# DIFFERENT AND PROUD OF IT: A TAG PERSPECTIVE ON THE COORDINATION OF UNLIKE CATEGORIES

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**Abstract**

This paper presents an analysis of sentences featuring superficial coordinations of unlike categories in English, such as *John is a Republican and proud of it* (NP and AP) and *Pat is stupid and a liar* (AP and NP). We argue that, despite the fact that examples like these have been grouped in the literature on coordination of unlikes, there are significant syntactic differences that justify distinguishing between them representationally and derivationally. We propose two categories of coordination of unlikes: *anaphoric* and *intersective* coordinations. In particular, we will focus on how to formulate a structural description that gets the right reference for *it* in *a Republican and proud of it*, a point unexplored in current proposals.

**Keywords**: Tree Adjoining grammar; coordination of unlikes; structure sharing; anaphoric coordination; intersective coordination

## 1. Introduction

The sentences in (1) have been given in the literature as examples of 'coordination of unlikes' (Abeillé, 2002; Bayer, 1996; Sag et al., 1985; Farkas & Ojeda, 1985; Dalrymple, 2017; Crysmann, 2003; Bruening & Al Khalaf, 2020; Przepiórkowski & Patejuk, 2021; Przepiórkowski, to appear):

(1) a. John is [$_{NP}$ a Republican] and [$_{AP}$ proud of it]
b. Pat is [$_{AP}$ stupid] and [$_{NP}$ a liar]

Sentence (1a) features, superficially, a coordination of an NP and an AP (Bayer, 1996: 580), both in predicate position. The same can be said of (1b), modulo linear order of the conjuncts. Since the coordinated phrases differ -*prima facie*- in their categorial specification, (1a-b) has been claimed to exemplify the possibility of coordinating phrases of different syntactic categories (a.k.a. 'coordination of unlikes'), in direct contradiction to Williams' (1981: 646) Law of Coordination of Likes (also called 'Chomsky's generalisation' in Pullum & Zwicky, 1986: 752):

> *A well-known law of coordination is that only likes and likes can coordinate; call this the Law of the Coordination of Likes (LCL).*

Given the attention that conditions on (structural and/or categorial) parallelism in coordination have received in the generative literature (e.g., Williams, 1978; Goodall, 1984 and much subsequent work; see also Goodall, 2017 for a general perspective, and §1.2 in particular; also Bruening & Al-Khalaf, 2020), coordination of unlikes is a particularly challenging and interesting phenomenon that an adequate theory of coordination (and of syntax, more generally) must be able to account for.

Previous studies on the coordination of unlikes have focused on the categorial label of the coordination and selectional restrictions imposed by the subcategorising predicate over the unlike conjuncts (Dalrymple, 2017; Sag et al., 1985; Sag, 2002; Bayer, 1996; Peterson, 2004; Farkas & Ojeda, 1983); the possibility of representing coordination of unlikes as the result of deletion of identical material in VP coordination (and thus the appearance of unlike categories would be a

superficial phenomenon, e.g. ellipsis; Beavers & Sag, 2004; Chaves, 2006 or structure sharing; Crysmann, 2003); the role of selection in the order of conjuncts and the general place of category mismatches in the grammar (Bruening & Al Khalaf, 2020; Crysmann, 2003); the matter of agreement (see Yatabe, 2004 for an overview) or Case (Przepiórkowski, to appear); and the question of whether the terms of the coordination form a single constituent and, if so, how it should be labelled (Peterson, 2004; Przepiórkowski & Patejuk, 2021; Bruening & Al Khalaf, 2020). In this paper we focus on an aspect that has not received much, if any, attention in the literature: how to formulate an appropriate structural description for cases like (1) which is capable of accounting for the reference of the embedded pronoun ('it' in (1)). In examining this issue, we will also be faced with the question of whether (1a) and (1b) should receive the same structural description at all. Our proposal will have consequences for the aforementioned phenomena analysed in the literature, but our focus will be set on a syntactic treatment that can deliver the correct reference of the pro-form contained in the second conjunct in (1a) as well as the structural differences between cases like (1a) and (1b).

In this paper we will explore the possibility that (1a) and (1b), despite some common superficial features, not only have different interpretations, but must (because of this) receive different structural descriptions. In particular, the structural description assigned to (1a) must deliver the appropriate reading for the bound pronoun, a point which has been mostly overlooked in the literature. To provide an adequate syntactic analysis for these cases of coordination of unlikes in English (which may differ from the properties of coordination of unlikes in other languages) we will first consider the defining properties of (1a) in contrast to (1b) in Section 2, and then formulate a syntactic proposal to account for the differences between these two kinds of coordinations of unlike terms in Section 3.

## 2. Relevant properties of (1a)

### *2.1 The conjuncts are not reorderable*

We consider here the ungrammaticality of (2), where the linear order of conjuncts has been inverted:

(2) *John is proud of it and a Republican

This suggests that we are dealing with an instance of asymmetric coordination (in the sense of Schmerling, 1975), analogous to (3) and (4):

(3) a. Harry stood up and objected to the proposal
b. Harry objected to the proposal and stood up (events are ordered in time)

(4) a. Smile and the world smiles with you (conditional interpretation)
b. *The world smiles with you and smile

In contrast, symmetric coordination allows for conjuncts to be reordered: in these cases, *and* behaves like the propositional logical connective ∧

(5) a. John had beer and Mary had wine (S coordination)
b. Susan laughed and jumped (VP coordination)
c. I gave a policeman a flower and a rioter a donut (non-constituent coordination; from Altshuler & Truswell, in press, ex. 15; see also Sarkar & Joshi, 1996)

Let us refer to the property of allowing for the linear reordering of conjuncts as *commutativity*. Does this property hold for (1b)? At first glance, it would seem it does not, based on the contrast in (6):

(6) a. They ate quickly and without restraint
b. #They ate without restraint and quickly

(3a) and (3b) are equally grammatical, but (3a) may be preferred due to the tendency of heavy constituents to be sentence-final. Coordinating a bare NP and a CP shows similar effects:

(7) a. We will talk about coordination and how to account for category mismatches
b. #We will talk about how to account for category mismatches and coordination

We can test this by having two conjuncts of roughly the same 'weight', adding an embedded phrase to the last conjunct:

(8) a. The soldiers fired without remorse or hesitation and oblivious of the consequences of their actions (PP & AP)
b. The soldiers fired oblivious of the consequences of their actions and without remorse or hesitation (AP & PP)
c. We will talk about how to account for category mismatches and the proper analysis of coordinated structures (interrogative CP & NP)[1]
d. We will discuss what to do and the place to do it (free relative CP & NP)
e. Our blackcurrants are grown with care to ensure the deliciously fruity taste you love and that local wildlife thrives on our farms (taken from the label of a popular soft drink in the UK; NP & declarative CP)

If we do this, acceptability drastically increases. The following examples from Chaves (2006) (judgments for the (a) examples are his) can be similarly reordered (as in (b)), provided we balance the weight of the conjuncts by adding modifiers:

(9) a. Fred became wealthy and a Republican. [AP & NP] (Chaves' (1a))[2]
b. Fred became a Republican and (very) wealthy
(10) a. Sue is healthy and in good shape. [AP & PP] (Chaves' (1b))
b. Sue is in good shape and (overall) healthy
(11) a. That was a rude remark and in very bad taste. [NP & PP] (Chaves' (1c))[3]
b. That was in very bad taste and a rude remark

Constraints on the order of intersective coordinations seem to be not syntactic, but prosodic (as seems to be the case for (3b) and (4b)) or pragmatic, as in (9):

(12) a. We emphasized Mr. Colson's many qualifications and that he had worked at the White House. (Bayer, 1996, fn. 7, ex. (ii))

b. #We emphasized that Mr. Colson had worked at the White House and his many qualifications

[1] If, as suggested in Bruening & Al-Khalaf (2020), CPs may optionally combine with a null N to yield an NP, this would not be a case of coordination of unlikes.

