TOWARDS A THEORY OF TRANSPARENT REFLEXIVIZATION[1]

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[1]The core ideas on which this paper is based have been presented at various occasions since 2005 at the University of Geneva (2005), University of Stuttgart (2006), University of Leiden (2006), University of Tromsø (GLOW 2007), and TEI Patras (2011). I am grateful to the audiences of all events for comments, questions and remarks. The paper profited greatly from discussion with Elena Anagnostopoulou, comments by Giorgos Spathas and in particular Uli Sauerland. I am especially indebted to Uli Sauerland, without whose persistent encouragement and constant moral support this paper would never have been written.

1. Introduction

Traditionally, there are two different approaches towards reflexivization that have historically been associated with two mutually exclusive sets of assumptions about the division of labor between semantics and syntax. Syntacto-centric analyses standardly treat reflexives as bound variables that are subject to construction specific formal conditions such as Principle A of the Binding Theory (Chomsky 1981, 1986).

(1) *Principle A*

An anaphor must be bound by a c-commanding antecedent within the same local domain.

Under this view, Principle A serves two purposes. On the one hand, it regulates the syntactic distribution of anaphors[2] by imposing well-formedness requirements on possible binding relations, or combinations of indices, exemplified by (2)b and (2)c:

(2) a. Mary believed that $John_1$ saw $himself_1$

b. *$John_1$ believed that Mary saw $himself_1$

c. *Mary believed $himself_1$ to have seen $John_1$

On the other hand, Principle A ensures that the reflexive is actually interpreted as a bound variable that co-varies with its antecedent. Technically, this can be implemented by demanding that these variables, which in turn are the semantic translation of syntactic indices, are captured by a sufficiently local suitable λ-binder (Heim and Kratzer 1998). While there have been attempts to reduce the locality condition to independent concepts such as the theory of movement (Lebeaux 1983; Pica 1987; Katada 1991; Chomsky 1992; Reuland 2001, 2008), the latter property by and large remains stipulative, in that it does neither follow from lexical characteristics of the expressions involved nor from general properties of the grammar.

On an alternative kind of analysis, which has mainly found proponents in categorial grammar, reflexives are not conceived of as bound variables subject to a co-binding requirement on reflexivization, but reflexivization is directly built into the lexical semantics of the anaphor (Bach and Partee 1980; Szabolcsi 1987). Initially, this hypothesis was motivated by the fact that popular versions of categorial grammar, among them Combinatory Categorial Grammar and Type Logical grammar, lack object language variables and indices, and therefore need to be supplemented by a method for analyzing binding relations.[3] Categorial approaches have been less interested in accounting for the locality conditions on anaphors, partially due to a deliberate

[2]As the conditions on reciprocals are more strict and complex than those on simple reflexives, I will disregard them from now on; see Dotlacil (2010) for recent discussion.

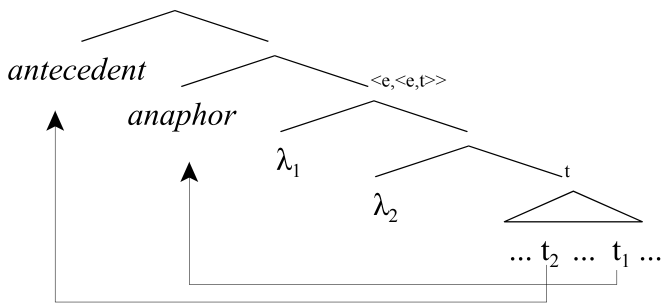
[3]On various versions of Combinatory Categorial Grammar see Curry and Feys (1958); Geach (1968); Szabolcsi (1987, 1992); Jacobson (1996, 1999); Steedman and Baldridge (2011) and references therein, among others. On Type Logical grammar see e.g. Dowty (1999, 2007). The classic locus on eliminating variables is Quine (1960).

tendency to disregard word order related phenomena, but partially also because there is disagreement on the nature of the core phenomena to be explained by a theory of anaphoric dependencies.

The present contribution aims at bringing together aspects of these two strands of research by combining a transparent analysis of reflexivization with a syntactic movement account of anaphora. This syncretic approach inherits various desirable features from both sides of its ancestors, resulting in a better understanding in at least two domains. To begin with, assuming that the semantic contribution of reflexives solely consists in reflexivization provides a promising and attractive strategy to remove the above mentioned stipulation inherent in Principle A of syntacto-centric models. On the other hand, the formulation of an articulated syntactic theory which (covertly) manipulates the position of anaphors in the object language makes it possible to envision a system in which occurrence restrictions on anaphors fall out from conditions generally held to be active in regulating overt displacement.

Specifically, it will be proposed that reflexive anaphors denote diagonalization operators, as in categorial grammar, but that these operators are not interpretable unless they covertly raise and attach next to a derived binary relation at Logical Form (LF), schematically shown in (3). (Section 2.3.2 explicates why movement is necessary even if *self* serves as the sister of a transitive predicate, as in *He hit himself.*)

(3)



Furthermore, (3) reveals that binary predicate formation requires the antecedent of the anaphor to undergo movement by itself. (This movement is special in a way to be discussed below.) Thus, reflexivization implicates two covert dislocation processes. I propose that the particular principles responsible for the order of movements and the exact landing sites are subject to two well-known more general conditions: the cycle and locality, i.e. the requirements that lower elements move first and that movement lands in the lowest possible position. On this conception, syntactic conditions on anaphor licensing can be - at least in large part - be derived from the universal laws of movement. The movement operation which transports the anaphor into its LF-position will henceforth also be referred to as AR (short for Anaphor Raising).[4]

[4]Movement processes for anaphors have been postulated before, but as far as I know never in order to achieve compositional interpretation. Representative analyses include Lebeaux (1983; *anaphor cliticization*); Pica (1987); Chomsky (1986); Katada (1991); Hestvik (1992); Safir (2003); Patel-Grosz

Finding support for the assumption that reflexivization proceeds in terms of AR requires the identification of correlates between AR and other movement processes. Given that as to date, there has been no systematic exploration of this question, the present study aims at filling this gap by contrasting the behavior or AR with the prototypical covert dislocation operation, viz. quantifier raising (QR). It will be seen that AR and QR share various commonalities, but also diverge in various respects. While some of these differences can be traced back to internal differences between the components involved - generalized quantifier denotations vs. a functor on binary predicates - some asymmetries turn out to prove more recalcitrant, raising interesting challenges and puzzles for further research.

Apart from defining a new theory of reflexivization and providing a catalogue of criteria which can be used to test the validity of the AR hypothesis, the present paper also pursues a third objective. On a widely held view, the formation of movement relations implicates indices, which are part of the syntactic derivation, to be inserted upon demand. The nature of the relation between indices and their hosts, that is their precise syntactic and semantic mode of combination, is usually left unspecified, though. In principle, there are at least two possible ways to conceive of the relation between indices and their hosts: either the host contains the index or *vice versa*. It is contended that the theory of transparent reflexivization is not innocent with respect to these two choices, thereby providing new insights into the internal composition of indexed nodes. Concretely, the particular mechanisms required to shift anaphors and their antecedents into the position where they can be interpreted are at tension with current views on what triggers the relevant, non-feature driven type of movement if the index is assumed to be dominated by the host node. This tension disappears once indices are taken to be not attached to their host, but are assumed to project. The resulting new phrase structure has the additional benefit of supporting a natural reduction of Heim and Kratzer's (1998) index re-analysis rule to better studied principles of movement.

The paper is structured as follows. Subsequent to supplying background assumptions relevant to the further discussion about binding and movement, section 2 explicates the core proposal and demonstrates how this new analysis derives the c-command condition on anaphors. In section 3, I explore commonalities between AR and QR, focusing on the locality conditions encoded in Principle A. Section 4 discusses three problems for the approach, which consecutively lead to a refinement the original account based on a new idea of how indices combine with their hosts, to be made specific in section 5.

2. Principle A as a reflexivization function

Traditionally, there are two competing groups of analyses of reflexive and reciprocal pronouns, which are usually held to be in conflict with each other: Principle A of Binding Theory and reflexivization accounts, which treat reflexives as arity reduction operators. I argue that

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(2011); Ahn (2012).

combining aspects of both theories into a hybrid account entails at least two favorable consequences. On the one hand, such an integrated analysis derives (larger parts of) the logical syntax of sentences which include anaphors from the lexical meanings of the expressions, together with orthodox assumptions about how syntactic derivations feed interpretation. In essence, this explains why anaphors are subject to locality conditions in the first place. One the other, the hybrid analysis offers a new perspective on how standard c-command and locality conditions on anaphors are to be derived. I discuss background assumptions about Binding Theory and the role of indices in modeling binding and movement relations in section 2.1, proceeding from there to a prominent type of analysis for anaphors in categorial grammar (section 2.2). Synthesizing the results, section 2.3 contains the main proposal and expands on some of its consequences.

2.1. Binding Theory

On the prevalent formulation of Binding Theory (Chomsky 1981, 1986), reflexive and reciprocal pronouns are treated as a uniform group of expressions that fall under the purview of Principle A. Principle A consists of three parts: (i) a shape specific requirement on a morphologically designated group of pronouns demanding that reflexives and reciprocals be bound, and two statements restricting the binding relation to configurations in which (ii) the antecedent c-command the anaphor and in which (iii) the antecedent and the anaphor are contained in the same local domain (where local domain roughly equals clauses with possibly covert subjects). Thus, (4)b fails to observe the c-command condition[5] while (4)c is blocked by the locality requirement:

(4) a. Mary believed that $John_1$ saw $himself_1$
b. *Him/$heself_1$ saw $John_1$
b'. *$Itself_1$ bit the dog_1
c. *$John_1$ believed that Mary saw $himself_1$

Co-indexing is used to signify three relations: coreference, syntactic binding (coindexing with a referential antecedent) or semantic variable binding; the latter two relations partially overlap in that semantic binding presupposes syntactic binding (Heim 1994; Büring 2005 among others). Since the present study is solely concerned with anaphors, where semantic and syntactic binding coincide, the distinction is not relevant for present purposes.[6] In what follows, I will explicate the specific assumptions to be adopted about the role of indices in modeling binding relations.

Heim and Kratzer (1998) propose that semantic binding, exemplified by (5)a, is encoded

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[5](4)b' demonstrates that the violation in (4)b is not due to an accidental gap in the morphological paradigm for a nominative anaphors.

[6]Syntactic binding can be subsumed under semantic binding once Principle C disjoint reference effects are factored out of Binding Theory; see Büring (2005: 124) for discussion and references.

at an abstract level of representation (LF) by enriching the object language with (object language versions of) λ-operators ((5)b).

(5) a. Surface syntax: Everbody$_1$ saw himself$_1$
b. LF: Everbody [λ_1 [$_{vP}$ t_1 saw himself$_1$]]

Turning to the semantics of (5) first, abstraction is interpreted by the standard mechanism of modified assignment functions, which renders the semantics of the binding relation context and assignment independent. A version of the abstraction rule is given in (6) (adapted from Heim and Kratzer 1998: 114). (7) provides two additional rules necessary for interpreting pronouns and traces (ibid):

(6) *Predicate Abstraction*
For any assignment g, index n∈ℕ, variable x of type σ and expression γ of type τ: if α is a branching node with immediate daughters β_n and γ, then α is a function of type <σ,τ> such that $[\![\alpha]\!]^g = [\![\beta]\!]^g (\lambda x_n.[\![\gamma]\!]^{g[n\to x_n]})$ if the domain of β contains $\lambda x_n.[\![\gamma]\!]^{g[n\to x_n]}$ and
$[\![\alpha]\!]^g = \lambda x_n.[\![\gamma]\!]^{g[n\to x_n]}([\![\beta]\!]^g)$ if the domain of $\lambda x_n.[\![\gamma]\!]^{g[n\to x_n]}$ contains β

(7) a. *Pronoun rule*
For any assignment g and n∈ℕ, $[\![\text{her(self)/him(self)/it(self)}_n]\!]^g = g(n)$
b. *Trace rule*
For any assignment g and n∈ℕ, $[\![t_n]\!]^g = g(n)$

(8) illustrates how the mechanisms above translate the vP constituent of (5), repeated in (8)a, into a reflexive predicate ((8)d), which is then combined with the subject denotation (where β_n := *everybody$_1$* and γ:= *[$_{vP}$ t_1 saw himself$_1$]*). I will return to the status of the trace t_1 momentarily.

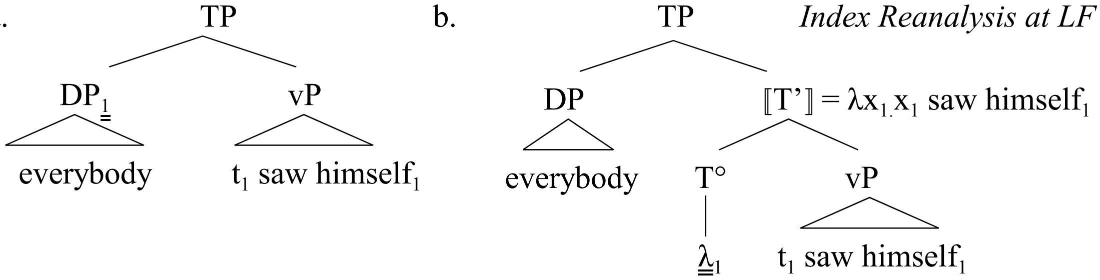
(8) a. $[_{vP}\ t_1 \text{ saw himself}_1]]^g =$
b. $\lambda x_1.[\![[_{vP} \text{ saw(himself}_1)(t_1)]\!]^{g[1\to x1]} =$ (by Predicate Abstraction)
c. $\lambda x_1.[\lambda y\lambda z.\text{saw'}(y)(z)\ ([\![\text{himself}_1]\!]^{g[1\to x1]})([\![t_1]\!]^{g[1\to x1]})$ (by lexical insertion)
d. $\lambda x_1.\text{saw'}(x_1)(x_1)$ (by pronoun and trace rule and β-conversion)

Note that in the rule format (6), unlike in classical Montague Grammar (PTQ; Montague 1973), it is the syntactic index subscripted to the NP which functions as λ-binder in the semantic component, and not the entire antecedent node *everybody$_1$*. On this popular conception, indices are not merely diacritic markers, which trigger a designated semantic rule (Quantifying-In), but are treated as autonomous parts of the natural language syntax. Thus, indices are also given a representation as abstract elements in the object language, where they actively partake in the derivation. This assumption will become relevant in the analysis of reflexives in section 2.3.

The derivation (8) also makes explicit another important feature of syntacto-centric, derivational models of the grammar. Indices are not only used to implement binding, but are also employed in the semantic analysis of syntactic displacement. In (8), this manifests itself in the fact that the translation of λ_1 co-values both the index on the pronoun and the subscript on the trace t_1. Following Heim and Kratzer (1998), it has accordingly become practice to collapse these two functions of indices on binders into a single abstraction rule which covers binding as well as movement.

Concretely, this rule has a syntactic and a semantic part to it. On the syntactic side, the operation of *Index Re-analysis* adjusts the relation between the host and its index along the lines spelled out in (9). Index Re-analysis proceeds in three steps: the index is separated from its host category, prefixed by a syntactic marker 'λ', and finally re-attached right below the host. In case movement targets a specifier, such as SpecTP in (9), it is natural to assume that the index is simply transferred to the next node made available by syntax, which corresponds to T° in (9)b:

(9) a. b. *Index Reanalysis at LF*



Strictly speaking, the λ-prefix on the index in (9)b serves as a diacritic meant to improve readability only but is ignored by semantics. The correct translation of (9)b is delivered by the abstraction rule (10)a (Sauerland 2004: 75) which exclusively targets the index. If desired, the index can also be given an interpretation as an object language vocabulary item with a lexical meaning of its own, as in (10)b (see also section 4).

(10) *Movement and binding index rule*
a. For any $n \in \mathbb{N}$ and assignment g: $[\![[n\ \alpha]]\!]^g = \lambda x_n.[\![\alpha]\!]^{g[n \rightarrow x_n]}$
b. For any $n \in \mathbb{N}$ and assignment g: $[\![n]\!]^g = \lambda\alpha\lambda x_n.[\![\alpha]\!]^{g[n \rightarrow x_n]}$

(11) illustrates the effects of (10). Crucially, the new incarnation of the index rule (10)a achieves a uniform treatment of variable binding and movement by factoring out the semantic contribution of the category hosting the index.

