satisfy modifier parallelism. Otherwise, the external head noun by virtue of being modified by the RC will always have n+1 modifiers.
11. Diagram for modifier (Mod) matching in NP topic drop.

A. Matching (NP<sub>Ext</sub> raises)

When the external NP (NP<sub>Ext</sub>) has \( n \) modifiers (Mod\(_n\)), then the internal NP (NP<sub>Int</sub>) has to match (NP<sub>Ext</sub>) in the amount of modifiers (Mod\(_n\)), plus it has to have one null AP (AP\(_\emptyset\)) to offset the relative clause itself (RC). This way both NP's have n+1 modifiers. (FP= functional projection of the extended NP domain discussed in next section).
B. Raising (NP<sub>int</sub> raises)

When the internal NP (NP<sub>int</sub>) has \( n \) modifiers (Mod<sub>n</sub>), then the external NP (NP<sub>ext</sub>) has to match (NP<sub>int</sub>) in the amount of modifiers (Mod<sub>n</sub>), plus it has the relative clause itself (RC), which means NP<sub>ext</sub> has \( n+1 \) modifiers, so NP<sub>int</sub> has to have one null AP (AP<sub>∅</sub>) to offset the RC. This way both NP's have \( n+1 \) modifiers.

The issue in the above derivation that will have to be addressed is why the RC is not deleted in the above configuration. One possibility is to argue that a null AP cannot license deletion. This has its problems. In Polish pro does not appear to block ellipsis like sluicing:

12. Zatańczyłeś z kimś ale Marek nie wiem z kim [pro zatańczyłeś]
pro danced with someone but Mark not know with who [pro danced]
'You danced with someone but I do not know with who [you danced]'

The antecedent clause contains a null subject but ellipsis of the IP is well formed. Another possibility is that AP can delete the RC and we obtain then indirect modification adjectives (Leu 2008, Cinque 2010). This is the option I will pursue at the end of this paper. Note that the null AP does not have to be deleted. In the derivation proposed here only the NP is deleted.

The AP will be argued to be the element that is contrastive with the relative clause, and thus does not get deleted. The postulation of null categories is always controversial, even more so if they participate in deletion phenomena. However, null AP's have been proposed before. For example, Bresnan (1973) in order to account for adnominal and adjectival use of more suggests that in
adnominal modification more students the NP is modified by a null many (Bresnan 1973, Hackl 2000)

13. Frank has [DP more [NP books]] than Eddie has [DP x-many [NP students]]

Let me suggest that the inventory of null modifiers is broader than just one instance of a null many and also includes a null intersective (AP) (Partee 2010). The postulation of a null AP modifier has some drawbacks. First of all, null elements do not usually participate in contrast ellipsis, with the noted exception of many in comparatives. Ellipsis within a DP is assumed to involve an AP, but it is never null (Ntelitheos 2004, Corver & van Koppen 2006) since it is focused. The AP cannot be also considered to be obligatorily deleted and thus null (in line with a many analysis of comparatives). AP deletion appears to be possible but unlike in (10), it appears optional as far as interpretation (14a). It is also not clear if AP deletion requires a linearly preceding antecedent (14b), or not (14c,d). The examples in (14b,c,d) are marginal at best, although they do not appear to be as bad as cases of VP ellipsis where the antecedent follows the ellipsis site (15)

14. a. John picked up a French newspaper, but read a French book
   b. John picked up a French newspaper/newspaper, but read a French book
   c. I don't have the professorial intellect/intellect but I have the professorial look
   d. I don't have a French newspaper/newspaper but I do have a French book

*15. Mary did (so) too and Mandy went to the store.

There is also reason to believe that a null AP might be present in order to make NP's quantificational. This would mean that AP's can be null not just via deletion, but also via base generation. The standard analysis of comparative constructions (Bresnan 1973) involves some form of quantificational element taking gradable adjective. Thus cases of gradation with no overt AP might be analyzed as having a null AP (17a), this would mean that (17b) would have two null quantifier/degree phrases modifying two null AP's.
16. a. John has [[DegP more [AP ∅ [NP charm]]] than Jake has [[DegP ∅ [AP ∅ [NP hair]]]]

   b. I don't have the/his [AP ∅ [NP charm]] but I have the [AP ∅ [NP hair]]

The above discussion shows that we can argue for the presence of a null AP in constructions other than relative clauses. If that is the case, then we can assume that a null A is part of the Lexicon in languages where relative clauses are derived via raising/matching. I leave open the debate whether all null AP's derived via deletion, base generated or that both options are available in the grammar.

Let me summarize the proposal so far. I have adopted the idea from Cinque (2008) and Krapova (2009) that restrictive relative clauses are always derived with the help of two nominal elements: one inside the clausal modifier, the other external to it. However, my account has the advantage it does not require both nominal elements to raise to CP in a matching derivation. This allows me to avoid the problem of Relativized Minimality where the internal raised nominal (NumP for Cinque) should block subsequent raising of the identical external nominal. I also depart from the idea that the modifying clause is an IP, and that the internal noun is NumP, and assume it is a DP. This brings this proposal in line with classical analyses of relative clauses. However, it still allows to capture the facts discussed in Cinque (2008) and Krapova (2009). I will argue that what appears to be IP modification in relative clauses (as observed by Sag 1997) is a reflex of Topicalization of the internal nominal that manifests itself on the IP. This will be discussed in detail in the following section. Such an approach has the advantage of dispensing with the issue whether an IP can be a clausal modifier, and avoids the issue of having two CP's. The indefinite nature of the internal nominal is captured not so much via its truncated structure, but via its deficient nature as far as the ability to project certain types of functional architecture. I will tie the issue of indefiniteness with the fact that an internal nominal element cannot, as a trace host its own relative clause. This is true even when a raising derivation is forced, for example in order to fix condition A (17a). Such behavior is in contrast to other A'-moved elements in English and other languages (17b):
17.  *a. Sue saw those [pictures of myself] that/which/0 I expected [t₁ that/which/0 were matte] to be safe
   b. [Which man] that/who/0 I see t₁ Susan likes t