[2] It has been pointed to us that 'a Republican' is ambiguous between 'a member of the Republican party' and 'an adherent to a certain ideology'; also, that a possible interpretation of (6a) entails that Fred became a Republican in order to preserve his wealth, as a consequence of a combination between the verb choice and the predicative NP. An alternative example, which would show the same in terms of possible combinations of conjuncts in symmetric conjunction, could be *Fred is very popular and a celebrity* / *Fred is a celebrity and very popular*.

[3] Some of our informants disagree with Chaves' judgment and do not quite like this sentence; to them, 'that was a rude remark' is weird (suggesting 'that remark was a rude remark'). The same syntactic point can be made with an example like *That was a big surprise and in very bad taste*.

Presumably, the ordering restriction is due to the fact that working at the White House can be seen as a crowning achievement when considering a candidate's qualifications. This imposes an order over the conjuncts, but not one based on the structural description assigned to the string. When presenting the possibility of reordering, Bayer (1996: 585) modifies the NP in (9a) to say [his many other qualifications], which circumvents the pragmatic anomaly.

For the distinction between symmetric and asymmetric coordination, what matters is that both versions (for A and B conjuncts, A & B and B & A) have the same truth conditions and denote the same proposition: the truth-set of (1b) is the intersection between the truth-sets of *Pat is stupid* and *Pat is a liar*. In all these cases we are dealing with coordinated predicative phrases which provide information about the subject NP. In none of the cases considered here changing the order of conjuncts makes any difference with respect to the entity or the event being denoted. In (5) both adjuncts modify the VP headed by *fire* without there being a relation of scope between them. In (6), Fred's wealth is defined in absolute terms, not relative to his being a Republican (but see fn. 1); in (7) Sue's being healthy and in good shape are similarly interpreted intersectively, such that (7) is true iff Sue is both healthy and in good shape (see Heim & Kratzer, 1998: 63, ff.; Despic & Sharvit, 2011 for semantic approaches to intersective and non-intersective modifiers) and linear order between the conjuncts has no effect for interpretation. Intersective coordination (of likes and unlikes alike), as highlighted above, is akin to the logical connective ∧ (as has been pointed out repeatedly in the literature, this does not come close to exhausting the possibilities of natural language *and*, even in coordination of likes). However, in (1) and examples of the same kind, John's being a Republican and proud of it cannot be interpreted intersectively: there is no set that is the intersection of the set of Republicans and the set of entities proud of 'it'. Why? This takes us to the next point.

### *2.2 The second conjunct contains an anaphoric element*

The first case of interest is that in which 'it' in (1) is the result of pronominalising the VP [is a Republican]: this entails that 'it' in (1) is a bound pronoun[4]. In this sense, we can paraphrase (1) as (10):

(13) John is a republican and he is proud of being a republican

We will refer to this kind of construction as *anaphoric coordination*, because the second conjunct contains an anaphoric element that refers back to (a constituent within) the first conjunct (this characterisation will be refined below). The question is whether coordinations like (4), (5), or (6) can be assimilated to anaphoric coordination somehow. In other words, if a unified analysis is possible and empirically adequate. We know that it is possible, since Bayer (1996); Sag et al. (1985); Abeillé (2002); Dalrymple (2017); Yatabe (2004); Bruening & Al Khalaf (2020), among others have provided such a unified account (or, at the very least, they have not distinguished, in dealing with coordination of unlikes, between cases like (1a) and (1b)). Our objections pertain to the empirical adequacy of such a unified theory, since there are properties exclusive to one of these kinds of coordinated structures. Crucial to our objections to a unified syntactic approach to coordination is the assumption that the

[4] It has been suggested to us that 'it' is not bound, based on examples like

i) John is proud of it. He is a Republican.

Our informants (speakers of Southern British and Southern American English) report that it is not possible to have 'it' refer to John being a Republican, which makes it an unsuitable point of comparison. Furthermore, even if (i) were acceptable, we are not sure what such an example would prove in terms of the structural description to be assigned to a case like (1), nor whether it could reveal anything about how the reference of 'it' is indeed determined, how (1a) and (1b) differ, or what structural description is adequate for these cases.

properties that do differ between distinct classes of coordinations of unlikes are ultimately configurational or dependent on syntactic configuration. It is uncontroversial that coordination is not a semantically uniform phenomenon (see Altshuler & Truswell, forthcoming for a general perspective; the arguments put forth by Lakoff, 1986 as exceptions to the Coordinate Structure Constraint, the classification of structures in Postal, 1998, the work on so-called pseudo-coordination by De Vos, 2005, among other works also attest to the semantic heterogeneity of superficially coordinated structures); in the present view this suggests that a single syntactic template is as unlikely to be empirically adequate as a universal semantic characterisation.

In anaphoric coordinations, the anaphoric element in the last term takes as its antecedent whatever other terms of the coordination we have:

(14) John is a Republican, a Trumpist, and proud of it (= of being a Republican and a Trumpist, ≠ of being a Republican, ≠ of being a Trumpist)
(15) Mary is a surgeon and a good one at that (= at being a surgeon)

This is not the case in intersective coordinations: each of the properties denoted by the predicative phrases holds of the subject NP independently with no relation to the other conjunct; the interpretation is the result of the intersection of the sets denoted by each property applied to the nominal argument that is the subject of the sentence.

Both anaphoric and intersective coordinations are, in principle, *n*-ary: they are not restricted to two conjuncts. While it is true that some natural language coordinations are limited to two terms (for example, English coordinators *both, either…or*, or *but* take only two terms), none of the cases analysed here is limited in principle to only two terms (for instance, (14) takes three terms). This is important insofar as it limits the possible structures that can be empirically adequate: approaches based on an endocentric, binary-branching ConjP / CoordP / &P assign, to some cases, too much structure in the form of non-terminal nodes (an intermediate Coord' / &' node in the tree) and enforce strictly binary relations to all cases of coordination (Abeillé, 2002; Borsley, 2005). Again, while there are some (English) cases that may be best analysed in binary terms (see e.g. Ross, 1967: 164, ff. for early arguments; more recently see Zoerner, 1995), this does not necessarily extend to all cases of natural language coordination or even all instances of coordination in English (Borsley, 2005; see also Gazdar, 1981; Altshuler & Truswell, 2022: Chapter 2). Since the present paper is not intended as a proposal for a general theory of coordination, our empirical focus will be restricted and so will our technical discussion. Consequences of our approach for a more general theory of coordination will left for future research.