(11) a. $[\![[_{vP}\ t_1 \text{ saw himself}_1]]\!]^g =$
b. $\lambda x_1.[\![[_{vP} \text{ saw(himself}_1)(t_1)]\!]^{g[1 \rightarrow x1]} =$ (by Predicate Abstraction)
c. $\lambda x_1.[\lambda y \lambda z.\text{saw'}(y)(z)\ ([\![\text{himself}_1]\!]^{g[1 \rightarrow x1]})([\![t_1]\!]^{g[1 \rightarrow x1]})) =$
d. $\lambda x_1.\text{saw'}(x_1)(x_1)$

While the analytical tools discussed so far suffice to interpret binding relations, an additional set of assumptions is necessary in order to deal with the lower position of movement chains. Suppose that movement leaves copies (Chomsky 1995) and that each pair of copies in a minimal movement chain bears identical indices. Without further ado, these lower copies cannot be assigned a proper interpretation. Fox (2002) has therefore suggested that in such structures, the index on the lower copy introduces a variable, which is bound by the index on the higher copy.[7] Concretely, lower movement copies are converted into semantically interpretable objects by two separate operations. First, a variable with the same value as the movement index is inserted into the position that normally occupied by the restrictor in lower copy (*Variable Insertion*). Then, the determiner is substituted by a definite operator (*Determiner Replacement*):

(12) *Trace Conversion*
 a. Variable Insertion: (Det) $(\text{Pred})_n \rightarrow$ (Det) [(Pred) $\lambda x.x = n$]
 b. Determiner Replacement: (Det) [(Pred) $\lambda x.x = n$] $\rightarrow$ the [(Pred) $\lambda x.x = n$]

By means of illustration, (13) provides the derivation of a classic example which has motivated the copy theory in Chomsky (1995):

(13) Which picture of himself$_1$ did he$_1$ like best
 a. [Which picture of himself$_1$] λ_2 did he$_1$ like best [which pictures of himelf$_1$]$_2$
 b. [Which picture of himself$_1$] λ_2 did he$_1$ like best which [picture of himelf$_1$ $\lambda x.x=2$]
 (by Variable Insertion)
 c. [Which picture of himself$_1$] λ_2 did he$_1$ like best the [picture of himself$_1$ $\lambda x.x=2$]
 (by Determiner Replacement)
 d. ⟦the picture of e.o. $\lambda x.x = 2$⟧ $\Leftrightarrow$ ιx[picture of e.o.$_1$ (x) $\wedge$ x = 2]
 (by Predicate Modification and lexical insertion of *the*)
 e. [Which picture of himself$_1$] λ_2 did he$_1$ like best ιx[picture of himelf$_1$ (x) $\wedge$ x = 2]
 f. [Which picture of e.o.$_1$] (λx_2 ⟦he$_1$ like best ιx[picture of himelf$_1$ (x) $\wedge$ x = 2]⟧)$^{g[2\rightarrow x2]}$
 g. [Which picture of e.o.$_1$] (λx_2 [he$_1$ like best ιx[picture of himelf$_1$ (x) $\wedge$ x = x_2])
 "Which is the x such that he likes the unique x which is a picture of him"

Note that just like Index Re-analysis, the rule of Variable Insertion dissolves the structural integrity of the index and its host. But this time, it is the lower copy that is affected, and not the higher one. Hence, the principles which shape LF representations operate homogeneously in that they treat higher and lower copies alike. The fact that indices are treated as terms subject to syntactic operations will become relevant in that it provides a consistency argument for the

[7]See Sauerland (1998, 2004) for an expansion of trace conversion to cases in which the copy contains a bound variable and can therefore not be closed off by the ι-operator.

analysis of reflexives to be presented in section 2.3 below.

To recapitulate, in systems that postulate a tight link between natural language representations and the logical syntax of the meta language (von Stechow 1991; Heim and Kratzer 1998), indices are used as a common device for modeling syntactic displacement as well as binding. Moreover, such systems employ two ingredients to achieve the goal of rendering object language indices interpretable. First, two syntactic operations that separate indices from their higher hosts (Index Reanalysis) and from their lower hosts (Variable Insertion), respectively. Second, a semantic rule which translates higher indices into meta language λ-binders.

For the Binding Theoretic analysis of anaphors, this standard system entails the following consequences. Since all bound variables, that is reflexives and non-reflexive bound variable pronouns, are treated alike semantically, the local relation between indices on reflexives and their binders must be stipulated. This is part of the function of Principle A. But the fact that binding and movement are analyzed by the same procedure, that is binding by a c-commanding index to be translated as a λ-binder, also predicts a close link between the two operations of binding and syntactic dislocation. Below (section 2.3), I will explore consequences of this strong hypothesis, expressed in Heim and Kratzer (1998), that all instances of semantic binding are the result of movement for anaphors. It will be seen that adherence to this hypothesis offers a new perspective on the nature of Principle A. Before spelling out the details of the proposal it is necessary, though, to briefly review an alternative perspective on anaphors, which supplies a second central ingredient for this novel account for reflexivization to be presented in section 2.3.

2.2. 'Self' as a reflexivizer

Binding Theory (Chomsky 1981, 1986) succeeds in defining the structural conditions on anaphors extensionally, which translate into c-command and locality requirements. But the theory fails to provide a principled explanation as to why Principle A regulates exactly the two classes of expressions it applies to, that is reflexives and reciprocal pronouns. Given the axioms of Binding Theory, this correlation is more or less accidental, leaving an essential part of the explanandum unaccounted for. It seems to be self-evident that anaphors are equal to other types of expressions in that all their requirements should solely fall out from their lexical semantics and general properties of the syntactic derivation and the semantic composition procedure. I suggest that attaining such a natural theory of reflexives is possible, but only by integrating into a derivational model aspects of an alternative conception of anaphor interpretation, which has mainly been explored by frameworks that do not share the conviction in movement, traces, indices and other abstract syntactic entities.

According to this alternative view, most explicitly formulated in various versions of categorial grammar, anaphors are not variables which are subject to designated syntactic filters, but are treated as arity reduction operators that reflexivize binary relations, yielding one place predicates (Bach and Partee 1980; Szabolcsi 1987, 1989)[8]. More concretely, English reflexives are made up of two components. The pronominal part of the anaphor (*her* in *herself,* etc...) expresses a presupposition ensuring Φ-feature match betwen the anaphor and its antecedent (Cooper 1983; Heim 2005; Sauerland 2008), while the bound morpheme *self* is assigned the denotation in (14). The subscript <x, x> on *self* signifies that the functor co-binds the arguments of a binary predicates. (Type polymorphic extensions to ternary relations are discussed below.)

(14) $[\![\text{self}_{<x,x>}]\!] \quad = \quad \lambda R_{<e,<e,t>>}\lambda x[R(x)(x)]$

The sample derivation in (15) illustrates that the reflexivizer (14) may directly combine with transitive predicates:

(15) a. John saw himself
b. $[\![(15)a]\!] = \lambda R_{<e,<e,t>>}\lambda x[R(x)(x)]([\![saw]\!])([\![John]\!]) =$
c. $\lambda x[\lambda y\lambda z[see'(y)(z)](x)(x)]([\![John]\!]) =$
d. see'(john)(john)

Reversing the positions of the two syntactic arguments, as in (16)a, results in ill-formedness. This is so because the *self*-functor needs to combine with a binary relation, while VPs are commonly taken to denote unary predicates of individuals, leading to a type mismatch ((16)c).

(16) a. *Heself likes John
b. $[\![(16)a]\!] = \lambda R_{<e,<e,t>>}\lambda x[R(x)(x)]\ ([\![saw\ John]\!]) =$
c. $\lambda R_{<e,<e,t>>}\lambda x[R(x)(x)]$ ✘ $(\lambda x.see'(john)(x))$ (Type mismach)

Thus, the reflexivization analysis offers a natural account of the c-command requirement on anaphors in transitive contexts.

Reflexives also surface as internal arguments of the double object construction. All together, there are six attested reflexivization templates for ditransitives, illustrated by (17) to (19). Assuming that the argument structure of alternating ditransitive predicates like *show* and *give* is invariantly verb(DO)(IO)(SUB), as argued in Bach (1980) and Dowty (1996), among others, these six templates reduce to three general patterns for reflexivization:[9]

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[8]See also Steedman (1985); Chierchia (1988); Zwarts (1991); Reuland (2001); Schlenker (2005). Szabolcsi (1987) and Zwarts (1991) quote Geach (1968) and von Stechow (1979) as early precursors of the arity reduction analysis of reflexives. On the syntax and semantics of reflexives see also Faltz (1985) and Keenan (1988).

[9]Nothing in the ensuing discussion bears on the actual order of the internal arguments. Identical conclusions obtain if the indirect object is the innermost argument, as e.g. argued for in Anagnostopoulou (2003) and Marantz (1993).

(17) <x, x, a>-pattern (Subject binds IO)

a. *Alice* showed us$_{DO}$ to *herself*$_{IO}$ (in the mirror)

b. *Alice* showed *herself*$_{IO}$ Bill$_{DO}$

(18) <a, x, x>-pattern (DO binds IO or v.v.)

a. We showed *Alice*$_{DO}$ to *herself*$_{IO}$

b. We showed *Alice*$_{IO}$ *herself*$_{DO}$

(19) <x, a, x>-pattern (Subject binds DO)

a. *Alice* showed *herself*$_{DO}$ to us$_{IO}$

b. *Alice* showed us$_{IO}$ *herself*$_{DO}$

Out of these six constellations, only the first one ((17)a) is directly consistent with the simple semantics of reflexivization presented above; but even the analysis of (17)a requires unusual syntactic assumptions. Moreover, the occurrence of reflexives in the remaining templates will be seen to pose intriguing challenges for the categorial approach, to be addressed in turn below.

In the DO-PP-frame (17)a, the reflexivizer applies to a ternary relation whose first argument position has been saturated, yielding the function-argument configuration (20)a. Syntactically, the string is accordingly parsed as in (20)b, with the verb and its first argument, the direct object, forming a constituent to the exclusion of the indirect one:

(20) *Alice* showed us$_{DO}$ to *herself*$_{IO}$ (= (17)a)

a. self(show'(us))(alice)

b. Alice [[showed us$_{DO}$] to herself$_{IO}$]

But (20)b contradicts the results of standard structure sensitive diagnostics for double object constructions such as licensing of Negative Polarity, disjoint reference effects and relative quantifier scope, all of which indicate that precedence among internal arguments translates into c-command (Barss and Lasnik 1986; Larson 1988).[10] While this complication reveals itself most readily with (17)a, it is pervasive and extends to the other templates as well. The analysis therefore needs to be supplemented by a mechanism to resolve discrepancies between syntactic representations, which assign prominence to the linearly first internal argument, and semantic functor argument structure (see Steedman 1993, reported in Dowty 1996).[11]

[10]Dowty (1996: 11) disagrees on this, noting that "there exists no concrete motivation for any tree-structural asymmetry between the two objects in [...] *Mary gave John a book.*"

[11]At the moment of writing, I was not able to gain access to Steedman (1993). According to Dowty (1996), Steedman (1993) proposes a two level model in which c-command relations between internal arguments are changed in the transition from surface representations ([[V DO] IO]) to logical form. C-command sensitive properties can then be read off logical forms.

The IO-PP frame (17)b illustrates another type of problem. In categorial grammar, (17)b is related to the DO-IO frame (17)a by a Wrap rule, pioneered in Bach (1979, 1980)[12].

(21) *Alice* showed *herself*$_{IO}$ Bill$_{DO}$ (= (17)b)

Wrap denotes a class of infixing operations which effect changes in surface word order without alternating the semantic representation. Technically, the rule can be implemented by delaying the saturation of the infixed argument by abstracting over the infixed position in the verb meaning. Applied to the double object constructions (22), the wrapped meaning of *show*, defined in (23)b, is employed in the derivation of the IO-DO frame (22)b:

(22) a. Alice [[showed *Ulysses*$_{DO}$] to Bill$_{IO}$]
b. Alice [[showed Bill$_{IO}$] *Ulysses*$_{DO}$]

(23) a. $[\![\text{show}]\!] = \lambda x \lambda y \lambda z[\text{show'}(x_{DO})(y_{IO})(z_{SUB})]$
b. $[\![\text{show}_{wrap}]\!] = \lambda x \lambda y \lambda z[\text{show'}(y_{IO})(x_{DO})(z_{SUB})]$

However, "simulating" Wrap by simply permuting the order of abstraction as in (23)b, fails for reflexives in double object constructions such as (17)b because the binary functor *self* does not fit type-wise into the direct object position of *show'*, a predicate denoting ternary relations among individuals ((24)b)[13].

(24) a. $[\![[\text{showed herself}_{IO}]]\!] =$
$[\![\text{show}_{wrap}]\!]([\![\text{self}]\!]) =$
b. $\lambda x \lambda y \lambda z[\text{show'}(x_{DO})(y_{IO})(z_{SUB})]$ ✘ $\lambda R \lambda x[R(x)(x)]$ (Type mismatch)

The standard method for resolving conflicts of this kind, which is also pursued in Szabolcsi (1987), consists in shifting *self* to an appropriate type, resulting in (25). Notably, (25) combines two properties - type adjustment and Wrap - and derives the correct meaning of (17)b from the bracketing in (26)a, as made explicit in the sample derivation under (26)b.

(25) $[\![\mathit{self}_{<x,x,a>,\ wrap}]\!] = \lambda \wp \lambda R \lambda x[\wp(\lambda y[R(y)(x)(x)])]$

(26) *Alice* showed *herself*$_{IO}$ Bill$_{DO}$ (= (17)b)
a. [Alice [$_{VP}$ showed [herself Bill]]]

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[12]For complications related to Wrap see Steedman and Baldridge (2011).

[13]This problem is also noted in Büring (2005: 43), among others.

b. $\llbracket self_{<x,x,a>,\ wrap} \rrbracket (\llbracket \text{Bill} \rrbracket)(\llbracket \text{show} \rrbracket)(\llbracket \text{Alice} \rrbracket) \quad =$
$\lambda\wp\lambda R\lambda x[\wp(\lambda y[R(y)(x)(x)])](\lambda P.P(bill))(\llbracket \text{show} \rrbracket)(\llbracket \text{Alice} \rrbracket) =$
$\lambda x[\lambda P.P(bill)(\lambda y[show(y)(x)(x)])(alice) =$
$\lambda x[\lambda y[show(y)(x)(x)](bill)](alice) =$
$\lambda x[show(bill)(x)(x)](alice) =$
$show(bill_{DO})(alice_{IO})(alice)$

In this analysis, *self* is treated as a type polymorphic expression and the differences between the various templates in (17) to (19) is essentially reduced to multiple lexical ambiguity of the reflexive. Following this line of reasoning, and given the neutral assumptions that the lexical semantics reflexivization treats all arguments equally, *self* can then be assigned the three additional ternary basic - i.e. unwrapped - interpretations (27), in addition to its binary <x,x> variant (14).[14]

(27) For all variables $R \in D_{<e,<e,<e,t>>>}$ and $\wp \in D_{<<e,t>,t>}$

a.	$\llbracket self_{<x,x,a>} \rrbracket =$	$\lambda R\lambda\wp\lambda x[\wp(\lambda y[R(y)(x)(x)])]$	((17)b)
b.	$\llbracket self_{<a,x,x>} \rrbracket =$	$\lambda R\lambda\wp\lambda x[\wp(\lambda y[R(x)(x)(y)])]$	(for (18)a)
c.	$\llbracket self_{<x,a,x>} \rrbracket =$	$\lambda R\lambda\wp\lambda x[\wp(\lambda y[R(x)(y)(x)])]$	(for (19)b)

Furthermore, since double object alternations are attested with all three patterns, one also expects the following three wrapped versions of *self* given in (28) to be part of the lexical inventory. The versions in (28) permute the order in which the reflexive picks up its internal arguments:

(28)

a.	$\llbracket self_{<x,x,a>wrap} \rrbracket =$	$\underline{\underline{\lambda\wp\lambda R}}\lambda x[\wp(\lambda y[R(y)(x)(x)])]$	(for (17)b)
b.	$\llbracket self_{<a,x,x>\ wrap} \rrbracket =$	$\underline{\underline{\lambda\wp\lambda R}}\lambda x[\wp(\lambda y[R(x)(x)(y)])]$	(for (18)b)
c.	$\llbracket self_{<x,a,x>wrap} \rrbracket =$	$\underline{\underline{\lambda\wp\lambda R}}\lambda x[\wp(\lambda y[R(x)(y)(x)])]$	(for (19)b)

In what follows, I will spell out some problematic consequences of such a system, starting with the first and the third pattern. Relevant portions of the derivations are detailed in (29) and (30).

To begin with, the two <x,x,a> templates (17) now fall out from the original binary version $self_{<x,x>}$ (see (29)a) and ternary $self_{<x,x,a>wrap}$ ((29)b), respectively, while the pair of <x,a,x> templates (19) is derived with the help of (27) $self_{<x,a,x>}$ ((30)a) and $self_{<x,a,x>wrap}$ ((30)b). In addition, there is an alternative analysis for (17)b based on a different phrase structure and the unwrapped version $self_{<x,x,a>}$, as shown in (29)c:

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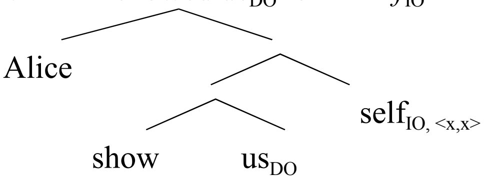
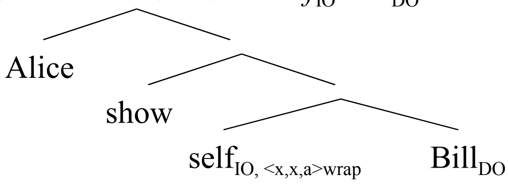
[14]Szabolcsi (1987, fn.8) notes that the entry for $self_{<x,a,x>}$, which builds the "skip of the irrelevant argument into the interpretation of the reflexive" (ibid, above (39)), can be derived from functional combinators by (i) applying to the verb the combinator Permutation, which switches the order of the internal arguments, (ii) applying the result to the object, (iii) followed by reflexivization.