The crucial point made in (17) is that there is no a priori reasons why there should be a contrast between the (a) and (b) examples if we assume traces are full copies.
Before I discuss in detail the nature of this deficiency, let me make clear what my assumptions are as far as Nominal clause structure is concerned. I assume the structure of the DP in Cinque (2010) where an NP projects a series of functional projections that form the NP’s extended domain. This cartographic approach to NP structure is primarily motivated to account for the distribution and behavior of various types of Adjectival phrases.


\[ DP \rightarrow FP₁ \rightarrow FPₙ₋₁ \rightarrow \ldots \rightarrow FP₁ \rightarrow N \]

Cinque (2010) proposes that relative clauses are Merged high up in the structure. This is what I will assume. However, I suggest it is not the highest FP₁ position, which I assume to be reserved for the NP itself. The nature of the functional heads that comprise the extended NP projection is far from obvious. One thing is for certain, they need to be able to probe and subcategorize for AP's, NP's and CP's. In a system like Cinque (2010), the extended projection is 'rolled up' by subsequent raising of FP's. Roll-up is not a new operation, it is reiterative Merge applied to extended Functional Projections, and it has been suggested for other categories than NP.
I assume roll-up is movement that this not feature driven in the same sense that wh-movement is or raising. Rather, I assume that it is a case of category conflation. For details based on the assumption that lexical items are non-well formed sets (hypersets) in the sense of Aczel (1986) and Barwise & Moss (1996) see Szczegielniak (2013).
19. Roll-up

The operation of Roll-up is the sequential application of Merge to functional projections of a given XP, forming \( FP_h = \{FP_k, FP_h\} \), where \( h > k \).

Example of roll-up, giving rise to the DP = D XP N YP

\[ [DP [D The] [XP blue] [N book] [YP that is on the table]] \]

Roll-up means that higher up FP's have to be able to probe and subcategorize for lower FP's. An FP with an XP in its Spec has to be of the same type as the XP by virtue of the fact that these cartographic heads are in part syntactic reflexes of semantic composition. This means that an FP with an AP in its Spec will be of the same semantic type as the AP:

20.
The lexical category status of $F_A$ will not be discussed in detail in this analysis. An interesting approach would be that $F$ inherits its category from AP, or NP. However, for the sake of brevity and clarity I will assume $F_A$ has its own category status. What is important is that the category of the FP with AP in its Spec is the same as the AP itself. This is required independently of the analysis here. If we are to introduce a set of cartographic projections in a given extend domain, then we have to make sure these projections behave like the structures in previous analyses as far as semantic composition.

Let me return to the issue of relative clauses. I argue that in matching derivation the internal nominal is not raised out of the modifying clause. Rather, I assume that the nominal raises to Spec-Topic where it will be deleted under identity with the external nominal. This makes the deletion of the internal nominal a form of Topic Drop (Huang 1984). There is no longer need to assume that there are two CP projections in the extended NP projection. Instead, a CP is merged with one of the functional projections of the external NP.

21. DP topicalization inside the relative clause that can be later followed by $FP_1$ raising out the DP.

Let me suggest that the clausal modifier is Merged with one of the higher F heads of the external NP projection as in (18). The clausal modifier phrase is partially labeled since $SO = \{FP_{AP}, CP\}$.
fulfills the criteria in (7). Both \( F_{P_A} \) and CP are of the same type \( <e,t> \) (functions of properties), and both are part of the sub-categorization frame of \( F_{P_{ReExt}} \). CP is in the subcategorization frame because it is a possible modifier, and any \( F_{P_A} \) is also subcategorized by default because of Cinque style roll up of the extended projection, that would normally target an FP lower down.

Note, that this assumes that roll-up targets FP's but is not very good at distinguishing their provenience. This is to be expected. Roll-up is basically Internal Merge within a given category domain. It does not involve feature checking. Merge is good at optimally implementing probe-goal relations that are feature checking marked. However, probe-goal relations that do not involve feature checking are not optimally designed to identify the root of a given tree since they are supposed to operate only the root that is the extended projection of a given item.

Furthermore, probe-goal relations rely on a Markovian process where each instance of Merge projects obfuscating previous instances of Merge (as to be expected in a pure derivational process).\(^{14}\) Derivation along the root is a by-product of well-formed iterations of Merge. I suggest that there are cases when well-formed iterations of Merge can 'confuse' the probe as to where the root of the tree is. This is possible when a given instance of Merge 'mislabels' the set, as outlined in (7).

Finally, the last condition in (7) is met since \( F_{P_{Ext}} \) is not a phase head. I will assume that FP's in an extended projection cannot be phases.

\(^{14}\) This is in contrast to previous approaches in Government and Binding literature, for example Kayne's (1983) Connectedness approach involving g-projections.
22. Simplified diagram of internal movement within the clausal modifier.