Both anaphoric and intersective coordinations, when predicative, may be fronted as adjuncts to the root, as seen in (16) and (17) respectively (examples in (17) are taken from Chaves, 2006):

(16) a. A Republican and proud of it, John backed Trump all the way (anaphoric)
(17) a. Alone and without money, John found himself unable to get a job (intersective)
b. A successful business woman and in the position to take charge of her life, Madam C. J. Walker went on to become a millionaire.
c. A woman, rich, and in the lucky position of owing a castle, Zoe did not let such an opportunity slip through her fingers.

A second case of interest is that in which the second conjunct contains a bound pronoun (not a pro-form), as in (18)

(18) Fred is a Republican senator and proud of his work

Unlike anaphoric coordinations, the coordination in (18) is commutative:

(19) Fred is proud of his work and a Republican senator

Here, we need to consider the interpretation of *his*: the antecedent cannot be the predicative NP in the first conjunct, or the first conjunct itself, but rather the subject of the whole clause:

(20) a. *Fred is a Republican and proud of a Republican's work
b. Fred is a Republican and proud of Fred's work

Observe the fact that the relation between the bound form and its antecedent, as formalised in a structural description, must be local enough to license a reflexive:

(21) a. Prof. Smith$_i$ is a world-renowned expert in Anthropology and very sure of himself$_i$
b. Prof. Smith$_i$ is Bill's$_j$ PhD advisor and very sure of himself$_{i/*j}$

We will return to (21) in the context of our proposal.

The impossibility of having an anaphoric pronoun refer to the object of the first conjunct is to be expected under the view that conjuncts are internally opaque, and contrasts with a situation like that in (22):

(22) a. John bought a book and is happy with it
b. John bought a book and is happy with [a book]

In (22), the anaphoric pronoun can refer back to the direct object alone. In this case, however, the terms of the coordination are both VPs: coordination of unlikes seems to enforce opacity. In the case of simple VP coordination, it is possible to find cases where an anaphoric pronoun contained in the second conjunct refers back to the whole first conjunct as well as to a proper subset of it (as is the case in (23)):

(23) a. John bought a book and is happy about it
b. ?John bought a book and is happy about [a book]
c. John bought a book and is happy about [John bought a book]

*2.3 The first conjunct contains a copula*

It seems to be a necessary condition to get a proper anaphoric coordination that, superficially, there is only one inflected verb and that it is a copula. Intersective coordinations, on the other hand, allow for much more categorial freedom, such that the inflected verb is not restricted in principle to any specific typology:

(24) a. John arrived [on time] and [tired] (Unaccusative)
b. Mary finished the race [with her friends] and [very quickly] (Transitive)
c. Bill slept [for hours] and [snoring like a pig] (Unergative)

Anaphoric coordinations are rigidly restricted in terms of what the finite verb may be. As we have seen, *be* is always a safe choice, but also verbs like *become* or *remain* seem to be acceptable:

(25) a. Jeff became a millionaire and insufferable about it
b. Jeff remained a millionaire and insufferable about it

There is another class of apparent coordination of unlikes that seems to be neither intersective nor anaphoric (in the strict sense we have defined the latter here):

(26) Everyone considered him [a great surgeon]$_{NP}$ and [the best <surgeon> in the country]$_{?P}$

Note that while there is no pro-form in the second conjunct, arguably there *is* a null noun in the second conjunct (indicated with < >), deleted under identity. This position is supported by the fact that the N head in the second conjunct can be realised as a pro-form:

(27) Everyone considered him [a great surgeon]$_{NP}$ and [the best one in the country]$_{NP}$

This makes it difficult to classify (27) as a case of coordination of unlikes, not to mention anaphoric coordination.

To summarise, we presented evidence that cases of coordination of unlike categories that have been grouped in the literature present different properties in terms of their interpretation. A subset of the cases, which we called *intersective coordinations* are interpreted as the logical conjunction of the predicates applying to the matrix subject: *the joke was insensitive and in bad taste* can be paraphrased by the conjunction of *the joke was insensitive* and *the joke was in bad taste*, and is true if and only if the joke belongs to the set that is the intersection between the sets of insensitive entities and entities in bad taste[5]. Also like logical conjunction, intersective coordination is commutative: the terms of the coordination can appear in any order without changing the semantic interpretation of the sentence. In intersective coordinations the terms are syntactically independent: none is embedded in the other, nor is there a syntactic object in either of them that establishes a dependency (e.g., coreference) with a syntactic object in the other conjunct. It is possible to coordinate as many terms as we want, and the conditions over the interpretation of the intersective coordination remain the same.

In contrast, as highlighted above, *anaphoric coordinations* are not commutative: the order between the conjuncts is determined by the fact that the last conjunct contains a pro-form whose reference is determined anaphorically: backwards binding is not possible (cf. **John is proud of it and a Republican*).

The question that we want to address, after a descriptive presentation of the data, is whether the same structural description can be assigned to these two kinds of coordination and whether the same derivation yields the output strings.

## 3. The structure of coordination of unlikes

In this section we will examine some previous proposals about the syntax of coordination of unlikes, from a variety of theoretical perspectives, and then propose our own treatment of anaphoric coordination.

### *3.1 Coordination of unlikes as coordination of likes + ellipsis*

It has been claimed that coordination of unlikes (or non-constituent coordination) is the superficial realisation of a coordination of VPs to which VP ellipsis under identity applies: this analysis in particular has been proposed in the HPSG literature, which has paid particular attention to

[5] Crucially, this must not be interpreted as an endorsement of a Conjunction Reduction (CR) approach (whereby coordination affects always S and is followed by deletion under identity): a paraphrasis is not a derivational relation. We will review some differences between CR and structure sharing (the mechanism we will make use of) below.

coordination of unlikes[6] (e.g., Crysmann, 2003; Beavers and Sag, 2004; Chaves, 2006; see also Gazdar et al., 1985: 174, ff. for an earlier GPSG perspective), but can also be found in generative analyses such as Bruening & Al-Khalaf (2020). Thus, a coordination like (28a) has the constituent structure in (28b) (from Beavers & Sag, 2004; we indicate a phonologically null element with angled brackets):

(28) a. Jan wanted [another doughnut]$_{NP}$ and [$_{IP}$ to leave Boston by five]
b. Jan [[wanted another doughnut] and [<wanted> to leave Boston by five sharp]].