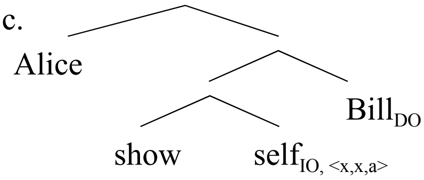
(29) a. *Alice* showed us$_{\text{DO}}$ to *herself*$_{\text{IO}}$



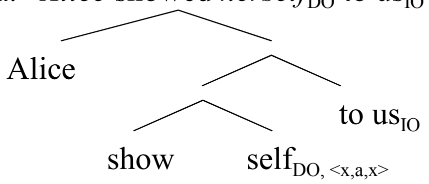
b. *Alice* showed *herself*$_{\text{IO}}$ Bill$_{\text{DO}}$



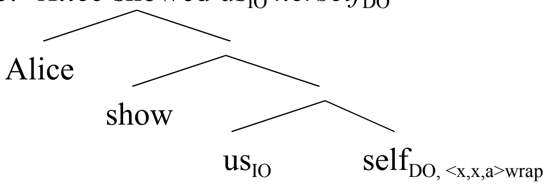
c.



(30) a. *Alice* showed *herself*$_{\text{DO}}$ to us$_{\text{IO}}$



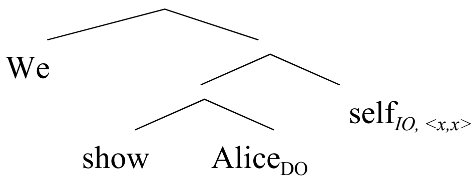
b. *Alice* showed us$_{\text{IO}}$ *herself*$_{\text{DO}}$



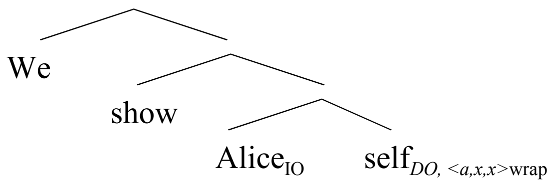
Thus, the analysis succeeds in accounting for two of the three pattern. However, in particular the remaining <a,x,x>-pattern (18) and definition (27)b, which expresses binding among internal arguments, proves problematic because it leads to overgeneration.

Concretely, the two well-formed templates (18) can be successfully derived by the original binary version *self*$_{<x,x>}$ (see (31)a) and the ternary manifestation *self*$_{<a,x,x>\text{wrap}}$ (see (31)b), respectively. But nothing said so far blocks *self*$_{<a,x,x>wrap}$ from partaking in the formation of ill-formed representations such as (31)d. (31)b differs minimally from (31)d only in that the linear order of DO and IO is reversed. A similar problem afflicts the unwrapped incarnation *self*$_{<a,x,x>}$, which is predicted to generate the illicit order (31)c.

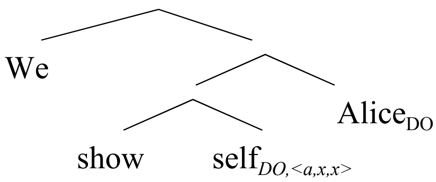
(31) a. We showed *Alice*$_{\text{DO}}$ to *herself*$_{\text{IO}}$



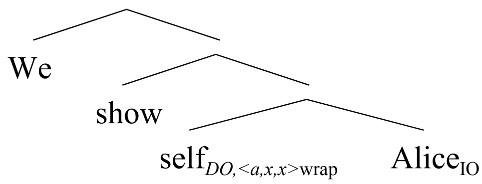
b. We showed *Alice*$_{\text{IO}}$ *herself*$_{\text{DO}}$



c. *We showed *herself*$_{\text{IO}}$ to *Alice*$_{\text{DO}}$



d. *We showed *herself*$_{\text{IO}}$ *Alice*$_{\text{DO}}$



It appears as if overgeneration in (31) can only be contained at the cost of a stipulation, that is by explicitly restricting the context of application for these two members of the polymorphic family (*self* $_{<a,x,x>}$ and *self* $_{<a,x,x>wrap}$) to the order *antecedent – self.* Note that it would not help to specify the direction of functional application, because there are versions (*self* $_{<x,x,a>wrap}$) that take their arguments on the right ((29)b) as well as on their left ((30)b). This contradicts the spirit of one of the central hypotheses of categorial grammar, according to which all meaning related information is lexically encoded.[15]

A plausible interpretation of the findings above is that precedence relations translate into asymmetric structural relations after all, such that the linearly first argument c-commands the second one (Barss and Lasnik 1986). Expressing this map in a categorial framework proves difficult, though (see fn. 15). While Wrap operations (or similar devices simulating Wrap) provide ways to reconcile flexible word orders with a canonical semantic structure, these strategies still cannot deliver the correct precedence - c-command relations, mainly for the reason that a successful analysis of the correlation rests on an assumption which is not part of the vocabulary of categorial grammars: movement. But then, there is also no natural way for barring overgeneration in (31)c/d except for by making explicit reference to word order. Clearly, this result casts doubts on whether the best account of binding in ditransitive VPs actually resides with the categorial polymorphism hypothesis.

A second general problem for the categorial approach comes in shape of the observation that, without further provisions, generalizing reflexivization to ternary relations creates the expectation that there should also be a two-place arity reducer *self* $_{<x,x,x>}$ ((32)). This version could apply to ternary relations, yielding one place predicates:

(32) $[\![self_{<x,x,x>}]\!] = \lambda R_{<e,<e,<e,t>>>}\lambda x[R(x)(x)(x)]$

If a language has *self* $_{<x,x,x>}$ strings such as *Alice showed herself* should be grammatical and translate into show'(alice)(alic)(alice). To the best of my knowledge, such languages do not exist. Again, the problem can be avoided if reflexivization is restricted to binary relations.

In sum, the categorial reflexivization hypothesis is successful in explaining why reflexives contrast with non-reflexive pronouns in that they need to be bound. However, this basic insight of the theory is considerably weakened by (i) the need to stipulate precedence restrictions on the distribution of at least one manifestation of *self*; (ii) unorthodox assumptions about the phrase structure of ditransitives; (iii) unfulfilled expectations of the polymorphism approach, i.e. the apparent cross-linguistic absence of (32). Finally, note that (iv) the need to assume multiple lexical entries for a single morphological item (*self*) might be seen as a disadvantage of the analysis, given that these different meanings are, as far as I know, not morphologically disambiguated in any language.

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[15]Comparable problems do not show up with binary *self.* Switching the order of arguments to $\lambda x\lambda R_{<e,<e,t>>}[R(x)(x)]$ instead of $\lambda R_{<e,<e,t>>}\lambda x[R(x)(x)]$ would yield V-initial or V-final strings, which one would presumably not like to generate in English for independent reasons.

2.3. The proposal

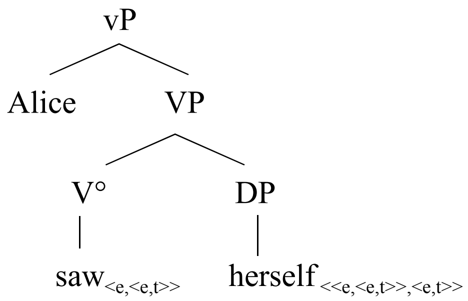
So far, it was seen that both the categorial arity reduction analysis and the binding theoretic account offer certain advantages not shared by the other. But it is also possible to devise a syncretic theory which incorporates positive aspects from both directions.

Suppose that *self* denotes a reflexivizer, as in (14), but that the way in which the *anaphor* combines with its arguments does not necessarily reflect surface structural realities.

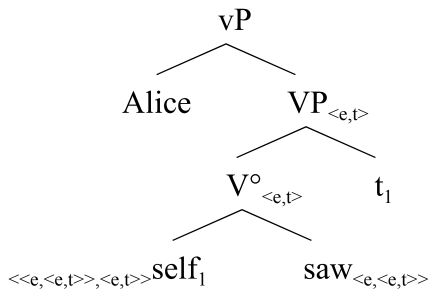
(14) $[\![\text{self}]\!] \;=\; \lambda R_{<e,<e,t>>}\lambda x[R(x)(x)]$

For reasons of exposition, it will moreover be assumed that transitive predicates denote binary relations between individuals[16] and that subjects originate in SpecvP. Case driven movement will be ignored throughout. Then, in transitive constructions, *self* may find its first argument in three different ways, outlined in the trees diagrams below. Either *self* directly applies to its sister node ((33)a; trivial) or incorporates into the verb ((33)b), leaving a semantically vacuous trace.[17] (34) provides a third alternative, on which the anaphor is raised up to a predicate denoting node, where it may combine with a derived relation subsequent to abstraction over the individual variable in the trace position of movement. Note that in the post-movement LF-representation (34)b, *self* is separated from its index, in line with Heim and Kratzer's Index Re-analysis rule introduced in section 2.1. (34)b provides relevant details of the semantic computation. The process which renders *self* interpretable by movement will henceforth also be referred to as *anaphor raising* (AR), which is intended to be simultaneously mnemonic of Principle *A* and Q*R*.[18]

(33) a. *Interpreting* self *in base position*



b. *Incorporating* self *in verb*



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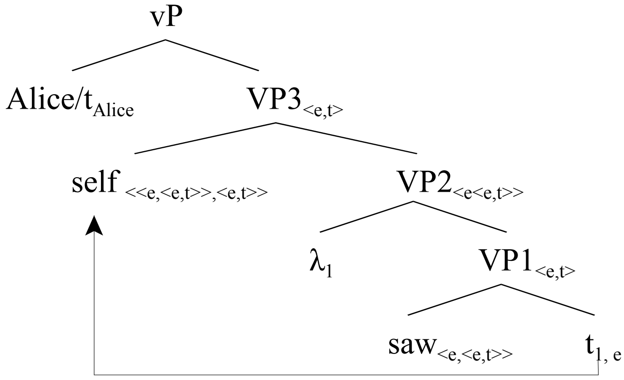
[16] If subjects are introduced by applicative heads (Chomsky 1995; Kratzer 1996) and transitive VPs denote unary predicates, *self* cannot directly combine or incorporate with the verb. In such models, *self* always needs to move in ways described in more detail below (see discussion of (42) in 2.3.2).

[17] See Patell-Grosz (2011) for an analysis in which the lower copy of *self*-incorporation is interpretable.

[18] I owe this connection, which I had not recognized when coining the term, to Uli Sauerland.

(34) a. *Anaphor Raising of* self



b.

$$
\begin{aligned}
[\![\text{see}]\!] &= \lambda x \lambda y[\text{see'}(x)(y)] \\
[\![\text{VP1}]\!] &= \lambda y[\text{see'}(t_1)(y)] \\
[\![\text{VP2}]\!] &= \lambda_1 \lambda y[\text{see'}(t_1)(y)] \\
[\![\text{VP3}]\!] &= [\![\text{self}]\!]\,([\![\text{VP2}]\!]) = \\
&= \lambda P \lambda x[P(x)(x)](\lambda_1 \lambda y[\text{see'}(t_1)(y)]) \\
&= \lambda x[\text{see'}(x)(x)] \\
[\![\text{vP}]\!] &= \lambda x[\text{see'}(x)(x)](\text{alice}) = \\
&= \text{see'}(\text{alice})(\text{alice})
\end{aligned}
$$

While (33)c demonstrates that movement is an option in simple clauses, the advantages of AR become visible only with more complex structures involving binding among internal arguments in double object constructions.

2.3.1. Double object constructions

In what follows, I present an analysis of binding in double object constructions, in particular the two schemata exemplified by (35). For expository reasons, the discussion will be developed on the basis of (35)b. All results carry over to (35)a, as well as to the other templates shown introduced in (17) to (19).

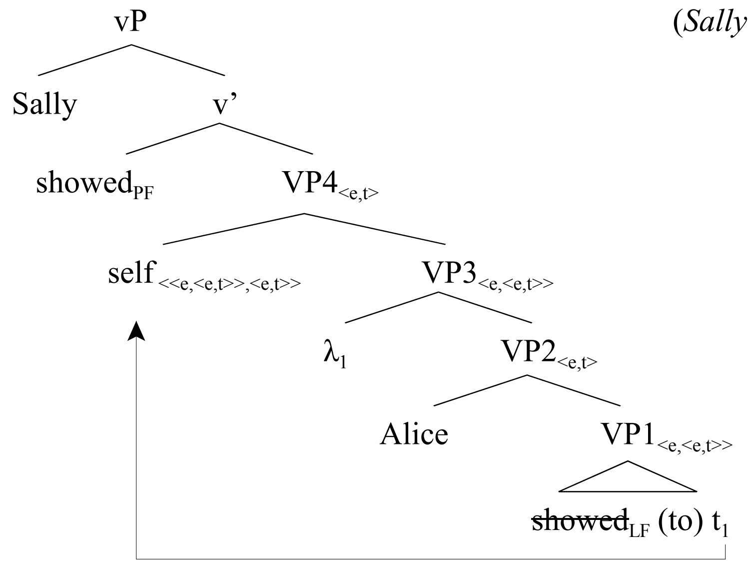
(35) a. Sally$_1$ showed Alice to herself$_1$ *<x, a, x>-pattern*

b. Sally showed Alice$_1$ (to) herself$_1$ *<a, x, x>-pattern*

As for the syntax of ditransitives, I adopt the common practice of assuming that the verb (*show*) overtly to the left of the first object (*Alice*), landing in v°, and is reconstructed at LF into its base position (Johnson 1991). For the moment, I also take it for granted that the semantics mimics that of transitives in that the highest VP denotes a predicate of individuals and that subjects are introduced in SpecvP.

Turning to the details, (36) demonstrates that the reflexive cannot combine with the verb directly or by incorporation, because *show* denotes a ternary relation but *self* requires a two place relation. Thus, *self* must be raised to a predicate denoting node. However, while AR to VP2, as in (36)a, yields a well-formed logical syntax, the derivation results in the wrong interpretation. (36)b demonstrates that the parse (36)a represents the equally possible, yet unintended subject oriented interpretation *Sally$_1$ showed Alice to herself$_1$*. What went wrong in (36)a is that the actual antecedent (*Alice*) is situated *below* the reflexivizer, instead of being attached right above it.

(36) a. (*Sally showed Alice to herself*)



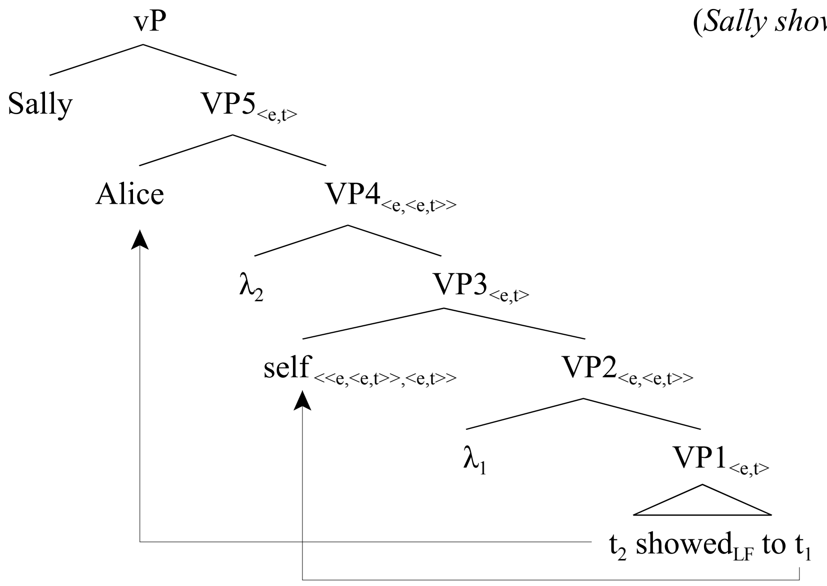
b.

	⟦show⟧	=	$\lambda x \lambda y \lambda z$[show'(x)(y)(z)]
	⟦VP1⟧	=	$\lambda y \lambda z$[show'(t_1)(y)(z)]
	⟦VP2⟧	=	λz[show'(t_1)(alice)(z)]
☛	⟦VP3⟧	=	$\lambda_1 \lambda z$[show'$\underline{\underline{(t_1)}}$(alice)$\underline{\underline{(z)}}$]
	⟦VP4⟧	=	λx[show'(x)(alice)(x)]
	⟦vP⟧	=	show'(sally)(alice)(sally)

Predicted meaning:
'Sally$_1$ showed Alice to herself$_1$'

A possible strategy for avoiding this shortcoming presents itself in assuming a second abstract dislocation process, which targets the antecedent, resulting in the new - and still preliminary - derivation (37). Specifically, movement of *Alice* in (37) ensures that the antecedent joins the semantic computation subsequent, and not prior to the reflexivizer:

(37) a. (*Sally showed Alice to herself*)



b. ⟦VP1⟧ = $\lambda z[\text{show'}(t_1)(t_2)(z)]$

☛ ⟦VP2⟧ = $\lambda_1 \lambda z[\text{show'}\underline{\underline{(t_1)}}(t_2)\underline{\underline{(z)}}]$

⟦VP3⟧ = $\lambda x[\text{show'}(x)(t_2)(x)]$

⟦VP4⟧ = $\lambda_2\ \lambda x[\text{show'}(x)(t_2)(x)]$

⟦VP5⟧ = $\lambda x[\text{show'}(x)(\text{alice})(x)]$

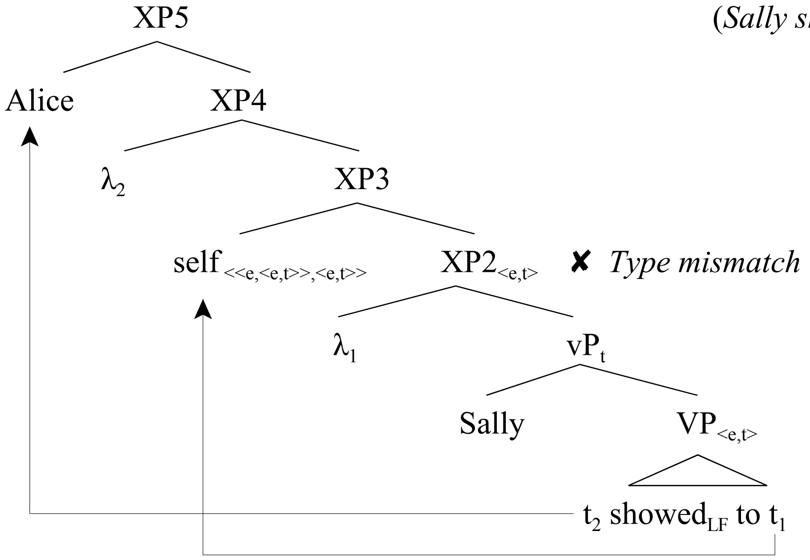
⟦vP⟧ = show'(sally)(alice)(sally)

Predicted meaning:
'Sally$_1$ showed Alice to herself$_1$'

Still, (37) generates the wrong meaning. This time it is not the order in which the antecedent and *self* are integrated into the semantic computation that is to blame for the undesired outcome, but the fact that the reflexivizer co-binds the subject position, which has not been filled at the point (singled out by ☛) at which *self* is added. Again, the resulting subject oriented reading is in principle available, but not the one sought after.