In the derivation in (22) I assume that the DP inside the clause is raised to a Spec-Topic position (Bianchi 1999, de Vries 2002). This licenses the DP inside the clause as a Topic and is input for Topic Drop (Huang 1984). After C^0 Merges with TopicP, the FP containing the AP and NP raises from within the DP complex and is merged with the CP. The FP_{Aint} is merged with CP because it is undergoing cyclic movement. The attractor is an F head in the extended domain of the external Nominal (F_{Ext}). Relative clause formation is triggered by a feature on F_{Ext}, a functional head within the extended projection of external head noun. This feature is most likely a general property attracting potential NP modifiers: CP, FP, PP. Crucially, the CP that will become part of a relative clause has no special feature composition; movement of FP_{Aint} to Spec-CP is cyclic movement. This is different from most approaches where CP is assumed to have some form of \{Rel\} feature (Rizzi 1997). The proposal put forward here makes the composition of relative clauses different from questions, and more in line with subordinate indicative CP's. This is a desired result since other clauses like PP, AP that modify Nouns are not syntactically tailored to be modifiers as opposed to being arguments. Thus in (23) below there is no special feature on the AP, or PP distinguishing its different syntactic and semantic roles.

23. a. The book is on the table
b. The book on the table is expensive
c. The book is blue
d. The blue book is expensive

There is no reason to assume that CP's are special and have to have a dedicated feature to become nominal modifiers as opposed to subordinate clauses, external arguments, etc.\(^\text{15}\)

In this approach, the trigger for relative clause formation is the feature composition of the external noun, or to be more precise, the feature composition in one of its extended projections that attracts clausal modifiers. The other crucial trigger is the composition of the internal noun.

It will be argued that the extended projection of the internal nominal inside the modifying clause is defective in that roll-up is halted midway. In other words, the internal nominal has a defective Functional projection that would normally host clausal modifiers. This accounts for the contrast in (17) where a trace of a head noun inside the clausal modifier cannot host a relative clause, even when head noun reconstruction is forced, whereas a trace of a wh-moved DP can. Let me propose that the defective Functional head, where a relative clause would be merged, selects for an FP that has a null AP in its Specifier. This null AP allows nominal deletion under identity since now the amount of modifiers on the internal nominal equals the amount of modifiers on the external nominal (see 10).

\(^{15}\) One issue that will have to be addressed is the lack of that-trace effects in relative clauses.
24. Extended NP projection of the internal NP (based on Cinque 2010)
(FRC = Functional position for restrictive relative clauses, m<n).

The above diagram illustrates the proposal that the internal NP is deficient in that the head FRC
does not induce 'roll up' of the extended functional projections.

Thus we have a convergence of requirements on the extended nominal domain. On one hand the
internal nominal has to be defective in order not to host relative clauses, on the other hand the
number of modifiers in the external and internal nominal has to match in order for deletion take
place. A null AP in place of the relative clause in the internal domain satisfies both requirements.
The presence of a null AP is required for ellipsis under identity via Topic Drop. The internal and
not 'rolled-up' DP raises to Spec-Topic, a prerequisite for Topic-Drop. Once the DP containing a
deficient NP has Topicalized, the AP part undergoes cyclic movement to Spec-CP in order to
potentially raise further to a Specifier position of the functional projection in the external
domain. Obviously, there is a look ahead problem as with all approaches to cyclic movement,
namely how does the FA 'know' that it has to raise to CP before the structure is Merged with
FP Ext. I will not address this issue. The problem is inherent for every approach that involves
cyclic raising to a structure that is not been construed (for possible solutions see Williams 2003).
I will assume that cyclic movement can happen to every Spec- phase head and if it does not
terminate in feature checking then the derivation proceeds as if cyclic raising never occurred (see
Szczegielniak 1999).
It has to be noted that this splitting of the DP by moving the AP to a higher position is not that unusual. Split Topics can be found in many languages (for an overview see: Ott 2011).

25. a. Französische Bücher hat Amina bisher nur wenige gute gelesen.
    French books has Amina so far only few good read
    ‘As for French books, so far Amina read only few good ones.’

    b. In Schlössern habe ich noch in keinen gewohnt.
    in castles have I so far in no lived
    ‘As for castles, I haven’t lived in any so far.’

I will not argue here that movement to Spec-CP inside relative clauses is a case of Split-Topicalization since these are usually argued to involve contrastive marking that is incompatible with ellipsis. What the examples show is that this kind of movement is possible. Examples like (25) above have been argued to obey locality constraints (Ott 2011). They have also been shown to have a definiteness restriction also present in the interpretation of the head noun inside the clause modifier. This I will argue is a result of splitting a DP and moving the lower part. Thus the ungrammaticality of (26) below is argued to be related to the restriction in (27).

    the car can I me only the new by BMW afford
    'I can only afford the new BMW car'

    b. Ein neues Auto kann ich mir leider kein richtig schickes leisten.
    a new car can I me unfortunately no really fancy afford
    'I cannot unfortunately really afford a fancy new car'

27. a. Pensava di essere un/*il/*0 genio incompreso

16 For example raising of a relative clause is impossible:

    (i) *Französische Bücher kennt sie [einen Typen [der schon drei langweilige gelesen hat]
    French books knows she [a guy [who already three boring read has]
He thought he was an undiscovered genius

b. Non era il [genio incompreso] che pensava di essere e

He wasn’t the undiscovered genius that he thought he was

The idea following Cinque (2008) is that the contrast in (27) shows that an indefinite DP is the source of interpretation inside the relative clause. Example (27a) shows that the DP can only be indefinite in the expression "he thought he was a genius undiscovered", but when relativized "genius undiscovered" can take a definite determiner, as shown in (27b).