A very similar analysis is argued for in Bruening & Al Khalaf (2020) for arguments conjoined with modifiers (non-subcategorised phrases):

(29) a. I eat neither meat nor at restaurants
b. I [$_{VP}$ eat neither meat] nor [$_{VP}$ <eat> at restaurants]

This analysis has the advantages of eliminating null coordinators (as required in Combinatory Categorial Grammar as well as strictly binary analyses of coordination in Transformational Grammar) and providing a unified analysis of coordination of likes and unlikes alike. It provides a straightforward analysis that satisfies what Yatabe (2004: 341), following Pullum & Zwicky (1986: 752-753), calls 'Wasow's generalisation', and which we cite in Yatabe's version[7]:

> *An element in construction with a coordinate constituent must be syntactically construable with each conjunct. Thus, a structure of the form*
>
> *D [A, B, and C]*
>
> *is grammatical only if structures of the form DA, DB, and DC are each grammatical.*

By assuming an elided V in the second conjunct, selectional properties are enforced locally: the ungrammaticality of (26) below can be blamed on *wealthy* and *a Republican* not being compatible with the selectional requirements of *grow*:

(30) *Pat grew and remained wealthy and a Republican (Chaves' ex. 2)

In other words, in a structure of the form A and B C and D, A C and A D are not grammatical, only B C and B D are. Beavers & Sag's (2004) analysis of what we have called here anaphoric coordination is in this sense identical to any other coordination of unlikes:

(31) Jan [[is a Republican] and [<is> proud of it]]. (Beavers & Sag, 2004, ex. 12a)

The constituent structure assigned to *n-ary* coordination in Beavers & Sag generates binary-branching trees where, depending on what is deleted, different constructions arise: constituent coordination (*John, Bill, and Mary came*), right node raising (*John cooked, and Mary ate, the stew*), and argument cluster coordination (a.k.a. non-constituent coordination: *I gave Mary a book and Sue a flower*). In Crysmann's (2003) approach, also within HPSG, coordination applies at the level of *sentential* signs, and a composition schema plays the role of a rule of Conjunction Reduction, with the elements that are different in each sentence being exempt from the structure-sharing. Structure sharing

[6] The GPSG treatment in Farkas & Ojeda (1983) differs from the HPSG one in avoiding reference to ellipsis, and proposing an underspecified headless PRED category (see also Gazdar et al., 1985). This category is affected by the phrase structure rule PRED → $X_{max}$, and delivers binary-branching structures where conjuncts may belong to any category.

[7] Pullum & Zwicky's formulation refers to syntactic features such as person, number, case, etc.

allows the grammar to identify and delete identical terms across coordinands (in these cases, the verbal head). His analysis also satisfies Wasow's generalisation, in that selectional restrictions must be met within sentential signs.

The main difficulty with this analysis, in the present context, is precisely the proposal of a unified analysis for (28b) and (31). As highlighted in Section 2, anaphoric coordinations are strictly ordered, but in (28b) the conjuncts are reversible, such that (32) is not any less grammatical than (28) is:

(32) Jan wanted to leave Boston by five and another doughnut

We take this possibility to be indicative of the fact that the structure of (25) is symmetric: both conjuncts are in a *paratactic* relation. This is, we contend, the main property of intersective coordinations. Note that the truth conditions of (28) are the same as those of (25b), which suggests that the coordinator acts like Boolean AND and does not yield the asymmetries we observe in anaphoric coordinations.

The technical specificities of the HPSG analyses need not concern us, for there are descriptive issues that are more pressing for purposes of this paper, and none of the references mentioned here deal with the problem of the reference of a pro-form contained in the second conjunct despite all of them containing at least one example of anaphoric coordination. Note that because the same structure is assigned to all cases, the restrictions and contrasts we observed in Section 2 remain unexplained. But perhaps most importantly for our current purposes, the problem of the reference of *it* is not addressed. The distinction between intersective and anaphoric coordination of unlikes is relevant also in the evaluation of the LFG argument in Dalrymple (2017) about how to label the coordination at the level of c(onstituent)-structure.

### *3.2 Against deletion: the LFG view*

The analysis of coordination of unlikes in Lexical Functional Grammar (LFG) takes as a departure point the ellipsis analysis. Peterson (2004) provides a number of arguments against the idea that coordination of unlikes involves V deletion. He considers examples such as (33):

(33) a. The children are awake and asking for you (Peterson's ex. (8a))
b. I imagined John a convicted felon and imprisoned for life (Peterson's ex. (8g))

In (33a) the verb *be* needs to be both a copula and a progressive auxiliary, since it selects for the morphological features of the non-finite verb *asking*. In this context, (33b) poses some additional difficulties. Peterson argues that if these sentences were derived from coordination of likes plus VP ellipsis, delivering (33b) from *I imagined John be a convicted felon and be imprisoned for life*, the elided *be* would need to be both a copula and a passive auxiliary. If deletion requires only formal identity this is not an issue, but if in addition to formal identity categorial, semantic, or referential identity are needed, this position is untenable since the *be* in the first and the second conjuncts would be different. Peterson's analysis hinges on *be* always receiving the same analysis: it is a predicate taking two arguments, a SUBJ and an XCOMP both of which would be semantically selected (which is problematic since auxiliaries -other than dynamic modals- are widely claimed not to have argument structure):

> 'be <SUBJ, XCOMP>' (see also Falk, 1984, 2004; however, Falk, 2004 leaves the analysis of passive *be* open and puts the SUBJ as a non-semantically selected argument).

As such, they need to are V heads at *c-structure* (see Falk, 1984; Falk, 2004 provides no *c-structures*), along the lines of Ross (1969)[8].

The second argument pertains to constituency: Peterson (2004) claims that the coordinated elements need to be a constituent, since they can be reordered by syntactic rules such as *as-preposing* (Ross, 2012):

(34) A convicted felon and imprisoned for life as/though John may be, he's still my friend

In the V-deletion analysis, Peterson argues, there is no node that exhaustively dominates only the string [a convicted felon and imprisoned for life]. This argument, however, depends entirely on whether the application of a syntactic rule is indicative of or definitional with respect to constituency (see Müller, 2018 for extensive discussion). For example, *wh*-clefting may separate the terms of the coordination (see also Beavers & Sag, 2004: 8):

(35) Stupid is what he is, and a liar

The example in (35) feature intersective coordination, but we can also try anaphoric coordination:

(36) a. A Republican senator is what he is, and proud of it
b. ?What he was was a demagogue and proud of it (Beavers & Sag's ex. (13b), judgment theirs)

(36a) exists alongside (37), where the anaphoric coordination as a whole is fronted

(37) A Republican senator and proud of it is what he is

A similar argument is used for Right Node Raising as a constituency test, and is similarly inconclusive:

(38) John is, and Zeke soon will be, in town and itching for a fight. (Peterson's ex. (12b))