A third possible type of derivation, exemplified by (38), aims at acknowledging this additional condition by having both *self* and *Alice* cross over the subject and land in some vP external position XP. However, the tree in (38) reveals that these movements, unless accompanied by a suitable re-adjustment process, end up producing uninterpretable results. The functor *self* cannot combine with a type compatible binary relation, leading to a type mismatch.

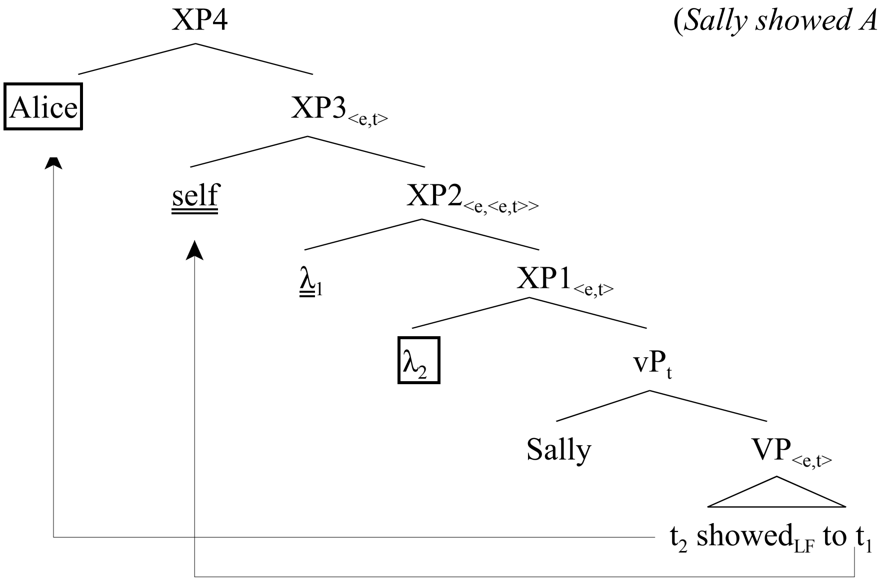
(38) (*Sally showed Alice to herself*)



The final derivation (39) presents a possible strategy to resolve the type conflict of (38). The solution relies on the assumption adopted in section 2.1 that indices are integral part of the object language which are visible to syntactic principles in the same way that other syntactic terms are.

In the LF-tree (39)a, the relation between *Alice* and its λ-binder is disrupted in syntax by squeezing the reflexivizer and its λ-binder λ_1 (underline) in between the antecedent *Alice* and its index λ_2 (boxed). (39)b demonstrates that this configuration yields the correct interpretation.[19]

(39) a. (*Sally showed Alice to herself*)



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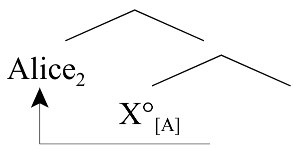
[19]Functors operating on binary relations have been used in Sternefeld (1998) and Beck and Sauerland (2000), among others. Nissenbaum's (2000) account of parasitic gaps makes use of similar device, whereby a category is squeezed inbetween a λ-binder and its host. Barker (2007) calls this strategy *parasitic scope* and employs it in the analysis of *same/different*.

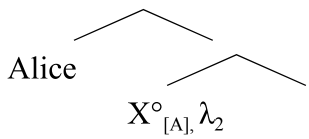
b. $[\![vP]\!] = show'[(t_1)(t_2)(sally)]$
$[\![XP1]\!] = \lambda_2[show'(t_1)(t_2)(sally)]$
$[\![XP2]\!] = \lambda_1\lambda_2[show'(t_1)(t_2)(sally)]$
$[\![XP3]\!] = \lambda x[show'(x)(x)(sally)]$
$[\![XP4]\!] = show'(alice)(alice)(sally)$

Crucially, there is a principled way to derive the upper, derived subtree of (39)a from standardly sanctioned syntactic mechanisms. Following Richards (2001), the output structure (39)a can be seen as the result of a particular order of movements and an economy metric that prefers shorter over longer movement paths (*Shortest*; *Minimal Link Condition*; Chomsky 1993, 1995: 311). Suppose for expository purposes[20] that both *self* and the antecedent are attracted by some abstract feature [A] on the head of X°. This [A]-feature can be thought of as a close relative to the feature implicated in QR in feature-based accounts of scope freezing effects with QR (Bruening 2001: 249pp). Given Shortest, the [A]-feature attracts the higher category, that is the antecedent *Alice*, first. Next, Index Reanalysis attaches the index to the head X°, which serves as the closes possible host for a λ-binder (see discussion of (9)). These first two steps are depicted in detail in (40)a/b. X° now contains [A] and λ_2. Next, the reflexive moves and needs to land in a position which satisfies two requirements: the landing site must c-command the [A]-feature, and it must be as close as possible to [A]. Thus, instead of landing below index λ_2, as orthodox movement would, *self* 'tucks in' directly beneath the antecedent, as shown in (40)c, thereby minimizing the distance between *self* and the [A]-feature. Finally, a second application of Index Reanalysis, which sticks λ_1 inbetween *self* and λ_2, yields the desired output configuration (40)d. To increase readability, and for the reasons laid out in footnote 20, head X° will from now on be suppressed.

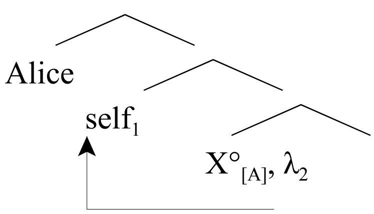
(40) a. *Move* Alice



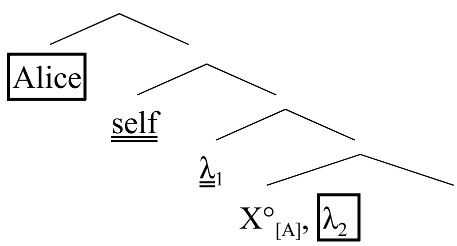
b. *Index Re-analysis of α*



c. *Move* self*, tucking in below* Alice



d. *Index Re-analysis of* self



[20]This assumption will be given up in section 5, where features are eliminated from the analysis.

In sum, if indices are assumed to be terms of the syntactic algebra, the LF-representations for reflexivization among internal arguments follows from the general algorithm which is standardly taken to regulate multiple feature induced movement (see also Bruening 2001).

Next, it can be shown that the c-command requirement on anaphors falls out as a corollary of the system presented so far. Before proceeding in this direction, it will be demonstrated, though, that the analysis of ditransitives naturally generalizes to transitive predicates. This step is helpful because it reduces the number of combinatorial options to be considered. With this result in place, the present analysis will be seen to admit derivations only that conform to the c-command requirement.

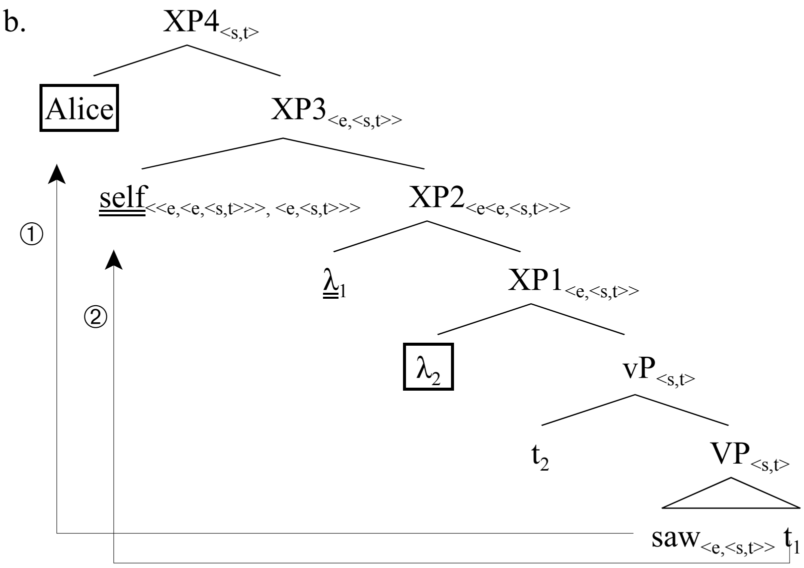
2.3.2. The c-command condition

Up to know, transitive verbs have been treated as two-place relations among individuals. There is a growing consensus, though, that the subject of binary verbs is not part of the verbs lexical semantic entry, and that the external argument is introduced by an applicative head (v°; Chomsky 1995; Kratzer 1996). If this premise is adopted, transitive predicates denote relations between events (or situations; elements of the typed domain D_s) and individuals, and *self* needs to be re-defined as in (41). What is of particular significance for present purposes is that this shift of perspective entails that the derivation of reflexive clauses involves two movement operations even in simple transitive constructions. Notably, the reflexivizer cannot combine with the verb meaning directly ((42)a). Hence, as made explicit in (42)b, the same covert adjustment operations are triggered which were observed in the derivation of double object constructions. Just as above, *self* is squeezed inbetween the antecedent and the λ-binder on the antecedent, from where it can function as an arity reducer

(41) $[\![\text{self}]\!] = \lambda R_{<e,<e,<s,t>>>}\lambda x\lambda e[R(x)(x)(e)]$

(42) a. $[_{VP}\ \text{saw}_{<e,<s,t>>}$ ✘ $\text{self}_{<<e,<e,<s,t>>>,\ <e,<s,t>>>}]$ (Type mismatch)

b. (*Alice saw herself*)



c. $[\![vP]\!] = \lambda e[see'(t_1)(t_2)(e)]$
$[\![XP2]\!] = \lambda_1\lambda_2\lambda e[see'(t_1)(t_2)(e)]$
$[\![XP3]\!] = [\![self]\!]([\![XP2]\!]) = \lambda x\lambda e[see'(x)(x)(e)]$
$[\![XP4]\!] = \lambda e[see'(alice)(alice)(e)]$

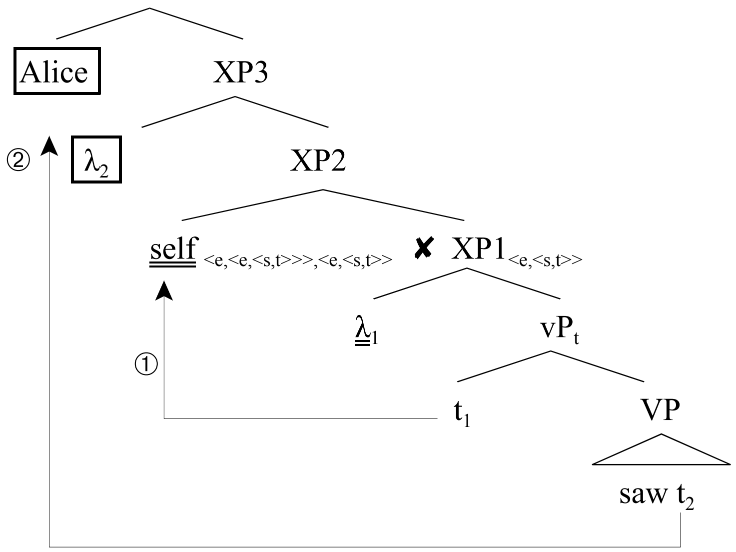
Consider next structures such as (43) in which the order to the syntactic arguments is reversed, in violation of the c-command conditions on anaphor licensing:

(43) *Herself$_{Nom}$ saw Alice.

It can be shown that there are two plausible derivations for (43), and that both of them inevitably lead to a conflict in the shape of a type mismatch or an inconsistent set of assumptions.

Suppose that *self* undergoes AR first, followed by covert movement of the antecedent *Alice*, as in (44). Given than at the point when AR applies, *Alice$_2$* still resides in its base position, the antecedent has not been separated from its index, yet. Consequently, *self* cannot be maneuvered inbetween inbetween *Alice* and the binder λ_2 and the derivation fails to produce an interpretable result:

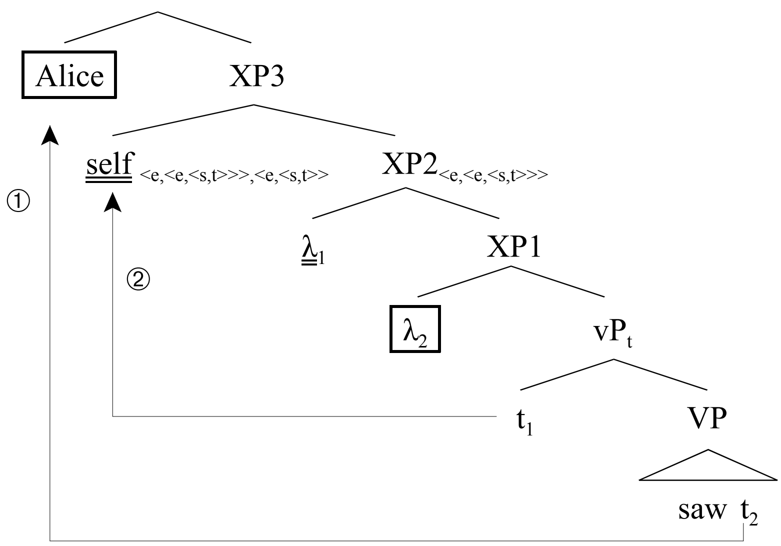
(44) (**Herself saw Alice*)



(Type mismatch)

If, alternatively, the antecedent moved first, followed by AR, as in (45), the derivation could not be obtained from a consistent set of assumptions on what drives movement.

(45) (**Herself saw Alice*)



On the one hand, the assumption that *Alice* moves first indicates that movement is cyclic, starting bottom up. This type of ordering movement cannot be feature driven, because feature attraction to a higher position always relocates the higher element first (Richards 2001; see discussion of (40)).

On the other hand, *self* needs to 'tuck-in' inbetween the antecedent and the binder on the antecedent. But tucking-in was seen to be a property of counter-cyclic, feature driven movement. Hence, movement in (45) would simultaneously has to be cyclic/non-feature driven and counter-cyclic/feature driven, imposing contradictory requirements on the derivation. Thus, the system does not admit derivations in which the reflexive illegitimately c-command the antecedent.

It needs to be pointed out in this context that relative clauses pose a problem for the analysis of the c-command condition presented above, which I have not found a way to resolve yet. Relative clause formation involves obligatory movement of a possibly silent pronoun and abstraction over the variable left behind by that pronoun, as in (46)a. Moreover, note that in (46)a, the index creating the derived predicate is not attached to any hosting expression. But from this it follows that there is no need for *self* to tuck-in below the host NP of the antecedent ((46)a). (46) differs minimally in this respect from (45).

(46) *(the man) λ_2 himself liked t_2

a. λ_2 [self liked t_2]

b. self [λ_1 [λ_2 [t_1 liked t_2]]

As a consequence, the two operations in (46) do not create a conflict as to the motivation for movement. Specifically, nothing blocks a cyclic derivation in which the pronoun undergoes relativization first, in overt syntax, followed by QR in the covert component. Thus, the explanation why (45) is not a possible strategy for anaphors in subject position does not carry over to relative clauses such, creating the wrong expectation that (46) is well-formed. At the moment, I can only offer some speculations which might eventually result in a more general re-analysis of the c-command condition.

On current assumptions, the antecedent needs to move as part of the procedure which generates a relational argument for *self*. One difference between the well-formed and the ill-formed instances is now that the structures which violate the c-command requirement involve a longer movement path for the antecedent. To exemplify with the case at hand, movement of the relative pronoun creates a shorter path in (47)a than in (47)b.

(47) a. (the man) who_2 t_2 liked himself
self λ_1 [λ_2 [t_2 liked t_1]]
b. *(the man) who_2 himself liked t_2
self λ_1 [λ_2 [t_1 liked t_2]]

Given that both representations are semantically equivalent, one might relate the contrast in (47) to general principles of economy, which favor shorter over longer movements if the choice does not affect interpretation (Fox 2000; Reinhart 2006). Note that the account would also capture the c-command condition in regular environments that do not involve relativization.