Another argument put forth by Cinque (2008:7) is that in Italian adjectives can have a specific and non specific reading. Thus (28a) can mean some specific famous actor: Kevin Bacon, or it can mean that non concrete actor is in mind, other than that he will be famous. However, when the DP is definite (28b) a non specific reading is impossible.

28. a. So che un attore famoso interverrà alla festa
I know that an actor famous will come to the party
'I know that a famous actor will come to the party'

b. So che l'attore famoso interverrà alla festa
I know that the actor famous will come to the party
'I know that the famous actor will come to the party'

Interestingly enough what looks like a definite DP when it is relativized, it is again ambiguous between a specific and non specific reading. Hence Cinque proposes that the structure of (29a) is (29b) where the head of a relative clause is indefinite.

29. a. L'attore famoso che interverrà alla festa sicuramente avrà lo smoking
The actor famous that will come to the party will surely wear a tuxedo
'The famous actor that will come to the party will surely wear a tuxedo'

b. L'UN attore famoso che interverrà alla festa sicuramente avrà lo smoking
The [an actor famous] that will come to the party will surely wear a tuxedo
"The famous actor that will come to the party will surely wear a tuxedo'

Further examples involve internally headed relative clauses where you see an indefinite determiner on the internal noun

   Mari quilt a make the Dem I buy

   b.* [[ Mary [owïža ki] kağe] ki] he ophewatũ
   Mari quilt the make the Dem I buy
   ‘I bought the quilt that Mari made.’

However, there are problems in assuming that the head of the relative clause is always indefinite.

In Basilico (1996) it is argued that in Quechua, the head noun in internally headed relative clauses is always definite. Consider the following (via Basilico 1996):

31. Nuna ishkay bestya-ta ranti-shqa-n alli bestya-m ka-rqo-n
    man two horse-Acc buy-PERF-3 good horse-VALIDATOR be -PAsT-3
    'The two horses that the man bought were good horses.'

It is argued that (31) and does not allow a continuation: "and the two were bad", which would be possible if the DP is indefinite. Interestingly, according to Basilico that is possible if the relative clause has the head noun externally.

The above data indicate that we have to weaken the claim in Cinque (2008). Let me argue that:

32. The process of relative clause formation can render the head nominal element that is interpreted inside the relative clause as indefinite.

The mechanism(s) that renders this interpretation will be argued to be similar to Topic-Split in German where the moved part of the nominal obligatorily is interpreted as indefinite, whereas the in-situ part as definite (as argued for examples 25 and 26). In other words, I argue against assuming that the head noun is generated with a truncated structure that only goes up to Numeral
Phrase, as proposed in Cinque (2008). Instead, I propose that the deficiency of the head noun comes from its inability to complete roll-up of its functional projections. The fact that there is no attested language where the trace of the head noun, or in the case of internally headed relative clauses, the head noun inside the relative clause, can host a relative clause indicates that the functional head of the nominal inside the relative clause responsible for hosting a relative clause is deficient. It has to be noted that we are not talking here about center embedded relative clauses (Chomsky & Miller 1968). Example (33a) below shows a center-embedded structure, example (33b) shows a structure that should be possible if the trace/copy of the head noun could host a relative clause.

I propose that the above contrast shows that the nominal element generated inside the relative clause is defective in that it itself cannot head a relative clause. The defectiveness of the

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17 It cannot be that traces of A'-movement are not possible head nouns. As I have shown a wh-trace can host a relative clause.

(i) [Which man] \_ \_ \_ did I see \_ \_ \_ who likes ice cream

The above contrast also cannot be fully explained if we assume that a relative operator cannot host a relative clause, since in a construction where head noun reconstruction is required for Condition –A the structure is also infelicitous:

(ii) Sue saw those [pictures of myself] \_ \_ \_ that I expected \_ \_ \_ which were matte to be safe
internal noun results in a split DP, as shown in (24). This in turn allows for a derivation where
the lower part of the DP, namely the NP+AP complex to raise to Spec-CP as shown in (22). The
split DP approach can also capture the fact that in some languages the internal nominal is
interpreted as an indefinite, even if the head noun is externally interpreted as definite. The
effects from Italian can be accounted for if we assume that what is interpreted as the head
noun is the part of the extended nominal projection that raises out of the defective DP. Thus, the
definiteness effect in Italian relative clauses can be argued to have the same underlying
mechanism as the indefiniteness of the displaced nominal in German split topic constructions. In
both cases the moved element is interpreted as indefinite. The difference between the two
structures is that the nature of relative clause formation allows for a nominal to be interpreted as
indefinite inside the relative clause, but as a definite outside it. The exact mechanism for this will
be discussed in the next section.
Internally headed relative clauses (IHRC) also are accounted. Lakhota IHRC’s are a mirror
image of Italian in that the upper part of the split nominal raises to CP instead of the lower part
of the extended nominal as in Italian. \(^\text{18}\)

34. a. ERHC

![Diagram a](image)

b. IRCH

![Diagram b](image)

In order for the relative operator account to work, we would have to assume that a head noun
raising derivation is impossible cross-linguistically.