Peterson's approach, formulated within an LFG framework, is to define the functional structure of coordinations as the set of functional structures of the coordinated elements. This allows him to propose a phrase structure rule that makes no reference to categories, but defines a coordination schema where coordinated structures are not endocentric (Peterson, 2004: 652; see also Butt et al., 1999: 139):

(39) $X \rightarrow \underset{\downarrow \in \uparrow}{X} \quad C \quad \underset{\downarrow \in \uparrow}{Y}$

This forces a flat c-structure for all coordinations, which may face issues in the light of an analysis of asymmetric conjunction: if not through phrase structure configuration, additional mechanisms would be required to provide adequate structural descriptions for asymmetric conjunction such as *Harry objected to the proposal and stood up*, where changing the order of conjuncts changes the meaning or *smile and the world smiles with you*, where changing the order of conjuncts yields an ungrammatical sentence (see Schmerling, 1975 for discussion). The problems with an approach where all coordinations are flat mirror the problems of the uniformly binary-branching approach: coordination

[8] There are good reasons to suspect a uniform XCOMP analysis for passive and progressive auxiliaries alongside copulas cross-linguistically, see e.g. Bravo et al. (2015); Krivochen & Schmerling (forthcoming) for arguments from Spanish. If the analysis of *be* does not hold cross-linguistically, then the prospects for a unified treatment of coordination of unlikes also suffers insofar as examples like (33a) are possible in Spanish (*los niños están despiertos y preguntando por ti*).

is not a semantically uniform phenomenon (see Altshuler & Truswell, forthcoming), and if we want syntactic structure to connect (compositionally) with semantic interpretation, we need either distinct structures or distinct derivations for symmetric and asymmetric conjunction[9].

That more general problem aside, for our current purposes the main issue is that Peterson's proposal does not deal with cases in which Y contains an expression that refers to either a proper constituent of X or to X itself, nor is it obvious how these would be dealt with. The closest we get in his framework is a way to filter out cases like (40), where the anaphora is not locally licensed:

(40) *Mary met John and asked about himself

Peterson observes that subjects, not objects, distribute across conjuncts (*modulo* RNR, presumably). However, our cases of anaphoric coordination pose a problem for the LFG approach: the pro-form *it* in *John is a Republican and proud of it* corresponds to the *f-structure* of *John is a Republican*[10], which is (41):

(41)
$$f_1 = \begin{bmatrix} \text{PRED} & \text{'BE<PREDLINK>SUBJ'} \\ \text{SUBJ} & [\text{PRED} \quad \text{'John'}] \\ \text{PREDLINK} & \begin{bmatrix} \text{PRED} & \text{'Republican'} \\ \text{SPEC} & \text{a} \end{bmatrix} \end{bmatrix}$$

Peterson advocates an analysis where the coordination is established at the level of VP, excluding the subject (see, e.g., the *f-structure* in 2004: 664): this is evidently problematic if the reference of a pro-form contained in the second conjunct is given by something that is not an *f-structure*. If we were to use Peterson's analysis, the *f*-structure of the anaphoric coordination would be (42):

(42)
$$f_1 = \begin{bmatrix} \text{PRED} & \text{'BE<PREDLINK>SUBJ'} \\ \text{SUBJ} & [\text{PRED} \quad \text{'John'}] \\ \text{PREDLINK} & \left\{ \begin{bmatrix} \text{PRED} & \text{'Republican'} \\ \text{SPEC} & \text{a} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{'proud<OBL>'} \\ \text{OBL} & \begin{bmatrix} \text{PRED} & \text{'of<OBJ>'} \\ \text{OBJ} & \textbf{????} \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{COMPFORM} & \text{and} \end{bmatrix} \right\} \end{bmatrix}$$

[9] The choice between these depends, we think, on the nature of the interaction between syntax and semantics. If semantic interpretation rules apply to the output of syntactic computations, as in most versions of the generative Y-model, then different derivations yielding the same output structure will not be differentiated. If, however, one adopts direct compositionality (Jacobson, 2012; see also Bach, 1976) as a guiding principle, different derivations entail different semantic interpretations.

[10] We follow Butt et al. (1999) in assuming that *be* subcategorises for a SUBJ and a PREDLINK (and not an XCOMP, the category of open complement predicative constructions) to avoid the complications of introducing functional control, but see Dalrymple et al. (2019: 32-33) for discussion. Peterson (2004) uses XCOMP; for purposes of the present argument the distinction between PREDLINK and XCOMP is inconsequential.

The value of the object of *of* is not any valid *f-structure*: it includes part of the value of the PREDLINK attribute as well as the subject of the main PRED[11]. The *f-structure* proposed in Dalrymple (2017) is the same as Peterson's in all relevant respects, and so far as we can tell, inadequate to provide an account of the distinction between anaphoric and intersective coordination.

Dalrymple (2017), while mainly concerned with the categorial specification of the coordination of unlikes (her treatment is based on the decomposition of lexical categories into features and the definition of categorial overspecification and indeterminacy in selection), presents interesting data aimed at challenging the ellipsis approach. If the cases in (43), below, were derived via VP coordination plus V ellipsis -Dalrymple argues- it would not be possible to get the right readings:

(43) a. Fred is simultaneously a professor and ashamed of his work
b. Fred is alternately in a good mood and suicidal

The argument requires the adjunct to be introduced before ellipsis; of course LFG does not allow us to formulate conditions over rule ordering given the absence of derivations. However, this only means that an aspect of the LFG architecture restricts the possibilities, not that the ellipsis account is inadequate. For the moment, we must observe that the conjuncts in (39) are commutative:

(44) a. Fred is simultaneously ashamed of his work and a well-known professor
b. Fred is alternately suicidal and in a good mood

In these cases, there are two possible analyses: under the ellipsis view, and within a procedural (or 'proof-theoretic') theory it is possible to assume that ellipsis takes place before the insertion of the adverb: specifically, under Minimalist assumptions, ellipsis needs to be cyclic, whereas adjunction ('pair merge') is post-cyclic (Stepanov, 2001; see also Zyman, 2022 for a different approach). Thus, the following derivation would be legitimate in a transformational framework:

(45) a. Fred is a professor and is ashamed of his work
b. Fred is a professor and <is> ashamed of his work → VP ellipsis
c. Fred is [simultaneously] a professor and <is> ashamed of his work → Late Adjunction

In this scenario, ellipsis under identity may take place at the VP level, cyclically, whereas adjunction applies afterwards, post-cyclically (but still before Spell-Out, in the overt syntax). If the adjunct is not part of the structural description to which ellipsis applies, then the problem noted by Dalrymple disappears. It is important to note that we are not advocating for an ellipsis analysis, merely noting that in a framework where an operation of ellipsis is formulable (a derivational theory), the existence of late adjunction invalidates Dalrymple's objection.