Alternatively, constellations such as (47)b, in which the (trace of the) reflexive and the trace of the relative pronoun are co-bound, can be excluded by Strong Crossover. One potential confound for this analysis is that Crossover is usually held to be a syntactic condition, which bars movement across a c-commanding categories with identical indices. But this does not hold at the point where relativization applies in (47)b, because the (trace of the) reflexive and the relative pronoun end up being co-bound only as the result of the semantic translation procedure. I will have to come back to a more detailed discussion of relative clauses this issue at another occasion, though.

Anaphors are subject to two distinct structural conditions: c-command and a requirement that limits the maximal distance between a c-commanding antecedent and the anaphor. The section to follow complements the analysis presented so far by demonstrating that the AR movement account successfully derives the most important locality conditions on reflexives.

3. Properties of Anaphor Raising and Quantifier Raising

The current section expands on similarities between AR and the prototypical covert movement operation *per se*, Quantifier Raising (May 1977, 1985). By systematically widening the empirical domain, it will become apparent that the AR-analysis succeeds in deriving the basic locality properties of Principle A by reducing them to locality properties of QR. Where differences between these two operations remain they can be traced back to independent factors that set AR apart from QR.

3.1. Finite clauses

Finite clause boundaries block inverted scope readings for embedded distributive quantifiers (examples due to Fox 2000; Johnson 2000).

(48) a. #Someone said [that every man is married to Sue $\exists \succ \forall / {*}\forall \succ \exists$
b. #Someone said [that Sue is married to every man] $\exists \succ \forall / {*}\forall \succ \exists$

Similarly, reflexives cannot find their antecedents across finite clause boundaries:[21]

(49) a. *John$_1$ said [that himself$_1$ saw Mary]
b. *John$_1$ said [that Mary saw himself$_1$]

Infinitival argument clauses behave less homogeneously, they fall into two distinct classes: scope islands and sentential complements that are transparent for covert movement. (See Moulton, Wurmbrand, to appear, and references therein for recent discussion of clause types and QR.) I will discuss representatives from both groups in turn.

3.2. Raising to subject

The upper limits on quantifier scope and anaphor movement match in raising-to-subject constructions, which are known to be islands for covert dislocation. As illustrated by (50)a/(51)a, embedded objects cannot take scope higher than the raising complement. From this, Lebeaux (1995) and Fox (1999) conclude that wide scope for *every senator* in (50)b must be generated by lowering of *two women* into the embedded infinitival, followed by optional scope shifting QR of *every senator* (analogous observations hold for (51)b).

(50) a. Mary$_1$ seemed to a different woman [t$_1$ to have danced with every senator]
$\exists_2 \succ \forall / {*}\forall \succ \exists_2$
b. A different woman$_1$ seemed [t$_1$ to have danced with every senator] $\exists_2 \succ \forall / \forall \succ \exists_2$

(51) a. #John seems to someone [t to be likely to die in every battle] $\exists \succ \forall / {*}\forall \succ \exists$
b. A soldier seems to John [t to be likely to die in every battle] $\exists \succ \forall / \forall \succ \exists$

---

[21] Anaphors inside *picture* noun phrases (see (i)), coordinate structures (see (ii)) and exempt anaphors in other contexts are known to display more liberal behavior, probably due to their logophoric nature (Reinhart and Reuland 1993; Pollard and Sag 1992; Büring 2005: 234):
(i) a. *John$_1$ wondered who$_2$ saw which picture of himself$_1$
b. John$_1$ wondered which picture of himself$_{1/2}$ Bill$_2$ saw (Chomsky 1995: 205)
(ii) Max boasted that the queen invited Lucy and himself for a drink
(Reinhart and Reuland 1993: 670)
Following the methodology of Reinhart and Reuland (1993), the present study focuses on anaphors in argument positions, ignoring logophors and exceptional anaphors.

The same pattern can be replicated by reflexivization, as shown by (52). While the raised, nominative subject may serve as the antecedent for an anaphor inside the embedded clause ((52)b), (52)a documents that the experiencer is not able to bind into the infinitival complement:

(52) a. *Mary seemed to $John_1$ [to like $himself_1$]
b. $John_1$ seemed to Mary [t_1 to like $himself_1$]

The parallelism above indicates that the upper bound for anaphor movement, just like for QR, is the infinitival complement. It is for this reason that the anaphor must not raise to the left of the experiencer in (52)a. Moreover, the licit long distance binding relation in (52)b is obtained by reconstruction of the nominative subject into its trace position, followed by local anaphors raising. Again, the analysis is identical to the one given to apparent cases of long QR in (50)b.

In contrast to raising infinitivals, some types of non-finite complements are transparent for QR as well as for AR. Exceptional Case Marking (ECM) constructions fall into this class.

3.3. Exceptional Case Marking

Whereas quantificational subjects of ECM complements may be assigned wide scope with respect to indefinites in the matrix clause ((53)a; May 1985: 44; Fox 2000; Reinhart 2006), ECM complements constitute barriers for QR out of lower positions ((53)b).[22]

(53) a. Somebody believed [every man to be married to Mary] $\exists \succ \forall / \forall \succ \exists$
b. #Someone believed [Mary to be married to every man] $\exists \succ \forall / {}^{*}\forall \succ \exists$

As documented by (54), anaphor binding is subject to exactly the same conditions as QR:

(54) a. John believed himself to win
b. *John believed Mary to have seen himself

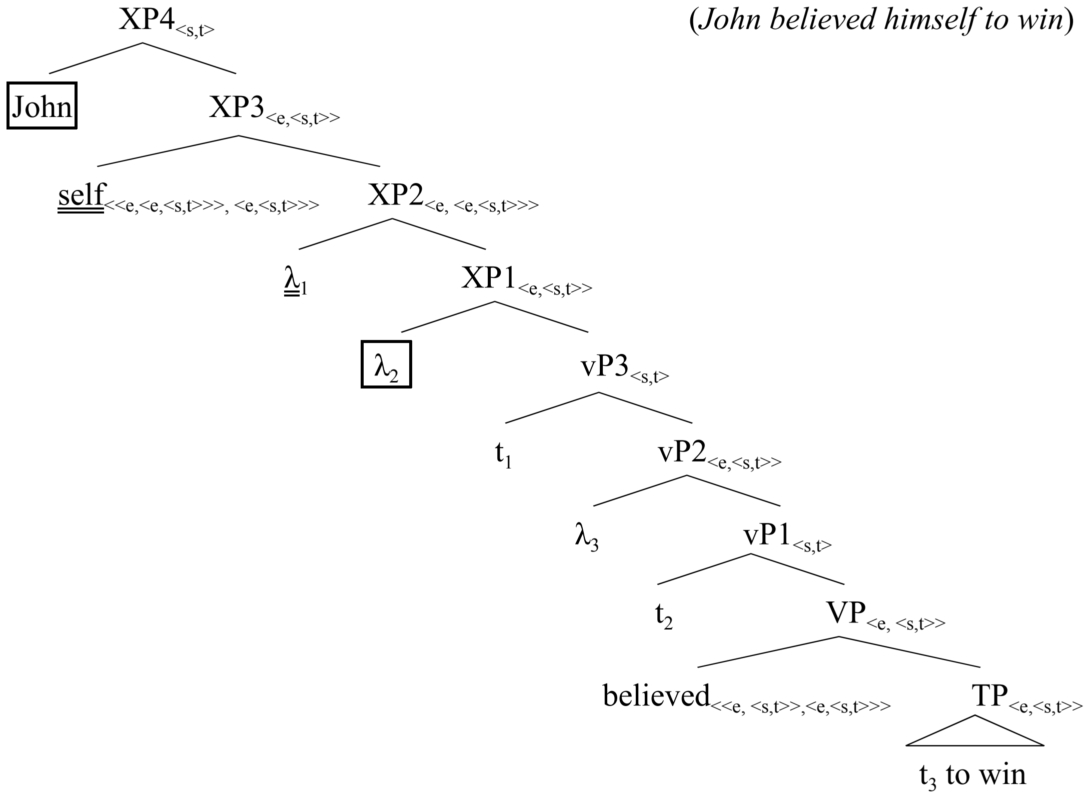
This follows on the assumption that the mechanism for reflexive licensing is similar to the procedure that derives distributive scope, in support of the AR-analysis.

Turning to the details, ECM is usually analyzed as a raising-to-object construction (Postal 1974). On this conception, the fact that ECM subjects admit inverse scope is not surprising, neither the non-clause boundedness of reflexives. In both instances, the accusative originates in

[22]Some authors report the availability of an inverse reading for examples similar to (53)b, such as (i) (from Wurmbrand, to appear):
(i) At least one professor believes Mary to have read every book
Distributivity in (i) might be a manifestation of illusive scope (Fox and Sauerland 1996), though, as can be seen from the fact that the inverse reading disappears in episodic examples with numerals:
(ii) Yesterday, many professors believed Mary to have answered every question

the lower clause but moves (covertly or overtly) into the higher vP-domain from where it can partake in scope and binding relations. The tree (55) tracks the evolution of (54)a.

(55) (*John believed himself to win*)



In (55), the reflexive moves to a Case position in the higher clause (SpecvP3), where it leaves behind a trace (t_1). This variable is then abstracted over (λ_2) in the by now familiar way, creating a derived binary relation that *self* applies to.[23]

3.4. Control

Unlike raising infinitivals - and similar to ECM constructions - a subclass of subject control complements has been observed to allow cross-sentential QR. In the examples below, the embedded universals appear to be able to distribute over an indefinite in the superordinate clause ((56)a/b from Kennedy 1997; see Moulton 2007; Truswell 2012; Wurmbrand, to appear, for recent discussion).

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[23]ECM-subjects are - just like control subjects - invariably interpreted *de se*:
(i) John believed himself to win *de se*/*non-*de se*
(55) accounts for this observation by implementing a property analysis of *de se* (Chierchia 1989), on which *believe* denotes a relation between properties.

(56) a. At least one American tourist$_1$ expects PRO$_1$ to visit every European country this year.
b. At least one American tourist$_1$ hopes PRO$_1$ to visit every European country this year.
c. At least one woman$_1$ hopes PRO$_1$ to marry every man in this group.
d. A different woman$_1$ promised PRO$_1$ to marry every man in this group.
all examples: $\exists \succ \forall / \forall \succ \exists$

These structures do, at least at first sight, not create any interesting predictions as to the scope of AR, since (56) involves subject control predicates, which provide the complement clauses with local binders that co-vary with the matrix subject. Following Heim and Kratzer (1998), derived property formation inside the control complement is implemented in terms of PRO moving to the top of the clause ((57)b). *self* is accordingly also licensed by local movement across PRO, as in (57)c, roughly resulting in the meaning (57)d.

(57) a. John$_1$ expected/hoped/promised [PRO$_1$ to vote for himself$_1$]
b. $[_{<e,<s,t>>} \lambda_2 [_{vP, <s,t>} t_{2, PRO}$ vote for himself$_1$]]
c. [self [λ_1 $[_{<e,<s,t>>} \lambda_2 [_{vP, <s,t>} t_{2, PRO}$ vote for himself$_1$]]
d. $[\![(57)c]\!] = \lambda x \lambda e.\text{vote\_for'}(x)(x)(e)$

A set of data which is more informative as to the parallel behavior of QR and AR comes from object control constructions. For many speakers, the embedded universals may not scope over the indefinite in any of the object control complements in (58) ((58)d from Wurmbrand to appear, fn. 7).[24]

(58) a. We persuaded at least one American tourist$_1$ PRO$_1$ to visit every European country this year.
b. #We asked at least one woman$_1$ PRO$_1$ to marry every man in this group.
c. #We convinced a different woman$_1$ PRO$_1$ to marry every man in this group.
d. Someone has persuaded Mary$_1$ PRO$_1$ to read every book on the reading list
for all examples: $\exists \succ \forall / {*}\forall \succ \exists$

If the locality conditions on AR mimic those on QR, reflexivization across object control predicates should be impossible. (59) confirms that this is correct:

(59) *John$_1$ promised/asked/convinced us PRO$_2$ to vote for himself$_1$

[24]The data is not uncontroversial. For instance, Truswell 2012, and Wurmbrand (to appear, fn. 7) report also dissenting judgements on (58)a-c.

Hence, AR is blocked where QR is unavailable. This is further support for the hypothesis that reflexivization proceeds in terms of a process that is very similar to the one responsible for transporting quantifiers in their scope positions.

As first noticed in Heim (1994), embedded anaphors under PRO are, under certain conditions, ambiguous between a *de se* and a (non-*de se*) *de re* construal.[25] (60) may be used to characterize situations in which John entertains consistent bouletic alternatives, as he is confused about his identity:

(60) John wanted $\text{PRO}_{\textit{de se}}$ to be smarter than $\text{himself}_{\text{non-}\textit{de se}}$

de se readings are also attested with object control predicates:

(61) a. We convinced Bill $\text{PRO}_{\textit{de se}/*\text{non-}\textit{de se}}$ to have won
b. We convinced Bill that $\text{he}_{\textit{de se}/\text{non-}\textit{de se}}$ has won (even though he didn't realize it)

(62) We urged/challenged Bill $\text{PRO}_{\textit{de se}/*\text{non-}\textit{de se}}$ to win

Suppose that, following Heim (1994), the ambiguity of the reflexive in (60) is resolved structurally, by either (i) moving the anaphor locally, above PRO, which produces a *de se* reading; or (ii) long distance movement across the attitude verb, resulting in the non-*de se* interpretation.[26]

Above, it was noted that object control predicates are scope islands, while subject control verbs are permeable for QR. If AR is constrained in ways similar to QR, a natural expectation is that non-*de se* readings are limited to contexts that admit wide QR, that is subject control complements. Thus, one is led to expect that (63)a contrasts with (63)b. Only the subject control structure is predicted to admit a consistent non-*de se* reading for the embedded reflexive:

(63) a. John wanted $\text{PRO}_{\textit{de se}}$ to be smarter than $\text{himself}_{\text{non-}\textit{de se}}$
b. We convinced/urged/challenged Bill $\text{PRO}_{\textit{de se}}$ to be smarter than $\text{himself}_{\text{non-}\textit{de se}}$

A first survey indicates that this expectation is borne out. If these judgements turn out to be representative, the distribution of non-*de se* therefore provides further, independent evidence for

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[25]This complicated way of phrasing is necessary because for many analyses, *de se* is a special kind of *de re* attitude (Lewis 1979); see Percus and Sauerland (2003a), Maier (2011) and Keshet (2011) for dissenting views.

[26]The observation that reflexives under *dream* can be bound by the dreamer goes back to Lakoff (1972). See Percus and Sauerland (2003a, b) for detailed analysis of the logical forms for *de se* pronouns. See Keshet (2011); Charlow and Sharvit (2010-11); Sharvit (2011) for arguments against a movement analysis of bound non *de se* readings.

the hypothesis that reflexive interpretation is produced by movement.

To recapitulate the findings so far, quantifier scope may not be extended across all types of complement clauses alike. While ECM and (certain) subject control are permeable for QR, finite clauses, raising complements and object control infinitivals by and large block covert scope shifting operations.[27] Thus, the pattern of QR parallels that of QR, in that QR is regulated by the same or very similar conditions that also define the an upper limit on the search space for reflexives.

3.5. Double object constructions

Double object constructions provide a further interesting testing ground for the AR analysis. As was discussed in section 2.2, anaphors in the DO-position of alternating ditransitives are flexible in that they may be bound either by the IO or by the subject:

(64) a. Mary showed John_1 himself_1 in the mirror
b. John_1 showed Mary himself_1 in the mirror

On first impression, it appears now as if the distribution of relative quantifier scope in the double object frame is subject to more severe conditions than that of reflexives. To begin with, indirect objects may scope over local subjects (Bruening 2001: 243, (28a,b)), confirming once again the parallelism between QR and AR:

(65) a. A different child gave me every book $\exists \succ \forall / \forall \succ \exists$
b. At least two judges awarded me every medal $\exists_2 \succ \forall / \forall \succ \exists_2$

However, IOs are also known to be scope rigid with respect to their DO co-arguments (examples from Bruening 2001: (2a), (28c)):[28]

(66) a. I gave a child each doll. $\exists \succ \forall /\ {*}\forall \succ \exists$
b. The judges awarded a (#different) athlete every medal. $\exists \succ \forall /\ {*}\forall \succ \exists$

This difference between binding and scope options comes, at least at first sight, as a surprise for the AR-hypothesis, because on present terms, binding and scope inversion are both effected by covert movement.

An explanation for this difference between QR and AR in double object constructions

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[27]The analysis of these differences falls outside the scope of the present study and will therefore not be further pursued here. See Wurmbrand (to appear) for a recent proposal, though.