\(^{18}\) The analysis of head internal relative clauses will also involve large amounts of remnant
movement, but this is not unique to this approach but shared among most that assume an LCA
type of structure as in Kayne (1994), which I tacitly do.
In the case of Lakhota, in order for the DP to raise and yet have the indefinite nominal appear in what seems as in-situ we need to have the lower part of the split DP raise out of the DP. In the case of object relative clauses this could be Spec-v. This movement can be motivated by the fact that most IHRC languages are OV. In an Anti-symmetry system (Kayne 1994) this requires the object to raise above the verb. This analysis predicts that IHRC's will differ from externally headed relative clauses (EHRC) in that the Definite marker/determiner will be higher up than the nominal itself. This can be argued to be the case in languages like Korean and Japanese (Kim 2007):

35. a. The EHRC construction in Korean:
   Antony-nun [[e; to Mangka-n]-un totwuk]-ul capassta.
   A.-top [ [ ___ run.away-imprf]-rel thief]-acc caught
   ‘Antony caught a/the thief who was running away.’

   b. The IHRC construction in Korean:
   Antony-nun [[totwuk-i to Mangka-n]-un kes]-ul capassta.
   A.-top [ [ thief-nom run.away-imprf]-rel kes]-acc caught
   ‘Antony caught a/the thief when he (=the thief) was running away.’
   ‘A/the thief who was running away and Antony caught him (=the thief).’

36. a. The EHRC construction in Japanese:
   Antony-wa [[e; nige-teiru]- Ø dorobo,]-o tukamaeta.
   A.-top [ [ ___ run.away-imprf]-rel thief]-acc caught
   ‘Antony caught a/the thief who was running away.’

   b. The IHRC construction in Japanese:
   Antony-wa [[dorobo-ga nige-teiru]- Ø no]-o tukamaeta.
   A.-top [ [ thief-nom run.away-imprf]-rel no]-acc caught
   ‘Antony caught a/the thief when he (=the thief) was running away.’
‘A/the thief who was running away and Antony caught him (=the thief).’

It appears that for Japanese and Korean both strategies in (34) are available. Following Hoshi (1995), Shimoyama (1999), Matsuda (2002), and Kim (2007), I will assume that internally headed relative clauses have a unique external E type pronoun element. In the case of Korean: *kes*, and in the case of Japanese *no*. Since Heim and Kratzer (1998) it has been assume that these types of pronouns can be considered DP's with a missing NP. I will follow Elbourne (2001:243) in assuming that "E-type pronouns can quite generally be viewed as being definite articles followed by an NP which is deleted in the phonology. For ease of reference, I call this the NP-Deletion Theory". Thus, it can be assumed that both *kes* and *no* are DP's that have raised from with the relative clause. What remains is to align the NP elements via remnant movement in such a way that the internal NP can license the deletion of the external one.

Let me return to labeling. The clause resulting from cyclic raising of FP<sub>A</sub> to CP is marked as PLP (Partially Labeled Phrase) and is not fully labeled at the point of the derivation when it is integrated with the extended projection.

37. Simplified diagram of internal movement within the clausal modifier.
The structure in (37) is similar to the one proposed in Cinque (2008), Krapova (2009). However, it also incorporates the intuition that relative clause formation involves re-labeling of the clausal modifier as argued in Donati & Checcetto (2011). The proposal here will be an attempt to combine these two approaches into one coherent account that captures the intuition in Quine (1960) that relative clauses are clausal adjectives. I suggest that this be taken literally. I have already suggested that the existence of a Partially Labeled Phrase in (37) indicates that the structure meets the conditions for partial labeling set out in (7). In the relevant part of the derivation a CP is merged with an FP. Both have the type <e,t>, that is they are functions mapping entities to truth values. The resulting SO is to be Merged with F_{Ext}, a functional head which is part of the external NP's extended domain. The head F_{Ext} has to have in its sub-categorization frame compatible with both CP or FP. Finally, F_{Ext} is not a phase head. The label of PLP is set to <e,t> as far as semantic type but its categorial status is undetermined, l_{PLP}={c=FPA/CP, s=<e,t>}. It will have to be established at some point of the derivation, namely at Spell-Out.

19. With the obvious and huge difference that for Donati and Checcetto (2011) the clause has an NP label derived via head movement.

20. I am simplifying the account, and avoiding the extensive debate about the semantic type of adjectives and of the NP's they modify. This is because, regardless what we assume a predicative AP's semantic type is, a CP modifying an NP has to be of the same type in order to capture the fact that, when modifying an NP, both CP and AP are functions that have the same range and the same domain. Thus, the zero assumption would be that they have the same semantic type. For simplicity, I assume it is <e,t>}; however, the analysis holds regardless what type CP and AP are, as long as they are of the same type when used for NP modification.
38. Structure of a clausal modifier has been Merged with FP in the functional domain of the modified NP. \( C_{SO} = C_{FPA} \lor C_{C} \)

![Diagram]

PLP can be labeled in the category domain as either a CP or an FP\(_{A}\). This will be the most prevailing paradigm involving a matching derivation with an optional overt relative pronoun. This is because I adopt a system proposed in Cinque (2010), where the F functional projections are 'rolled up' via subsequent raising. In such a system an FP\(_{n}\) will attract an FP\(_{n-1}\) to its Spec. As I have argued, this roll-up is halted in internal DP's. The lack of 'roll-up' means that the DP is built with internal movement stopping at FP\(_{A}\) level. Such a DP can be an argument, obtain case, trigger agreement etc. However, it will not be as cohesive as its rolled up counterparts, meaning subparts of it will be easier to extract. The internal DP is defective in the sense that its internal NP core is disjoint from the DP layer. This allows for raising of the FP\(_{Ai}\) layer to Spec-CP forming PLP = \{FP\(_{A}\), CP\}. This phrase is then merged with external noun's F\(_{RCo}\) (the functional head that hosts relative clause modifiers).
39. Merger of PLP with the external NP's projection (shaded area structure that has not been formed, i=internal NP projections, e= external NP projections).