Alternatively, under declarative or 'model-theoretic' assumptions (where derivations do not exist and therefore rule ordering becomes informulable) it is possible to analyse these cases as not involving not coordination of likes + ellipsis, but coordination of unlikes from the onset (as proposed by Dalrymple). The adjunct is always part of the structure, but is outside the coordination, just like the subject:

(46) Fred is simultaneously [a professor] and [ashamed of his work]

[11] A commenter suggested that the value of the embedded attribute OBJ is PRO. That, so far as we can see, is just another statement of the problem (a terminological variant), since now the reference of PRO needs to be determined (presumably, by anaphoric control) and the same problem arises.

Still, we need a way to get the reference of the anaphoric pronoun in the second conjunct: this is the problem that we are focusing on in this paper. This case is, crucially, different from anaphoric coordination in that the value of the PRED for *his* is simply the *f-structure* of the matrix subject: we do not run into the problem, noted above, that the pronoun in an anaphoric coordination refers to something that is not an *f-structure*.

### *3.3 A Tree Adjoining Grammar view*

Let us summarise some of the salient structural points in the previous sections. In terms of Schmerling's (1975) typology of (true) coordinated structures[12], we want to capture the fact that intersective coordinations must be *symmetric*: set-theoretic intersection ($x \in A \cap B$ iff $(x \in A) \wedge (x \in B)$). In these cases, natural language conjunction is close to logical conjunction, and the property of commutativity holds (see also Krivochen, 2021 for a 'flat structure' approach to symmetric conjunction of sentences).

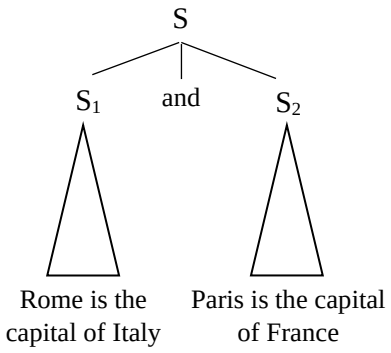
On the other hand, anaphoric coordinations must be assimilated to *asymmetric* conjunction, by virtue of the first conjunct being an antecedent for pronominalisation in the second. There is an order imposed over the conjuncts.

The structural description assigned to an anaphoric coordination, if it is to represent some aspect of its meaning, must convey the fact that the conjuncts are in a *hierarchical* relation, such that the first conjunct serves as an antecedent for an element contained in the second. Hierarchy between conjuncts in the structural description assigned to anaphoric coordination is the way in which we choose to capture the asymmetry requirement noted above. There are many ways to implement this requirement, but most struggle with the fact that symmetric and asymmetric coordinations require distinct structural descriptions if these are to represent in some way semantic dependencies (and, in our case, referential dependencies). In Krivochen (2021) we proposed that the structural description for a case like

(47) Paris is the capital of France and Rome is the capital of Italy

should impose no hierarchy between conjuncts: the first conjunct should neither asymmetrically c-command nor (transitively or immediately) dominate the root of the second conjunct. Here, a 'flat' constituent structure like that proposed in classical transformational grammar (see Ross, 1967, although he proposes that the coordinating conjunction is introduced with the conjunct that follows it; also McCawley, 1998), LFG (Peterson, 2004; Dalrymple, 2017), or Tree Adjoining Grammar (Sarkar & Joshi, 1997) would be sufficient:

(48)




[12] We leave aside so-called 'pseudo-coordination' (e.g., *which dress did you go and ruin now?*), first noted in Ross (1967) and analysed in De Vos (2005) and much related work.

Note that there is no hierarchical relation between $S_1$ and $S_2$, the structure is *paratactic*. In this manner, more conjuncts can be added to the symmetric structure simply by adding more branches. The LFG rule schema may be modified to this effect as follows (based on Butt et al., 1999: 142):

(49) $X \rightarrow X\ (\downarrow \in \uparrow)\ ([comma\ X^{+}]\ (comma))\ (\downarrow \in \uparrow)\ C\ Y\ (\downarrow \in \uparrow)$

Where $^{+}$ is the Kleene plus: the set that contains X is closed under string concatenation but does not contain the empty string $\{\varepsilon\}$. In other words: there can be any number of conjuncts, and the coordinating conjunction will appear before the last one. This flat *c-structure* is appropriate for intersective coordination, but not for anaphoric coordination, for the reasons exposed in Section 2.

For anaphoric coordination, where the second conjunct contains an anaphoric pronoun whose reference is the first conjunct, we need additional structure with respect to the flat, paratactic structural description in (48). We know there must be some extra structure since in (50) below we need to assume more than what is given: as emphasised above, pronominalisation cannot just target the predicative phrase (an NP in this case):

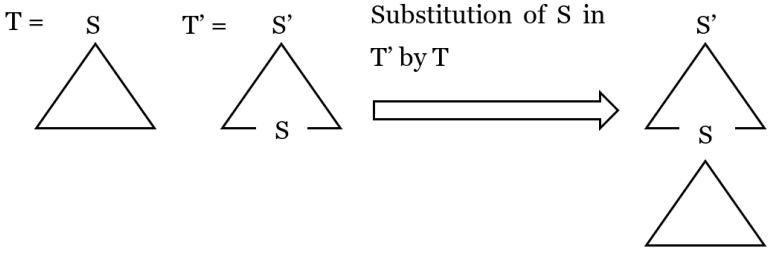
(50) *John is a Republican and John is proud of a Republican

Rather, what we should have goes along the lines of (51)[13]:

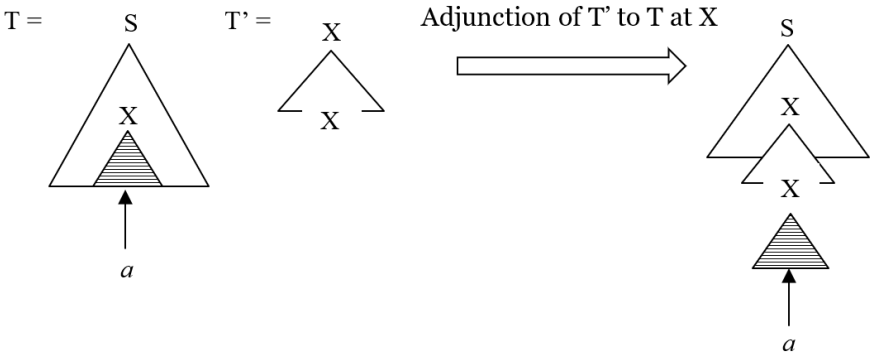
(51) John is a Republican and John is proud of [John is a Republican]

We can implement a structural description that captures the relevant properties of anaphoric coordination of unlikes by means of a grammar that includes a generalised transformation of Substitution, such as a Tree Adjoining Grammar (TAG). We will see that TAGs are also particularly suitable for our analysis given the treatment that coordination receives in a TAG. A TAG is a tree rewriting system, where structure is built by means of two basic operations: *substitution* and *adjunction*. Both are generalised transformations (in the sense of Chomsky, 1955) that apply to *elementary trees* to output *derived trees*. Substitution and adjunction operate by replacing a node X in a tree T, call it an *initial tree*, with another tree T', call it an *auxiliary tree*. The difference between *substitution* and *adjunction* comes from whether X is a node in the frontier of T or an internal node:

(52)




[13] We thank Susan F. Schmerling for valuable discussion about this point.