[28]See Sauerland (2000); Bruening (2001); Lechner (2009, to appear) for recent discussion and possible analyses of scope freezing.

resides in the observation that the two movement operations produce two different output configurations which abide equally well to structural conditions on interpretation. Assume that covert displacement operations are subject to Relativized Minimality (RM; Rizzi 1990; see Sauerland 2000 for application to QR). RM excludes the constellation in (67)a, while admitting derivations such as (67)b, in which the intervener β has 'moved out of the way' of α.[29]

(67) a. $*\alpha ... [\beta ... [t_\alpha$ (where α and β are sufficiently 'similar')
b. $\alpha ...[t_\beta ... [t_\alpha$

In order to generate an inverse scope reading, QR has to transport the direct object across the highest occurrence of the indirect one. For double object construction (68)a, this straightforwardly derives the scope freezing effect, because inverse scope of the DO with respect to the IO is contingent upon *each doll* having crossed over *a child* at some point in the tree, as shown in (68)b, and (68)b fails to abide by RM:[30]

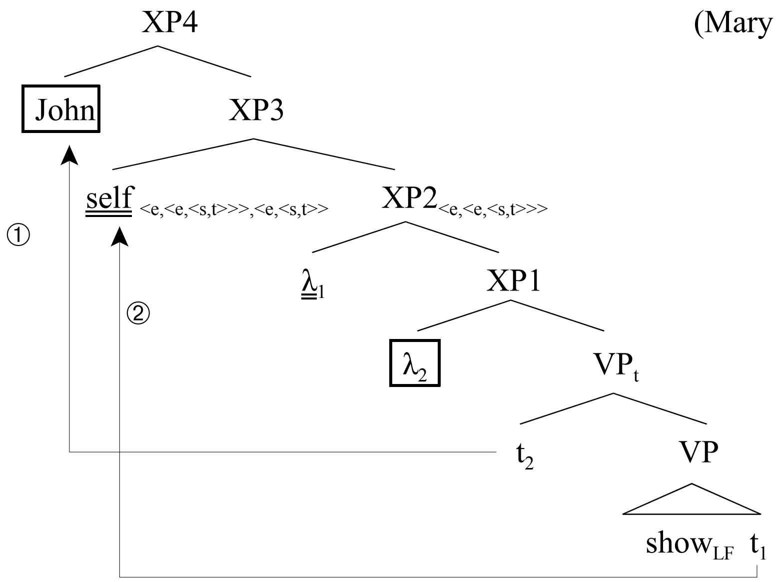
(68) a. I gave a $child_{IO}$ each $doll_{DO}$
b. ....[each $doll_{DO}$ ... [a $child_{IO}$ ... (t_{IO}) ... t_{DO} $\forall \succ \exists$

AR implicates now an independent property, which makes the operation sufficiently different from QR in order to provide an understanding for the more liberal behavior of reflexives. As made explicit by the tree (69), which tracks the derivation for (64)a, the formation of anaphoric dependencies does not only involve one movement operation, but two. First, the antecedent (*John*) needs to raise, then the reflexive tucks in below this newly created position:

[29]Naturally, this assumption is only compatible with a non-symmetric version of minimality; see below.

[30]Wide scope readings for objects with respect to subjects can be achieved by subject reconstruction, as suggested in Sauerland (2000). In these cases, the object does - on certain assumptions about orders of movement - not have to cross over the subject, but only the subject trace, thus an RM violation can be avoided.

(69) (Mary showed *John₁ himself₁*)



Crucially, the constellation (69) is unlike QR ((68)b) in that it does not induce a minimality violation. This is so because at the point where the potentially offending operation AR applies, the potential intervener *John* has already been 'moved out of the way'. Moreover, while inverse scope requires crossing over the highest occurrence of the narrow scope quantifier, reflexivization is obtained by tucking in below the antecedent, again in observance of minimality. Thus, an at first sight surprising difference between AR and QR disappears upon closer inspection, revealing a property shared by both operations. Both AR and QR generate crossing dependencies that do not alter the surface order of the terms involved.

Identical results can be obtained if a popular alternative implementation of the scope freezing mechanism is adopted, which reduces the phenomenon to a condition on ordering of movement operations. Bruening (2001), for one, derives the prohibition on inverse scope for the DO from the assumptions that (i) QR is feature driven and that (ii) the attracting feature is located on a single head, v°. It follows now from the algorithm outlined in section 2.3.1 that multiple movements preserve the original hierarchical relations. As illustrated in the step-wise derivation (70), IO moves first ((70)b), then DO tucks in below IO ((70)c), yielding the desired relative scope order IO ≻ DO.

(70) a. $[_{vP}$ v° $[IO_1$ $[DO_2$]]]
b. IO_1 $[_{vP}$ v° $[t_1$ $[DO_2$]]]
c. IO_1 $[DO_2$ $[_{vP}$ v° $[t_1$ $[t_2$]]]]

At this point, it also becomes possible to see the similarities between QR and AR. Just like in (70), the two movement operations involved in reflexivization display the signature of order preserving derivations. Thus, two popular analyses of scope freezing treat QR and AR alike, irrespective whether the conditions on movement are phrased in terms of minimality or Shortest.

The remainder of this subsection addresses another, important consequence of the assumption that the antecedent of the reflexive undergoes movement, which this time pertains to the theory of economy. Many structural accounts of scope freezing effects, including the RM-analysis outlined above and Bruening (2001), proceed from the notion that movement is subject to syntactic economy, which favors shorter over longer movement paths. If economy also regulates the scope of AR, one is furthermore led to the wrong prediction that the choice of possible antecedents for the anaphor in (71) is not free, but limited to the closest binder (*Bill*).

(71) John_1 showed Bill_2 $\text{himself}_{1/2}$ in the mirror

Once again, though, independent differences between AR and QR present a plausible explanation for the absence of syntactic economy effects with AR.

In general, the concept of an antecedent is not lexically determined. Whether an NP functions as an antecedent for an anaphor or not must therefore be specified by the derivation. On the present account, this is achieved by covertly raising the antecedent, providing the necessary structural environment for the subsequent application of AR. Concretely, antecedent movement may land in a VP-adjoined position, if the object (*Bill* in (71)) serves as binder (see LF (72)a); or in a sister node to vP, if the anaphor is subject oriented (see (72)b); or next to any higher node denoting a property of events/situations.

(72) a. [Bill [λ_2 [$_{\text{VP}, <s,t>}$ t_2 [show himself]]]]
b. [John [λ_3 [$_{\text{vP}, <s,t>}$ t_3 [$_{\text{VP}}$ Bill [show himself]]]]]

As (72) documents, the ambiguity of (71) is now structurally resolved by moving either the subject or the indirect object prior to AR.

Which of these two alternative derivations is actually selected does not have to be stipulated, say, in form of a movement inducing feature on either *John* or *Bill*. For the derivation to converge, it suffices that the LF contains a derived predicate. Moreover, LFs in which none of the potential antecedents have moved end up as uninterpretable, because AR cannot find a suitable landing site. (I will come back to more general consequences of the observation that movement does not have to be induced by features in section 5.1.)

Recall at this point from the discussion of order preserving movement and scope freezing above (see (70)), that the type of syntactic economy relevant for present purposes compares the path lengths between the attracting feature on a single v° head and all lower quantifiers. In essence this implements the insight that the principles determining scope treat all quantifiers within a domain alike, and shift them to designated positions in the tree for interpretational purposes, possibly subject to other conditions that restrict quantifier exportation.

Anaphor resolution is unlike QR in this respect for two reasons. First, antecedent movement is not feature driven, and second, antecedent movement does not target the local domain of a single head, but may vary in its choice of landing site, as witnessed by (72). One is therefore correctly lead to expect that antecedent movement - and thereby AR - is exempt from the pressures of syntactic economy. Thus, the ambiguity of (71) does not pose a problem for the analysis from the point of view of economy.

A final question arising at this point is what happens if the antecedent moves, and another NP raises for independent reasons, for instance because it denotes a generalized quantifier in object position, as in (73)a. (73)b provides relevant parts of the LF prior to AR.[31] If AR were subject to syntactic economy, (73)a should be disambiguated in favor of the local strategy, blocking the subject oriented reading.

(73) a. John showed every friend himself in the mirror
b. John λ_2 [every friend [λ_3 [$_{XP<t>}$ pro$_s$ [$_{vP, <s,t>}$ t_2 showed t_3 himself in the mirror]]]]

The fact that (73)a also admits the subject oriented reading can accordingly be taken as a preliminary indication that AR is regulated by interface economy only, that is by a metric that compares (roughly) synonymous derivations.

3.6. Small clauses/causatives

Reflexivization may not reach into causatives and bare perception verb complements, testifying to the fact that AR of an object anaphor is unable to pass small clause boundaries:

(74) a. Mary made $John_1$ hit $himself_1$
b. *$John_1$ made Mary hit $himself_1$

(75) a. Mary heard/saw/... $John_1$ hit $himself_1$
b. *$John_1$ heard/saw/... Mary hit $himself_1$

The same restriction holds for QR, as witnessed by the contrasts below. The scope domain of small clause internal objects does not extend into the superordinate clause:

(76) a. Mary made a different representative call every client $\exists \succ \forall / \forall \succ \exists$
b. A (#different) representative made Mary call every client $\exists \succ \forall / {*}\forall \succ \exists$

(77) a. Bill saw some woman marry every man $\exists \succ \forall / \forall \succ \exists$
b. #Someone saw Mary marry every man $\exists \succ \forall / {*}\forall \succ \exists$

This observation supports the claim that small clause establish barriers for QR and AR out of

[31] I assume that event/situation pronouns are part of the object language (Percus 2000) and can be freely inserted (pro$_s$) or abstracted over in the spine of the tree above the vP-node.

non-subject positions alike.[32]

Subjects of small clause differ from objects in the same environment in that they are obligatorily assigned wide scope with respect to the selecting intensional matrix predicate (for recent discussion and exceptions see Moulton 2011).

(78) a. Someone seems to be sick $\exists \succ$ *seem/seem* $\succ \exists$
b. Someone seems sick $\exists \succ$ *seem/*seem* $\succ \exists$

Thus, while small clauses are islands for object AR (see (74)b), small clause subjects need to leave their minimal sentential domain. Together with the movement analysis of the *de se* vs. non-*de se* distinction adopted above, this creates the following prediction. The small clause (79)b should only admit an LF in which (i) the antecedent is interpreted outside the scope of the intensional operator and (ii) the reflexive moves locally.

(79) a. Someone seems to be taller than himself
b. Someone seems taller than himself

That is, it should be possible to assign (79)b the LF (81)a, while the representations (81)b and (81)c should be unavailable. If *self* is defined as in (80), these readings differ across two dimensions, namely which binder captures the world/situation variable of the *taller_than* relation and the semantic scope of the subject (scope of the existential with respect to *seem*, *de dicto*):

(80) $[\![\text{self}]\!] = \lambda R_{<e,est>}\ \lambda x \lambda w.R(w)(x)$

(81) a. someone [λ_3 seems [t_3 [self [λ_1 λ_2 [t_2 taller than t_1]]]]
$\lambda w \exists x[\text{person}(x)(w) \wedge \forall w'[R_{seem}(w)(w') \rightarrow \text{taller\_than}(\underline{\underline{w'}})(x)(x)]$
b. *someone [self [λ_1 λ_3 seems [t_3 λ_2 [t_2 taller than t_1]]]]
$\lambda w \exists x[\text{person}(x)(w) \wedge \forall w'[R_{seem}(w)(w') \rightarrow \text{taller\_than}(\underline{\underline{w}})(x)(x)]$
c. *seems someone [self [λ_1 λ_2 [t_2 taller than t_1]]]]
$\lambda w \forall w'[R_{seem}(w)(w') \rightarrow \exists x[\text{person}(w')(x) \wedge \text{taller\_than}(\underline{\underline{w'}})(x)(x)]]$

So far, I have not been able to design a test for the empirical ramifications of this prediction, though.

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[32]It has been claimed (e.g. Kayne 1984) that double object constructions are small clauses. If correct, the contrast between the causative (74)b, which does not admit wide AR, and the double object construction (64)b, which licenses long binding, is surprising. I am grateful to Heidi Harley for pointing out this puzzle.

3.7. NP-internal readings and the i-withing-i condition

The existence of inverse linking and antecedent contained ellipsis inside the complement position of nouns ((82)a) demonstrates that QR may pass over dominating NP nodes. AR displays the same pattern as QR, as shown by ((82)b):[33]

(82) a. John read/commissioned a report on [every suspect Bill did] (Kennedy 1997)
b. John read/commissioned a report on himself

NP-internal reflexivization is subject to numerous complex, poorly understood restrictions (Hestvik 1991) which will - with one exception - not be addressed in the present study. The exception to be briefly discussed in what follows comes in form of the i-within-i condition, which limits anaphoric co-indexing to subtrees that are not in a containment relation (Chomsky 1981; Frey 1993; Hoeksema and Napoli 1990; Sauerland 1998: 231, among others):

(83) a. *a picture of itself (is always surprising)
b. *a supervisor of himself
c. *friends of each other

In line with the analysis so far, the antecedent - for instance *a picture of itself* - must raise in all of (83) in order to provide a predicate abstract that *self* can attach to, as illustrated in (84)a. But from this configuration, the anaphor cannot be moved into a type compatible position without violating the prohibition on syntactic lowering ((84)b). Semantically, this translates into a failure of *self* to bind its variable:

(84) a. [a picture of itself] λ_1 [t_1 is surprising]
b. *[a picture of t_2] *self* λ_1 λ_2 [t_1 is surprising] (*self* lowering)

This simple syntactic account is not complete, though. First, it incorrectly rules out well-known exceptions to the i-within-i condition, which differ from the paradigm (83) in that the anaphor resides within a (reduced) relative clause, instead of an argument position (Chomsky 1981: 212, 229; Jacobson 1994; Sauerland 1998: 231):

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[33] Adjunct PPs are generally opaque for anaphor binding (see (i); Hestvik 1991 and references). It is less clear whether adjunct PPs also block QR. If inverse scope is possible in (ii), this discrepancy between QR and AR poses a challenge for the AR hypothesis:

(i) a. John saw a snake near him/*himself (Wilkins 1988)
b. John found a dollar bill in front of him/??himself (Hestvik 1991)

(ii) Someone saw a snake near everyone $\exists \succ \forall$/?$\forall \succ \exists$

(85) a. a picture showing itself (cf. (83)a)
b. a man supervising himself (cf. (83)b)
c. der auf sich stolze Mann (Frey 1989: 131)
the of himself proud man
"the man proud of himself"

Second, (83) has an alternative derivation, which also involves movement of the antecedent but which avoids lowering. Concretely, (84)b becomes interpretable if one adopts (i) an LF-transparent version of the copy theory of movement (Fox 1999; see section 2.1) and, of particular significance, (ii) a specific ordering of operations. The sample computation in (86) demonstrates the evolution of such an interpretable LF for (83)a. In (86)a, the antecedent moves, just as before, this time leaving behind a full copy. Next, Trace Conversion (section 2.1) inserts a variable ((86)b) and links that variable to the higher λ-binder ((86)c). AR then raises *self* out of the lower copy, as seen in (86)d. Finally, in (86)e, the higher copy is erased from the representation, yielding the target interpretation (86)f.

(86) *a picture of itself
a. [a picture of self] λ_2 [a picture of self]$_1$ (Move antecedent)
b. [a picture of self] λ_2 [picture(x) $\wedge$ of(self)(x) $\wedge$ x = 2] (Variable Insertion)
c. [a picture of self] λ_2 ιx[picture(x) $\wedge$ of(self)(x) $\wedge$ x = 2] (Determiner Replacement)
d. [a picture of self] self λ_1 λ_2 ιx[picture(x) $\wedge$ of(t_1)(x) $\wedge$ x = 2] (AR)
e. [~~a picture of self~~] self λ_1 λ_2 ιx[picture(x) $\wedge$ of(t_1)(x) $\wedge$ x = 2] (Delete higher copy)
f. $\exists$y[picture(y) $\wedge$ ιx[picture(x) $\wedge$ of(x)(y) $\wedge$ x = y]]

Note that the derivation converges only if AR precedes deletion of the higher copy; otherwise, the abstractor λ_2 would arguably be deleted, as in other cases of total reconstruction.[34]

If derivations such as (86) are legitimate - and I do not see any reason why they should not be - i-within-i configurations should be well-formed. It follows that the syntactic account of the i-within-i condition, according to which the antecedent moves prior to AR, cannot be correct.