The partial label algorithm allows us to model a situation where the core of the internal NP takes over the external NP. In essence, the internal NP structure is 'grafted' into the external NP (I borrow this term, rather loosely from Van Riemsdijk, 1998, 2000, 2001). When PLP = FP_{Ai} the structure looks like a rolled-up NP, except this is a fusion of two structures. This becomes apparent once the next functional projection (F_2) is merged with FP_{RCe}. Note, that even though PLP is partially labeled, SO=\{PLP, FP_{RCe}\} is an unambiguous structure since F_{RC} can probe for FP_{Ai}, or CP (in other words PLP is in Spec- F_{RCe} for reasons other than cyclic movement). The head F_{2e} is Merged higher into the structure and F_{2e} will probe for an F head inside the FP_{RCe}. It can do it down two paths: the grafted one, or the external one. This depends on whether it will determine the root based on information in Spec-F_{RCe}, or based on the information in the head.
If the root is established based on the head $F_{RC}$ then $FP_{me}$ will be raised to Spec-$FP_{2c}$. This will trigger deletion of the grafted $FP_{mi}$ (on the assumption that $FP_{m}$ is identical in both extended projections).

40. Two possible paths for $F_{2}$ to probe. Solid line probing down the root, via the head resulting in matching (internal nominal raised). Dashed line probing down the Spec, and grafted structure resulting in internal nominal raising and a raising structure. Orange arrow points to the functional head down which subsequent roll-up will proceed.

Let us examine exactly how a matching derivation would look in our system.
40. Matching derivation, step 1 roll-up of extended projection based on $F_{RC}$. Shaded area=structure marked for deletion under identity.

Note that the $F_{Ai}$ head and contents of its Spec are not marked for deletion. This is because the AP will serve as the contrasting material required for DP ellipsis as argued on the basis of examples in (9). This means the null AP is a predicative Adjective, occupying a fairly high up position within the extended projection of the internal noun. Ellipsis of $F_A$ and its Spec would be blocked anyway since it will project making $PLP = FP_{Ai}$. Ellipsis of $FP_{Ai}$ would mean deletion of the whole clause. After $FP_{me}$ has raised to Spec-$F_{2e}$ the derivation continues up to $DP_e$. It has to be noted that the determiner restrictions vary between non-modified and modified NPs, but that has nothing to do with how the relative clause is derived, but is a function of what modifies it.

41. a. The Paris of my dreams is in France
b. The Paris that I love is in France
*c. The Paris is a city in France

What happens when the external DP is built? There is still structure inside the CP, namely the internal DP in Spec-Topic. This is marked for deletion via Topic-Drop. Now we are left with a structure where the FP\textsubscript{mi}, a sub-part of the internal DP, is raised out of the internal DP, which is marked for deletion, and then the raised out part is also marked for deletion via ellipsis. This poses some recoverability issues. Many languages have a strategy of spelling out the agreement/case features of one (or both) instances of FP\textsubscript{mi}. In some languages this is obligatory in order to provide nominal support for the AP, hence the higher instance of FP\textsubscript{mi} is spelled out as a relative pronoun. English is confusing in that there is a zero/that complementizer alternation. Thus, when there is no overt relative marker at all, it is not clear if we are dealing with a zero relative pronoun, or a zero complementizer. The assumption in the literature is that it is both. This was based on the existence of island violations even with zero markers. Something had to be moving in order to trigger them. In our case, this will be the DP raising to Spec-Topic. Such an approach allows us to dispense with zero relative pronouns. Relative clauses will be always constrained by internal A’-movement of the DP, even if the complementizer is not spelled out. This is the correct prediction, since relative clauses with no overt relative markers tend to pattern in their behavior with relative clauses headed by complementizers as far as their reconstruction properties. The claim is that, in English, FP\textsubscript{mi} is spelled out as a relative pronoun at the top position of its movement chain. This eliminates recoverability issues, and provides nominal support for the AP.
42. Matching analysis. Step 2. DP antecedence. Circle = DP antecedent and ellipsis goal, Triangle = relative marker formation. Elongated triangle = grafting of internal NP structure to external NP

This somewhat daunting representation is in actuality very simple. A sub-part of the internal DP, FP_{Ai}, has raised to CP. This is because the internal NP has a defective functional head F_{RCi} and there is no 'roll-up' of the internal NP's functional architecture. According to (7), PLP is formed after \{FP_{Ai}, CP\} is merged with FP_{RCe} of the external NP. Then, as in regular DP formation, the external NP's functional architecture is rolled up and FP_{me} raises to Spec-F_{2e}. This configuration allows the raised FP_{me} to serve as antecedent in the licensing the pronominalization of FP_{mi}, a
sub-part of the internal \( \text{FP}_{A_i} \). The structure has \( \text{FP}_{A_i} \) belonging to the internal noun's extended projection grafted on in Spec-\( \text{FP} \_{R_{C_e}} \), which is part of the external NP's architecture. Finally, the external NP structure, including the graft, is built into a \( \text{DP}_{e} \). This external \( \text{DP}_{e} \) licenses Topic-drop of the internal \( \text{DP}_{i} \).