As Frank (2002) observes, the TAG formalism as a tree-rewriting system remains agnostic about how elementary trees are created, and so will we: elementary trees may be derived via recursive combinatorics (as in Minimalism), the application of phrase structure rules (as in LFG), the logical conjunction of well-formedness conditions over local trees (Pullum, 2019), and possibly other mechanisms. We will commit to some substantive assumptions about the singulary transformations that apply to elementary and derived trees, and these are independent from the requirements imposed by the TAG formalism.

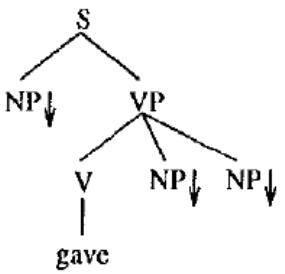
There are additional constraints over the dependencies that may hold between expressions in trees, specifically:

> **Fundamental TAG hypothesis**: Every syntactic dependency is expressed locally within a single elementary tree

Furthermore, any well-formedness constraint imposed by a specific theory will apply within the domain of elementary trees, not across them (Frank, 2002: 23).

TAGs have traditionally treated coordination as the result of an operation *conjoin* (Sarkar & Joshi, 1997), which may be rephrased as *adjunction* with *structure sharing* (Karttunen & Kay, 1985): *conjoin*, applied to conjuncts with shared arguments, identifies those arguments and delivers a structure where identical nodes are unified. Let us see an example. The elementary tree proposed in Sarkar & Joshi (1998: 614) for a ditransitive construction is the following:

(53)

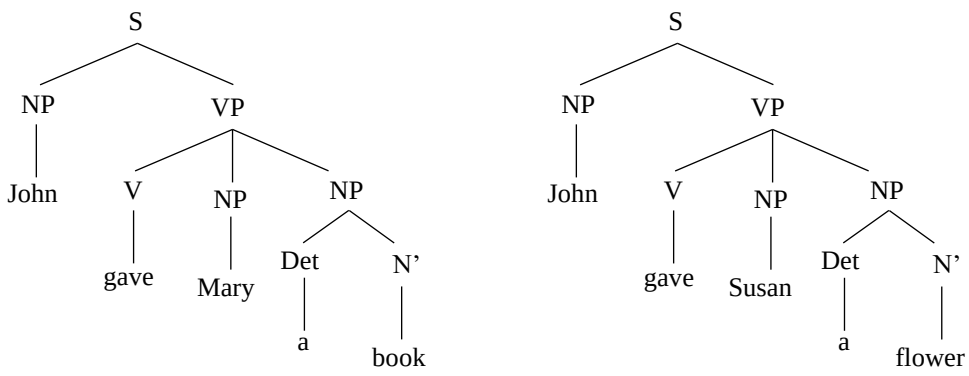



The nodes marked with downward arrows indicate *substitution* sites: at these nodes, elementary trees with root NP will be inserted. If we want to provide a structural description for the coordination of two ditransitive VPs, such as

(54) John gave Mary a book and Susan a flower

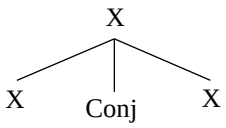
assuming that the structure underlying (54) goes along the lines of *John gave Mary a book and John gave Susan a flower*, then the elementary tree (53) must be used twice, with different NPs being targeted for substitution:

(55)



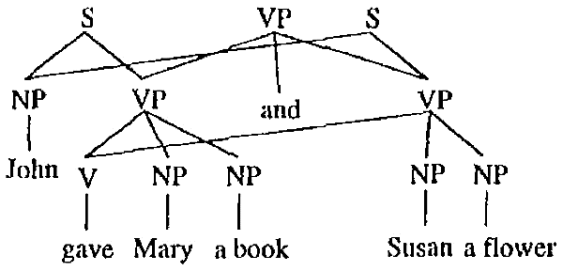

We now need a way to derive the coordination and identify common nodes between conjuncts. Sarkar and Joshi define a coordination schema as in (56), where X stands for any category label:

(56)




After substitution and structure sharing, the derived tree for *John gave Mary a book and Susan a flower* is (57) (taken from Sarkar & Joshi, 1997: 614):

(57)




Note that some nodes are multidominated: these are expressions that occur in both conjuncts, and get unified under identity. In Sarkar & Joshi (1996), identity is defined in terms of a unique indexing mechanism: each node in a tree is assigned an *address* (Sarkar & Joshi explicitly cite Gorn, 1967 as an antecedent of this view). Let us call the elementary tree of *give Mary a book* $S_1$ and the elementary tree of *give Susan a flower* $S_2$. Then, tree composition operates like graph union in that nodes with the same address are collapsed into one, delivering multidominance: *gave* in $S_1$ is identical to *gave* in $S_2$ (they are assigned the same uniquely identifying address). Thus, the result of composition collapses those nodes into one, which is dominated by VP in $S_1$ and VP in $S_2$: the neighbourhoods of these nodes are not affected. Also noteworthy is the fact that the coordination schema applies here at the VP level, thus in (56) X = VP.

The approach we will work with makes the following assumptions:

- With some HPSG approaches (in particular, Beavers & Sag, 2004; Crysmann, 2003) and Bruening & Al Khalaf (2020), we assume that at least in anaphoric coordination there is coordination of likes. In our specific case, at the level of S (or IP/TP, the specific labels are inconsequential). Therefore, the underlying structure we have is, provisionally, (54):

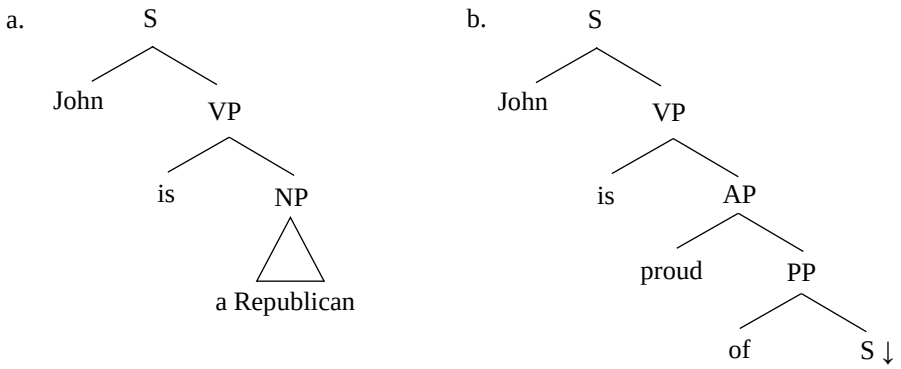
  (58) [[$_S$ John is a Republican] and [$_S$ John is proud of it]]

This assumption is motivated by the fact that we want the antecedent of *it* to be a constituent, which would not be possible if the coordination affected only [a Republican and proud of it]. This requires us to formulate a structural description where the material that is the antecedent of *it* is exhaustively dominated by a single node[14].