The contours of a more adequate theory which correctly distinguishes between (83) and (83) become visible, though, once a strengthened variant of the AR-analysis is adopted. Suppose that reflexivization not only *can* be effected by movement, but *must* involve AR. As suggested by Uli Sauerland (personal communication), this requirement can be derived from the assumption that the pronominal part of the anaphor (i.e. *him*) functions as a resumptive that needs to be

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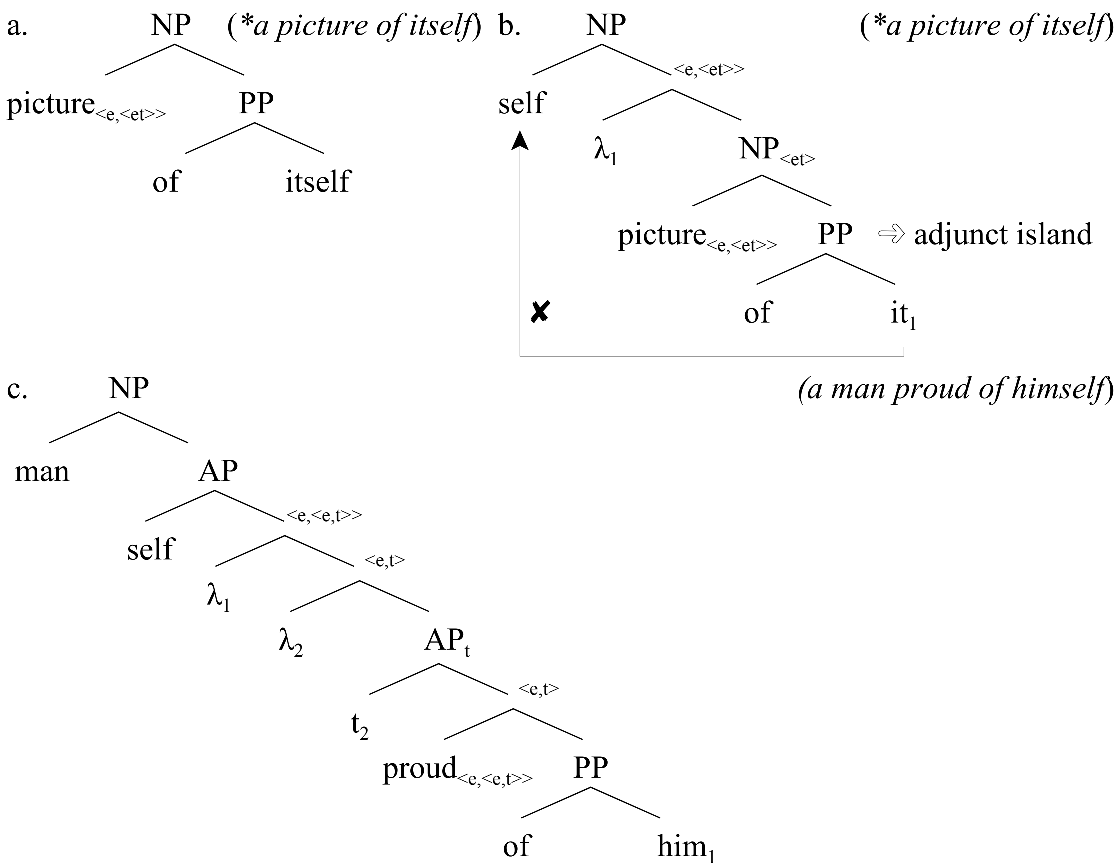
[34]That the λ-binder must be erased follows from the fact that failure to delete the λ-binder in (i)b would illegitimately turn the proposition into a derived predicate (if λ_1 binds a variable inserted into the lower copy) or would result in vacuous quantification (if no variable is inserted):
(i) a. This book about himself, Bill liked
b. ~~[this book about himself] λ_1~~ Bill liked [this book about himself]$_1$

bound by *self*. Suppose moreover that case marking prepositions such as *of* (or *in* in (83)b) are semantically vacuous. Then, one expects AR to succeed whenever the local context provides a suitable landing site for *self*.

This requirement is not met by (83)a, as shown in more detail in (87)b, because the structure does not contain a target position for AR between the head noun and the reflexive. Furthermore, while the alternative tree for (83)a given in (87)b[35], in which *self* attaches above NP, is semantically interpretable, the derivation can be excluded by syntactic locality. More specifically, the anaphor in (87)b is contained inside an NP-adjunct, but AR out of adjuncts for some reason seems to be generally prohibited (see footnote 33). By contrast, the well-formed instances of *i-within-i* configurations (85)b, exemplified by (87)c, incorporates a larger amount of structure, which makes available the requisite landing site for AR:

(87)



A direct consequence of this is, of course, that standard instances of NP-internal anaphors (see (82)b above) cannot must be treated as logophors. I have to leave the issue unresolved for now.

To conclude, the AR analysis has the potential of offereing a novel perspective on an intriguing property of the i-within-i condition. Moreover, by resting on the strengthened version of the AR hypothesis, according to which AR is obligatory in all contexts, the account gives further credibility to the assumption that the interpretation of reflexives implicates movement.

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[35]The relevance of derivation (87)b was pointed out to me by Uli Sauerland.

4. Three Problems

The theory of AR developed in the last two sections proves successful in capturing (i) the fact that reflexives are obligatorily interpreted as bound variables; (ii) the c-command requirement encoded in Principle A; and (iii) a variety of locality conditions on reflexivization. But the account also suffers from a number of weaknesses, three of which will be addressed below. In section 5, it will then be seen that these shortcomings can be removed by supplementing the analysis with a theory of indexing, which specifies a new way in which indices are combined with their hosts.

4.1. Motivation for movement

The present analysis of reflexivization postulates two separate movement procedures which raise the antecedent and the anaphor without changing their pre-movement order. It was suggested that this reflex of order preservation can be derived from the two hypotheses that AR and antecedent movement are feature driven, and that the attracting feature is located on a single, higher head. But at another point (see discussion of (72)), the ability of AR to skip potential landing sites, in violation of interface economy, signaled that motivating anaphor raising by features seems ill-founded. For one, the flexibility of AR in choosing its landing sites is best accounted for in terms of interpretive conditions driving the derivation, and not by placing features into specific slots of the tree. Also, postulating features for operations that solely affect interpretation results in redundancy, because movement is already motivated to ensure interpretability. Finally, that AR is not likely to be feature driven can furthermore be seen from a comparison with typical instances of feature induced dislocation such as overt wh-movement. While wh-movement satisfies requirements of a higher head (C°), which has consequences both for form (e.g. complementizer agreement) and meaning (question semantics, possibly enforced by a superordinate selecting predicate), AR is self-serving and its effects are not reflected in changes of meaning or form in higher heads.

In sum, the observations (i) that the choice of the antecedent is not (always) deterministic; (ii) that the LF- position of anaphors is entirely regulated by type considerations; and (iii) that anaphors do not enter into selectional relations with higher heads strongly argues that the displacement operations implicated in reflexivization are not feature driven. Still, the fact remains that for the derivations to yield interpretable outputs, AR and antecedent movement need to produce crossing, order preserving dependencies, in which the higher NP is raised first. Since the property of order preservation was derived from the axiom of feature driven displacement, the analysis is based on conflicting assumptions as to the motivation of movement. This presents a serious challenge which needs to be addressed.

4.2. Index reanalysis

The Index Reanalysis rule (Heim and Kratzer 1998), repeated below in (88) and (10)a, adds a second complication to the analysis which more generally affects the interpretation of movement chains.[36]

(88) a. (*Syntax*) → b. (*LF*)

$[\ XP_1\ \ \ldots t_1 \ldots\ ]$ *Index Re-analysis* $[\ XP\ [\ \lambda_1\ \ \ldots t_1 \ldots\ ]\ ]$

(10)a For any $n \in \mathbb{N}$ and assignment g: $[\![[n\ \alpha]]\!]^g = \lambda x_n . [\![\alpha]\!]^{g[n \rightarrow x_n]}$ (*Semantics*)

Even though Index Reanalysis is indispensable for creating interpretable output representations of movement, the procedure is suboptimal in two ways. First, it is syncategorematic in that it applies to a particular internally structured environment, i.e. movement, and is not definable in terms of the primitives, i.e. the index, its host and the trace. Second, the syntactic part of Index Reanalysis is without precedent because it involves severing off the index from the host, followed by lowering of the index. But subtraction and lowering are two operations commonly thought not to be part of the rule inventory of natural language syntax.

The variant (10)b, repeated from above, improves on the semantic side by providing the index with an interpretation of its own, yet still fails to specify how the index is separated from its host. Note that applying (10)b directly to 'XP_1' violates compositionality because a semantic rule would have to look into a complex node.

(10)b For any $n \in \mathbb{N}$ and assignment g: $[\![n]\!]^g = \lambda\alpha\lambda x_n . [\![\alpha]\!]^{g[n \rightarrow x_n]}$

These considerations make it desirable to replace Index Reanalysis by a different mechanism which can be reduced to other known syntactic processes.

4.3. Inclusiveness

The third problem is also related to the use of indices to model movement. If indices are not part of the object language vocabulary (the numeration), they must be introduced when need arises in course of the derivation. But this contradicts the idea to restrict the inventory of the syntactic system to symbols which are drawn from the lexicon (Inclusiveness Condition; Chomsky 2000).

(89) *Inclusiveness Condition* (adapted from Chomsky 2000)
Do not introduce into the tree symbols that are not part of the numeration.

To recapitulate, the AR hypothesis is afflicted by three deficiencies, which are related to how the analysis implements movement more generally, and the role of indices more specifically. In search for a common solution to these three problems, the following section therefore explores a new procedure for introducing indices into the derivation.

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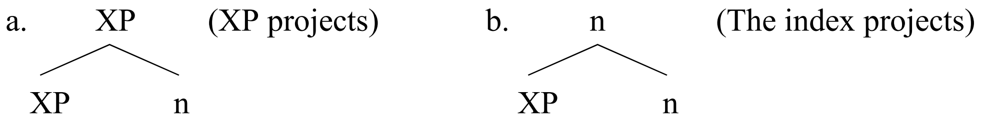
[36]Recall that the λ-prefix in (88)b is a syntactic diacritic which is not interpreted.

5. Index Splitting: a novel analysis of indices

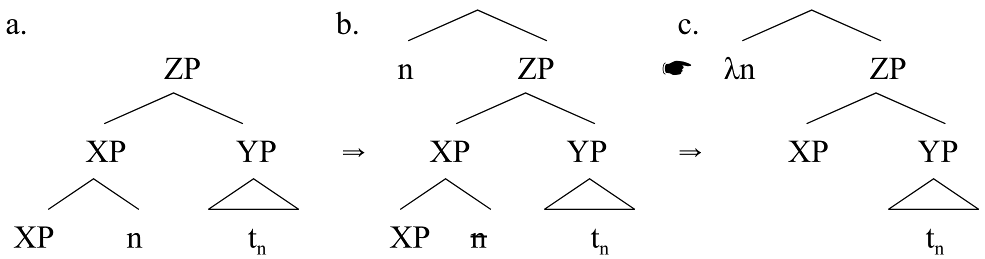
5.1. The relation between indices and their hosts

Adopting the Inclusiveness Condition, as will be done here, implies that indices are part of the syntactic vocabulary. More precisely, indices are included in a numerations whenever that numeration induces derivations involving movement. In a parsimonious system, which employs a single combinatorial operation (Merge; Chomsky 2000), all indexed expressions are then assembled by (external) Merge. Hence, 'XP_n' - that is the string 'XP' subscripted with an index n - is strictly speaking not a syntactically well-formed expression, but a notational convention which abbreviates either the tree in (90)a or the one in (90)b. In (90)a, the host category projects, embedding the index, whereas the relations are reversed in (90)b:

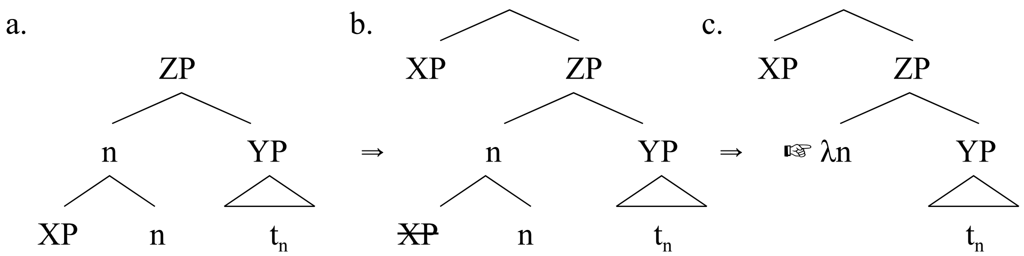
(90)


The correct choice between these two options can be determined by considering how each of these formats fit into contexts of syntactic movement.

Suppose that the hosting XP projects ((90)a), and that XP has moved to SpecZP, shown in (91)a. (91)b demonstrates that it is possible to separate the index from its host by raising the index into a higher position. But (91)b translates into the LF representation (91)c, in which the host XP ends up *below* the representation of the λ-binder, instead of *above.* The derivation does therefore not produce a suitable representation for movement:

(91)


The problem above can be avoided if (90)a is abandoned in favor of the phrase structure in (90)b, according to which it is the index which projects, and not the host. The alterantive analysis now proceeds as in (92):

(92)


Subsequent to short movement to SpecZP ((92)a), the host is re-merged with ZP, yielding (92)b. Crucially, the XP is at this point located in a c-commanding position just above the binder index, and the LF-tree (90)c is therefore transparently interpretable.[37] In what follows, the procedure by which the host is separated from its index (90)b will also be referred to as *Index Splitting*.

The higher occurrences created by Index Splitting can be interpreted by standard mechanisms defined in section 2. The lower occurrence of XP (not graphically presented in (90)) is more complicated, in that transforming these copies into interpretable expressions requires some additional device. The complications are similar to those encountered with the standard version of Trace Conversion, though, and hint at a more general problem of transparency.

In its most explicit[38] version (Fox 2003), Trace Conversion effects two changes: (i) it inserts a variable identical in value to the syntactic index on the whole copy ((93)a) and (ii) it ensures that this variable is bound by the λ-binder on the higher copy ((93)b,c).

(93) She liked every dog

a. [every [dog]]$_2$ → [every [dog λx.x = 2]] (Variable Insertion)

b. [every [dog λx.x = 2]] → [the [dog ∧ x = 2]] (Determiner Replacement)

c. [[every dog] [λ_2 [she liked [the [dog ∧ x = 2]]]]]

Observe now that the first step, depicted in (93)a, involves a process similar to Index Re-analysis in that it changes the hierarchical structure of the index and its host. In the transition from the left hand to the right hand side of (93)a, the index 2 is severed off the host (*[every [dog]]$_2$*) and lowered into a position where it lands as the sister node of the predicate (*dog*). Syntactically, this change entails lowering.

Semantically, this lowering operation makes sense in that while predicate denotations are assignment dependent, the denotations of quantificational determiners are not:

(94) For any determiner D and any assignment g, h, such that g is unlike h: $[\![D]\!]^g = [\![D]\!]^h$

So indices, which semantically translate into arguments of assignment functions, should be modulating predicates only, and their presence on determiners can be ignored. Still, syntax does not conform with this intuituion, because on current assumptions, (semantic) binding is implemented in terms of indices.[39] To the best of my knowledge, no general solution has been

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[37]The struck out, lower occurrence of the host XP in (90)b is semantically vacuous. I have to relegate a study of this artifical aspect of the analysis to future research.

[38]Other versions, e.g. Takahashi and Hulsey (2009: 396, (18)), forego making explicit the index.

[39]One way to resolve this conflict consists in neglecting the quantificational determiner in the lower copy entirely, merging it only at the point from where it takes scope, as e.g. suggested in Sportiche (2006). But then, one would loose one of the strongest arguments for type driven movement in general, and QR out

presented so far that eschews the problems mentioned above. Crucially for present concerns, whatever mechanism works for the interpretation of standard lower occurrence copies also extends to copies created by movement in the present system. A concrete version of Trace Conversion adopted for present purposes is given in (95). As a comparison with the orginal version of Trace Conversion in (96) (repeated from (12) with more explicit structure) reveals, both procedures involve rebracketing of the index in the Variable Insertion step:

(95) a. Variable Insertion: $[n\ [_{XP}\ (\text{Det})\ \text{Pred}]] \rightarrow \text{Det}\ [\text{Pred}\ \lambda x.x = n]$
b. Determiner Replacement: $\text{Det}\ [\text{Pred}\ \lambda x.x = n] \rightarrow \text{the}\ [\text{Pred}\ \lambda x.x = n]$

(96) a. Variable Insertion: $[(\text{Det})\ (\text{Pred})]_n \rightarrow (\text{Det})\ [(\text{Pred})\ \lambda x.x = n]$
b. Determiner Replacement: $(\text{Det})\ [(\text{Pred})\ \lambda x.x = n] \rightarrow \text{the}\ [(\text{Pred})\ \lambda x.x = n]$

At the moment, I have to leave a more satisfactory treatment of the transition from the index to variable insertion as an issue for future research.

5.2. Analysis of the three problems of section 4

Index Splitting provides a natural solution for the three problems raised in the preceding section. First, on the present view, indices are discrete expressions of the object language which can raised ((90)a) and stranded ((90)b) and more generally manipulated by the syntactic system just like other ordinary syntactic terms. The algorithm implementing movement does therefore not need to introduce indices as diacritics, in observance of Inclusiveness. This eliminates the problem recognized in section 4.3.

Second, the analysis provides a simple conception of how to re-organize indices and their hosts such that they end up in a compositionally interpretable position at LF. This improves on the Index Re-analysis rule ((9)/(88)), which had to employ lowering and removes the problem of section 4.2.

Finally, the Index Splitting analysis is also successful in deriving the c-command requirement for anaphors, and it does so without invoking features as the motivating force for displacement, answering the challenge posed in section 4.1. Before proceeding to the concrete analysis, consider the consequences of the assumption that AR and movement of the antecedent are no longer feature driven, but necessary for reasons of interpretability.

The relevant configurations, schematized in (97), now no longer contain a higher head attracting α or β. Hence, the order of movements is not any more determined by Shortest, but by

of object positions in particular, because it is the semantic contribution of the determiner which turns the predicate into a type-incompatible expression - removing it from the calculation would also elimiate the motivation for covert displacement of non-individual denoting terms. Thus, adding the determiner at a later point helps to increase transparency of the copy interpretation, but counteracts the general program of derivational systems that try to correlate QR and other silent operations with type incompatibility.

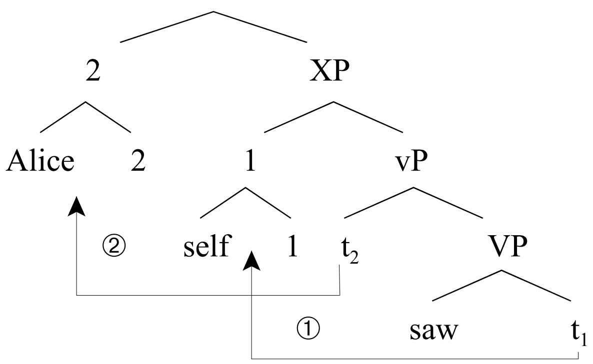
the Strict Cycle Condition, which demands that syntactic operations target inner domains before they affect outer domains. For (97), this entails that movement of β precedes movement of α (see (97)b).