This derivation gives us a head noun matching representation. There are two instances of the DP, and the external \( \text{NP}_{e} \) is pronounced and associated with the relative clause via shared Functional Structure and ellipsis/Topic Drop of the internal \( \text{DP}_{i} \). However, it has been argued that there are cases where the relationship between the pronounced noun and the gap inside the clause is that of movement (initially proposed in Schachter 1973 and Vergnaud 1974). The so-called head noun raising analysis in this system is triggered for convergence reasons – namely forced head noun reconstruction. I suggest that it is \( F_{2e} \) probing algorithm that is responsible for the possibility of having both derivations. For a matching derivation, I argued that \( F_{2e} \) searches for \( F_{me} \) in order to carry out the roll-up of the extended projection. In a matching analysis, that search is based on \( F_{2e} \) probing the head, \( F_{R_{C_e}} \) in order to establish the root of the derivation. However, if \( F_{2e} \) probes \( \text{FP}_{R_{C_e}} \) not via the head of \( F_{R_{C_e}} \) but via its maximal projection \( \text{SO} = \{ \text{FP}_{A_i}, \text{FP}_{R_{C_e}} \} \), then it can establish the graft as the root of the derivation.\(^{21}\) The lower NP is deleted under identity. Note that the number of modifiers will again be symmetrical. One interesting consequence is that in head noun raising the PLP I labeled a CP. This is because movement changes the type of the copy left to \(< e > \) and conditions on partial labeling are not met. The only viable candidate is CP. This means that Relative Clauses that require a matching can be AP's but ones that require a head noun raising interpretation have to be CP's.

\(^{21}\) This is not unlikely, since material in Spec- \( F_{R_{C_e}} \) fits the requirements of moving via roll-up. Thus the NP, whose AP is a modifier of, is the head noun.
43. Head Noun raising derivation

The approach that head noun raising triggers PLP to become CP has some interesting consequences. First it predicts that if PLP were to be gradable it would have to be a non-head noun raising derivation. This is the pattern reported in Szczegielsniak (2012). In the following examples we see that head noun reconstruction required for condition A (a hallmark for a head noun raising derivation) is not compatible with so called amount/degree relatives (Heim 1987).\(^{22}\)

44. It would take us all year to drink the champagne that Alan spilled at the party

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\(^{22}\) The classical "there were" amount relatives (Carlson 1977) have received a non degree derivation in Herdan (2008) and predictably allow for head noun raising as reported in Sauerland (2003) that 'there' relative clauses do not alleviate Condition C effects – something possible under a matching analysis.
Example (44) has two readings: a silly one where champagne is sucked out of the carpet (identity of substance), and the main one where we are talking about degrees of amounts (identity of amount). In our system this behavior is predicted since only a matching analysis allows the PLP to become an AP type element that can be modified by a Degree Phrase. This means that an identity of amount reading is possible only if there is no head noun movement.

45. a. No head noun reconstruction needed
   It would take us all year to paint the portraits of Roger that John, burned in a fit of paranoia
   #A. Type of portrait
   B. painting the actual burned canvas
   C. paint the amount of portraits

   b. Head noun reconstruction needed because of anaphor.
   It would take us all year to paint the portraits of himself, that John, burned in a fit of paranoia
   #A. Type of portrait
   B. painting the actual burned canvas
   #C. paint the amount of portraits.

Thus in this system PLP becomes gradable because it is really an AP. But this is only possible in a matching derivation.

Conversely, the system predicts that certain types or relatives that require head noun movement will never be AP like. Consider Functional Relative clauses (Sharvit 1977). 23

46. ha-iSa Se kol gever hizmin Ø/ota hayta iSt-o
    the-woman Op every man invited Ø/her was wife-his
    a. The woman every man invited was his (he = y) wife.
    b. For every man x, the woman x invited was x's wife

23 The issue of resumption and the distribution of relative markers obviously requires further research within this project.
I will argue that reading (b) is only possible in a head noun raising analysis, which again forces PLP to be CP. Predictably, functional multiple individual readings are not possible with amount relative clauses.

47. It would take us all year to photograph the woman that every man invited

The above example has only one reading where there is only one woman. It cannot have the meaning where a lot of men bought their women and there were so many of them that if we were eager to photograph them the task would take a year.

The proposal adopted here is aimed at capturing the dual head noun raising/head noun matching analyses proposed in the literature (see: Bhatt 2002, Sauerland 2003, Hulsey and Sauerland 2006). I believe it does capture all the relevant difference between the two derivations but also makes interesting additional predictions. First of all, there is no possibility cross-linguistically of structures like:

*48. [The man]_i that/who_i [that/who_i t_i lives in Oregon] went to the store] is handsome

Neither a matching nor a raising analysis can exclude (24). In a raising analysis, the head noun should be able to raise of out the CP leaving behind its CP modifier, creating a nested relative clause inside a relative clause. In a matching approach, it should also be possible to elide the NP leaving a contrasting relative clause. In the approach here, the head noun of a relative clause cannot license more than one CP modifier, since the extended projection of the internal NP is defective and does not license an RC. This implies that constructions where one noun is associated with more than one CP modifier have to be reduced to ATB type constructions.

The proposal provides an account why relative clause center embedding is taxing on language processing. Karlsson (2007) argues that center embedding in relative clauses is limited cross-linguistically to three (see: Chomsky and Miller 1963).
49. a. [The rat<sub>1</sub> that the cat<sub>2</sub> that the dog chased t<sub>2</sub>] killed t<sub>1</sub>] t<sub>1</sub> ate the malt

*b. [The boy<sub>1</sub> that a woman<sub>2</sub> that a child<sub>3</sub> that a bird<sub>4</sub> that I heard t<sub>4</sub>] t<sub>4</sub> saw t<sub>3</sub>] t<sub>3</sub> knows t<sub>2</sub>] t<sub>2</sub> loves t<sub>1</sub>]

The answer to why three is a limit for structures like (49a) can be provided within a partial labeling account. Each PLP has to be labeled when spelled-out. Spell-out occurs upon completion of the higher up phrase. In (49a), the underlined structure shows that there are two phases (marked with the complementizer that), hence this is the maximal Partially Labeled construction. Example (49b) is impossible to parse simply because the hearer has to keep in short-term memory four PLP's.


The assumption that labels are two membered sets containing lexical category and semantic type carry the prediction that when a given XP raises the copy changes its label. This is by definition since movement shifts any type <x> to type <e>. Therefore only for words denoting individuals movement does not change type. This means that one way of avoiding the triggering of the algorithm in (7) is to raise one of the XP's forming PLP. Movement will force unambiguous labeling. I suggest that this might be the case when we form certain types of adjectives. When FP<sub>A</sub> raises out of PLP, CP has to project. This follows the intuition in Leu (2008) that some AP's are formed from relative clauses.
In such a scenario, $F_{PAi}$ raises into the extended projection of the external noun. The entire complex $F_{RCE}$ is elided under identity with $F_{PAi}$. Recoverability forces AP to have lexical content, its denotation will be the CP, one might call this "semantic sprouting." These would be cases of what Cinque (2010:54) calls indirect modification adjectives like:

51. Wir sahen die $\text{Angkommenen}_{\text{PL}}$ Studenten $\text{Angkommenen}_{\text{PL}}$ (we saw) the arrived students

'We saw the students who arrived'

In the analysis proposed here, the $\text{arrived students}$ is $F_{PAi}$, whose null AP is phonetically realized as the AP inside the elided $F_{RCE}$, but whose meaning is the whole $F_{RCE}$. 
52. The $[\text{FP}_2[\text{arrived students}]; [\text{top}_{\text{FP}2}; [\text{AP students}]; [\text{top}_{\text{FP}2}; [\text{the AP students}]; \text{[have arrived]}]]$)

This proposal hinges on a claim that $\text{FP}_\text{Ai}$ with a null AP and overt NP$_i$ can be the antecedent to a whole $\text{FP}_{\text{RCE}}$, which means the null AP inherits the semantics of the item its eliding.

Citko (2006)

On the Comp Account, the head is missing and the whphrase

is in Spec,CP, as shown in (51a) (Groos and van Riemsdijk (1981), Grosu (1998), Gračanin-Yuksek (2005), among many others). On the Head Account, the [Spec, CP] position is empty and the head position is empty, as shown in (51b) (Bresnan and Grimshaw (1978), Larson (1987), Citko (2002).

51) a. John plays $[\text{DP } \emptyset [\text{CP } \text{whatever} [\text{TP he likes } t(\text{whatever})]]$] (Comp Account)

b. John plays $[\text{DP whatever} [\text{CP } \emptyset [\text{TP he likes } __]]$] (Head Account)

Convincing arguments in favor of the Comp Account come from locality effects; in particular from the fact that free relatives show the same locality restrictions on movement as wh-questions. This parallelism between free relatives and wh-questions is illustrated in (52-54) with respect to the Complex Noun Phrase

Constraint, the Wh-Island Constraint, and the Adjunct Condition, respectively.

52) a. * John plays $\text{whatever}$ he hears the claim that Mary likes $ti$.

b. * $\text{Whati}$ did John hear the claim that Mary likes $ti$?

53) a. * John plays $\text{whatever}$ he wonders why Mary plays $ti$.

b. * $\text{Whati}$ does John wonder why Mary plays $ti$?

54) a. * John did $\text{whatever}$ Mary left because John did $ti$?

b. * $\text{Whati}$ did John leave because Mary did $ti$?

The presence of the so-called category and case matching effects, on the other hand, seems to favor the Head Account.
Case matching effects are best illustrated in languages with richer morphological systems (than English).

As shown by the following examples from German, the case of the wh-pronoun inside the free relative has to be simultaneously satisfy the requirements of the matrix verb and the embedded verb.

Citko (2000) discusses analogous data from Polish, a language whose case system is richer than German.

56) a. Ich nehme [wenACC du mir empfehlst ]ACC. (Groos and van Riemsdijk 1981:177)
I take whom you me recommend
‘I take whom you recommended to me.’

b. * Ich nehme, [wemDAT du vertraust]ACC
I take whom you trust
‘I take who you trust.’

In the grammatical example given in (56a), the verb *nehme* ‘take’ requires an Accusative object.

Since the wh-pronoun heading the relative is also Accusative, the result is grammatical.