(97) a. $[\alpha ... [\beta ...$
 b. $[\beta \;\; [\alpha ... [t_\beta ...$
 c. $[\alpha \;\; [\beta \;\; [t_\alpha ... [t_\beta ...$

Moreover, given that Shortest has been removed from the analysis, the choice of the landing sites now needs to be relegated to independent principles such as the Extension Condition (Chomsky 1995).[40] It follows that all moved categories are re-merged with the root node, resulting in crossing, order preserving paths in (see (97)c). Thus, the new system illustrated by (97) differs from feature induced derivations in that lower nodes move first (Cycle). Both procedures have in common that the output representations preserve the order of the pre-movement configuration.

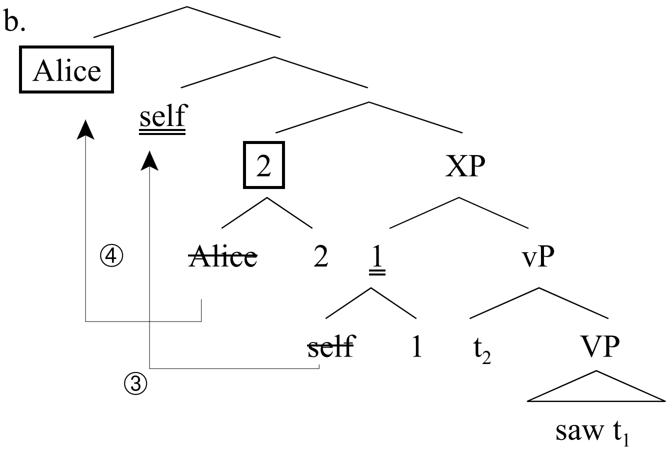
Applied to the Index Splitting analysis of reflexivization, the derivation of *Alice saw herself* now proceeds as depicted in (98). The cycle dictates that the first movement targets *self,* followed by covert raising of the antecedent across the reflexive ((98)a; Extension Condition). In a second battery of cyclic movement operations, Index Splitting separates *self* and the antecedent from their respective indices, generating the LF-output (98)c. Observe that in (98)c, the moved nodes and their binders are 'intertwined' in an $\alpha - \beta - \lambda_\alpha - \lambda_\beta$ pattern:

(98) a.

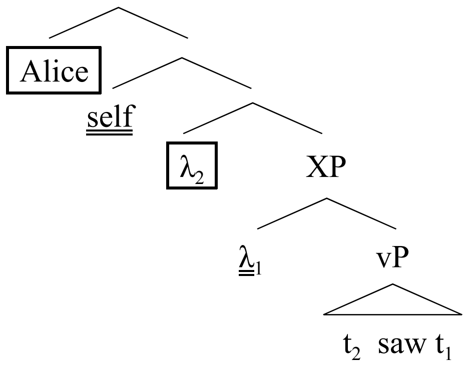


[40]Since the Extension Condition does not to hold for LF-movement, it will be assumed that AR and silent raising of the antecedent proceed by Overt Covert Movement in the overt component (see Bobaljik 1995; Groat and O'Neil 1996; Pesetsky 2000; Fox and Nissenbaum 1999, among others).

b.



c.



One question which arises at this point is how the present system accounts for regular order preserving movement, for instance multiple QR in *I gave a child each doll* (see section 3.5). As can be seen in (99)a, these structures do not display the intertwined $\alpha - \beta - \lambda_\alpha - \lambda_\beta$ signature characteristic of (98)c. Rather, each host in (99)a needs to end up immediately above its index, creating the appearance of a $\alpha - \lambda_\alpha - \beta - \lambda_\beta$ pattern:

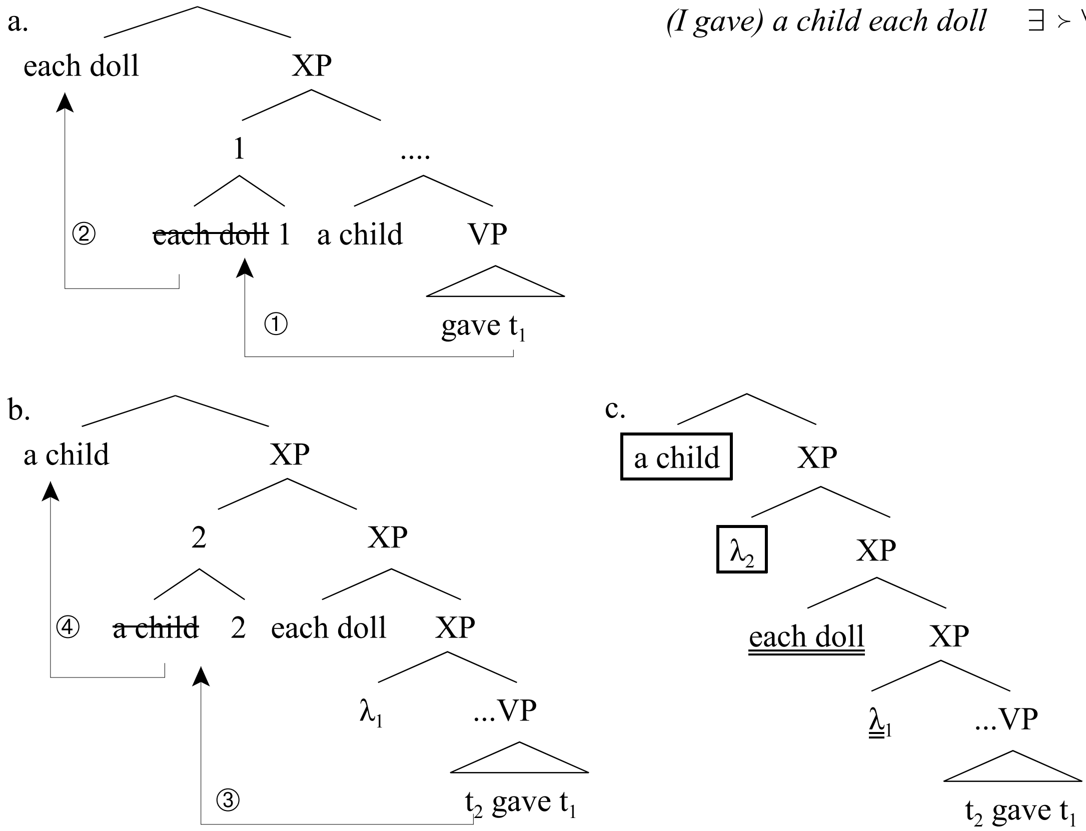
(99) a. .... [a child [λ_2 [every doll [λ_1 [... [$_{VP}$ t_2 gave t_1]]]]]]
b. .... [[a child [[$_2$] [[every doll [[$_1$][... [$_{VP}$ t_2 gave t_1]]]]]]

The analysis above cannot create such constellations, because all movement by assumption extends the tree, preventing the Index Splittinging step of the lower node (*every doll*) depicted in (99)b. (This step is the analogue of operation ③ in (99)b). Instead, the system is predicted to generate the non-sensical representation (100)a, which is based on (100)b:

(100) a. .... [a child [every doll [λ_2 [λ_1 [... [$_{VP}$ t_2 gave t_1]]]]]]
b. .... [a child [every doll [$_2$] [$_1$] [... [$_{VP}$ t_2 gave t_1]]]]]]

The answer to this conundrum comes from the observation that the Extension Condition and the cycle also license another order of operations that straightforwardly results in the desired output configuration. In the initial step of such an alternative derivation, tagged by ① in (101)a, the lower category (*each doll*) is raised, much like in (98). However, the next operation (②), does not affect the remaining object (*a child*), but unpacks *each doll* and its index instead. Only then does QR target the indirect object (③ in (101)b), followed by another application of Index Splitting (④). Moreover, as seen in (101)c, this particular combination of operations yields the interpretable order for movement of nodes denoting generalized quantifiers (or individuals):

(101) *(I gave) a child each doll* $\exists \succ \forall$



Thus, the differences between ordinary order preserving movement by QR and reflexivization in terms of AR are insubstantial inasmuch as they merely indicate the presence of an alternative order of operations predicted by the system.

At this poin, it becomes possible to return to the initial objective of deriving the c-command condition on reflexivization, the workings of which are exemplified by (102).

(102) *Herself$_{Nom}$ saw Alice

Given that all movements observe the Cycle and the Extension Condition,[41] the antecedent *Alice*, which is the structurally lowest of all categories, needs to move first, as shown in (103)a, followed by AR in (103)b. Next, Index Splitting targets *Alice* ((103)c). Finally, the reason why the derivation fails becomes apparent once the derivation reaches the step depicted in (103)d. The Extension Condition mandates that the movement operation which separates *self* from its index land at the root node. But then, the reflexive cannot combine with a binary relation, leading to an uninterpretable output:

[41]Note that not all movements abide by minimality, though - (98) is a case in point, where *self* skips the antecedent.

(103)	a.				[$_1$ Alice]	[$_2$ self]	saw t_1	(**Herself saw Alice*)
	b.			[$_2$ self]	[$_1$ Alice]	t_2	saw t_1	
	c.		Alice	[$_2$ self]	1	t_2	saw t_1	
	d.	self	Alice	2	1	t_2	saw t_1	
	e.	self	✘Alice	λ_2	λ_1	t_2	saw t_1	(Type mismatch)

A second possible derivation, given in (104), renders the final representation interpretable, but violates the Cycle - a higher node (*self*; (104)a) moves prior to a lower one (*Alice*; (104)b) and is accordingly barred by the syntactic system:

(104)	a.				[$_2$ self]	t_2	saw [$_1$ Alice]	(**Herself saw Alice*)
	b.			[$_1$ Alice]	[$_2$ self]	t_2	saw t_1	
	c.		self	[$_1$ Alice]	2	t_2	saw t_1	
	d.	Alice self		1	2	t_2	saw t_1	
	e.	Alice self		λ_1	λ_2	t_2	saw t_1	

Finally, changing the order or movements as in the QR-derivation (101) also does not help, because this order of operations invariantly results in the $\alpha - \lambda_\alpha - \beta - \lambda_\beta$ pattern, which does not provide suitable LF representations for structures involving reflexives.

To summarize, the Index Splitting analysis proves successful in correctly excluding three potential derivations for (102), thereby reducing the c-command condition on anaphor licensing to more general properties of the syntactic derivation. Crucial for the success of the analysis is the assumption that cyclicity requirement and the Extension Condition cannot be outranked by considerations of interpretability. If correct, this finding is also of theoretical value in that it provides a strong argument for the claim that aspects of the logical syntax - in particular the distribution of λ-binders - are co-determined by principles of natural language syntax.

5.3. Index Splitting vs. free insertion of lambdas

Danny Fox and Uli Sauerland (p.c.) independently suggest that AR - and movement more generally - can also be implemented in a way which does not make reference to Index Splitting. On this *insertion analysis*, lambdas are freely inserted into the tree and function much like edge features in syntax in that they attract the closest category of suitable type.

For *Alice saw herself*, the derivation would then proceed as in (105). After insertion of λ_1 ((105)a), the closest argument moves, resulting in (105)b. Next, λ_2 is merged counter-cyclically right below the antecedent *Alice* ((105)c), followed by as second application of locality driven movement targeting the reflexive. The output (105)d is interpretable.

(105)	a.		$[\lambda_1$	Alice saw self]	(*Alice saw herself*)
	b.	Alice	$[\lambda_1$	$[t_1$ saw self]]	
	c.	Alice	$[\lambda_2$ $[\lambda_1$	$[t_1$ saw self]]]	
	d.	Alice [self	$[\lambda_2$ $[\lambda_1$ self	$[t_1$ saw $t_2]]]]$	

The analysis also correctly discriminates between (105) and cases in which the order of arguments is reversed. In (106), the first λ-binder (λ_1) attracts the reflexive ((106)a/b) instead of the antecedent. But from the intermediate representation (106)b it is not possible to arrive at an interpretable output, irrespective whether λ_2 is merged below *self,* as in (106)c/d (cf. (103)e) or in some other position of the tree:

(106)	a.		$[\lambda_1$ self saw Alice]	(**Herself saw Alice*)
	b.	self	$[\lambda_1$ $[t_1$ saw Alice]]	
	c.	self	$[\lambda_2$ $[\lambda_1$ $[t_1$ saw Alice]]]	
	d.	self ✘[Alice	$[\lambda_2$ $[\lambda_1$ $[t_1$ saw $t_2]]]]$	(Type mismatch)

Thus, the free insertion mechanism presents an attractive, arguably simpler alternative way of implementing AR, which is fully compatible with the analysis of reflexivization in terms of AR.

The insertion approach faces a problem, though, which follows as a corollary from the observation that indices are not only to be found in the position of the attracting λ-binder, but also need to be postulated on lower occurrences of dislocated categories. I will explicate first why (at least some) lower copies need to be assigned indices, and proceed from there to the problem for the insertion analysis.

As was seen in section 2.2, reflexives in double object constructions can be subject or object oriented:

(107) a. Alice $[_{vP}$ showed us (to) herself]
b. We $[_{vP}$ showed Alice (to) herself]

Moreover, in order to arrive at an interpretable LF, the antecedent needs to be raised to a proposition denoting node, which in the current system translates into a position above vP. Thus, the first λ-binder must be inserted above vP. Given the standard assumption that vP also contains a copy of the subject, the insertion analysis incorrectly leads one to expect that only the closest argument - the subject - may serve as the antecedent of the anaphor:[42]

(108) λ_1 [SUB [IO [show self]]]

The problem does not arise if the category to be attracted is supplied with an index which

[42] A possible way out consists in assuming that Trace Conversion of the subject precedes

matches that of the λ-attractor, as schematized in (109)a.

(109) a. λ_1 [SUB [IO_1 [show self]]]
b. IO_1 [λ_1 [SUB [IO_1 [show self]]]]

But representation (109)a contains now 'too much' information. Subsequent to antecedent movement in (109)b, the IO bears an index which in itself is not interpretable. Employing Index Reanalysis (or Index Splitting) does not deliver the desired results, though, because this operation introduces a second, spurious λ-binder in addition to λ_1, resulting in vacuous quantification:[43]

(110) IO [λ_1 [λ_1 [SUB [IO_1 [show self]]]]]

Thus, the insertion analysis is faced with the dilemma that while lower occurrences of dislocated categories must be assigned indices, these indices behave as if not being present semantically. In essence, this amounts to treating indices as diacritics which provide hidden instructions to the derivation.

The need to assume that moved nodes are indexed also entails another negative consequence for the insertion analysis - it invalidates the movement account for the c-command condition. More precisely, allowing the antecedent in (111) to be the first category to be attracted ((111)a) sets in motion a derivation which both abides by syntactic locality (Shortest) and produces semantically well-formed results ((111)d). Thus, the insertion analysis incorrectly predicts (111) to be well-formed:

(111) a. [λ_1 self saw Alice$_1$] (**Herself saw Alice*)
b. [Alice$_1$ [λ_1 self saw t_1]]
c. [Alice$_1$ [λ_2 [λ_1 self$_2$ saw t_1]]]
d. [Alice$_1$ [self$_2$ [λ_2 [λ_1 self saw t_1]]]]

The conflict resides in the incompatibility of two assumptions: lower occurrences need to be able to bear indices, but these indices interfere with the derivation in unwanted ways.

In light of these preliminary findings, it will be concluded for the moment that Index Splitting, while possibly more complex is better suited to implement movement dependencies, as it faces no difficulties in handling indices on lower occurrences.

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[43]One could of course stipulate an operation which simply erases the higher index, but this would overlook the non-accidental relation between the index on the host and the index of the λ-attractor.

6. Conclusion

In the present paper, I proposed that the distribution of non-logophoric reflexives can be entirely derived from their interpretation as arity reduction functors. By their lexical semantics, reflexives combine with binary predicates, which in turn forces them to undergo covert raising (by Overt Covert Movement) to a position right below their antecedents. This movement process, referred to as AR, was seen to display the hallmarks of feature driven 'tucking-in' (Richards 2001) in that it is order preserving, and in that it targets higher nodes first. Together with covert movement of the antecedent, AR forms the basis of the AR-analysis of reflexives.

Three core properties of reflexives directly fall out from the AR-analysis: (i) the compositional interpretation of reflexive constructions is derivable from the lexical entry of *self* and standardly sanctioned syntactic operations only; (ii) the c-command requirement on anaphors; (iii) syntactic locality effects, which were seen to mimic the locality effects observable with quantifier raising.

The observation that the initial feature driven account only admitted a suboptimal fit between syntax and the semantic interface lead to a second incarnation of the AR-analysis, in which order preservation and apparent tucking in effects are seen as the result of cyclic movement of antecedent and reflexives, instead of counter-cyclic attract operations. Implemented in terms of an Index Splitting algorithm, which unpacks the relation between indices and their hosts by standard movement operations, the analysis not only improved on the problems afflicting the original account but also resulted in a more transparent version of Index Reanalysis rule (Heim and Kratzer 1998).

Various issues were addressed only superficially or needed to be left unexplored. Among them are the treatment of c-command condition in relative clauses; the details of the interpretive procedures underlying *de se* readings; the relation between *self* movement and Trace Conversion; a possible extension of the analysis to (some readings of) reciprocals; connections with similar analyses employing binary functors (Beck and Sauerland 2000; Nissenbaum 2000; Barker 2007).

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