- In contrast to Beavers & Sag's analysis, however, we do not make use of deletion. Sarkar & Joshi (1996) explicitly point out that structure sharing is *not* conjunction reduction, or more generally a form of deletion. For structure sharing, all that is required is that the grammar is capable of identifying nodes in distinct elementary trees which are assigned the same addresses

- Each S corresponds to an elementary tree, by virtue of containing a single lexical predicate (a modification over the original proposal in Frank, 2002, which only required lexical categories; see Krivochen & Padovan, 2021). The elementary trees are the following:

(59)




A crucial part of our argument is that we need to be able to use the ET more than once in a derivation.

- Finally, we assume that the grammar contains an operation *pronominalisation*, which operates under identity[15]. Pronominalisation derives bound pronouns from the occurrence of identical NP or S nodes in a simplex or complex sentence. This does not entail that all instances of pronouns are derived transformationally: as Postal (1969) convincingly argues, a transformational analysis is untenable for unbound pronouns.

3.3.1 Antecedent-contained pro-forms

At this point, we need to address the question of whether anaphoric coordination presents the same problems for pronominalisation that cases of so-called *antecedent-contained pro-forms* (Bouton,

[14] We can be more precise. Let *s* be a string of arbitrary length. Then, *s* is a **constituent** in a derivation D iff *s* is *exhaustively transitively dominated* by a single symbol $\alpha \in V_N$ in D.

**Exhaustively transitively dominated** means that:

I. We refer to *all* symbols in *s*, and

II. All the parent nodes of all symbols in *s* (that is: the set of all symbols for which the relation **is-a** is defined for members of *s*), and

III. There is no symbol that transitively excludes a symbol in *s* if we follow dominance relations

[15] More specifically, we assume that pronominals are not distinct nodes from their antecedents; conditions on bound pronominal reference are defined over walks in closed graphs (Krivochen, 2022).

1970), most famously shown to be paradoxical in Bach (1970) (the argument was already known in 1967). In these cases, such as (60):

(60) Every pilot who shot at it hit the MIG that chased him

Pronominalisation under structural, morpho-phonological, and referential identity yields a *regressio ad infinitum* in the construction of an underlying structure, since *it* = [the MIG that chased **him**] and *him* = [every pilot who shot at **it**]. The antecedent of each pronoun contains the other (that is, the antecedent of *it* contains *him*, and the antecedent of *him* contains *it*), thus leading (under certain assumptions) to a structure with '*an infinite pile of relative clauses*' (Karttunen, 1971: 158). These cases, known now as Bach-Peters paradoxes, were used against a transformational treatment of pronominalisation as presented in Lees & Klima (1963). However, the idea that bound pronouns may be the result of syntactic operations and not lexical insertion has been revived recently (see, e.g., Hornstein, 2001: Chapter 5; Kayne, 2002; Gärtner, 2002, 2014), after attempts to solve the paradox have been proposed. Interestingly, the mechanism that underlies some classical treatments of Bach-Peters paradoxes (e.g., McCawley, 1970) is similar to that invoked to solve another case of antecedent containment: *antecedent-contained deletion* (ACD). These are cases such as (61):

(61) John liked every student Mary did

Under the assumption that VP deletion operates under identity, the underlying structure of (61) should be

(62) John liked every student Mary [liked every student Mary [liked every student… […]]]

*ad infinitum*. The solution proposed by May (1985), and widely adopted in generative grammar consisted of removing the 'offending' constituent by means of covert A'-movement, such that the antecedent contained relation is eliminated. This operation of *quantifier raising* (QR) assigns a Logical Form like (63) to (61), where the quantified NP *every student Mary did* is adjoined to IP:

(63) $[[\text{every student Mary did}]_i\ [_{\text{IP}}\ \text{John [liked [}e_i\text{]]]}$

Alternatives such as Hornstein's (1995) treatment of ACD also aim at removing the quantified NP from its base position, not through quantifier raising but through A-movement to a position above VP (at that time, $\text{Agr}_\text{O}$P, for Case reasons). The underlying mechanism is the same, in that movement is invoked to dissolve the problematic configuration. The spirit of the proposal is the same as McCawley's treatment of Bach-Peters sentences.

The question we need to address now is whether anaphoric coordination should be grouped with these cases (and thus a further operation, analogous to QR is needed) or whether pronominalisation can apply without worrying about creating paradoxical configurations.

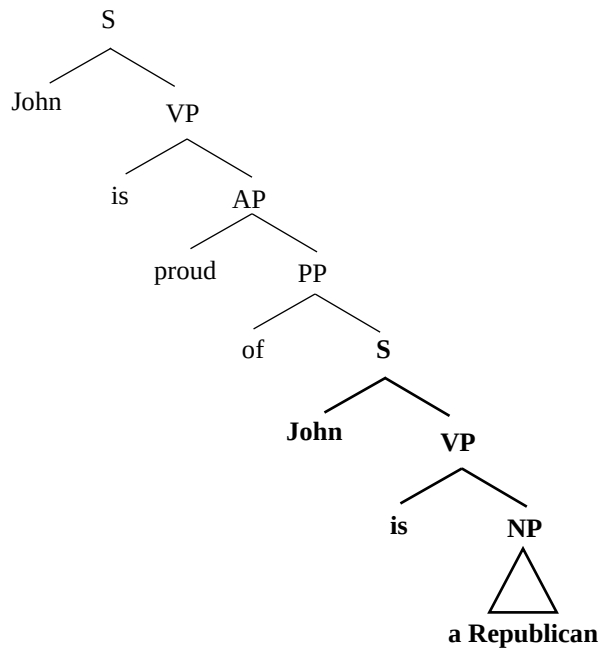
Fortunately for us, it seems to be the case that anaphoric coordination does not generate paradoxical structures: in *John is a Republican and proud of it*, pronominalisation may target only *John is a Republican*, which does not contain any bound expression itself. But the question is more general, of course: we are not just interested in this one example but in whether anaphoric coordination as a phenomenon can create antecedent-contained configurations. A crucial ingredient in the recipe for antecedent contained paradoxes is *hypotaxis*: either (i) there is a term in an embedded clause whose reference is determined by a syntactic object (which may itself be contained in a syntactic object) that properly contains that embedded clause or (ii) there is a term in an embedded clause whose reference is determined by a syntactic object which does not properly contain the embedded clause but which

contains a pro-form that refers to that embedded clause[16]. Anaphoric coordination, we argue, falls under neither category: the reference of the embedded pronoun can be determined unambiguously without infinite regression even though, as we will show, the second conjunct is a derived tree formed by substitution inserting (59a) into the designated position in (59b).

3.3.2 The machinery in action

The derivation of the canonical case of anaphoric coordination is the following. We start with the elementary trees in (59). The first step is to apply Substitution inserting (59a) in the designated position in (59b), which yields (64) (the elementary tree inserted by substitution has been bolded):

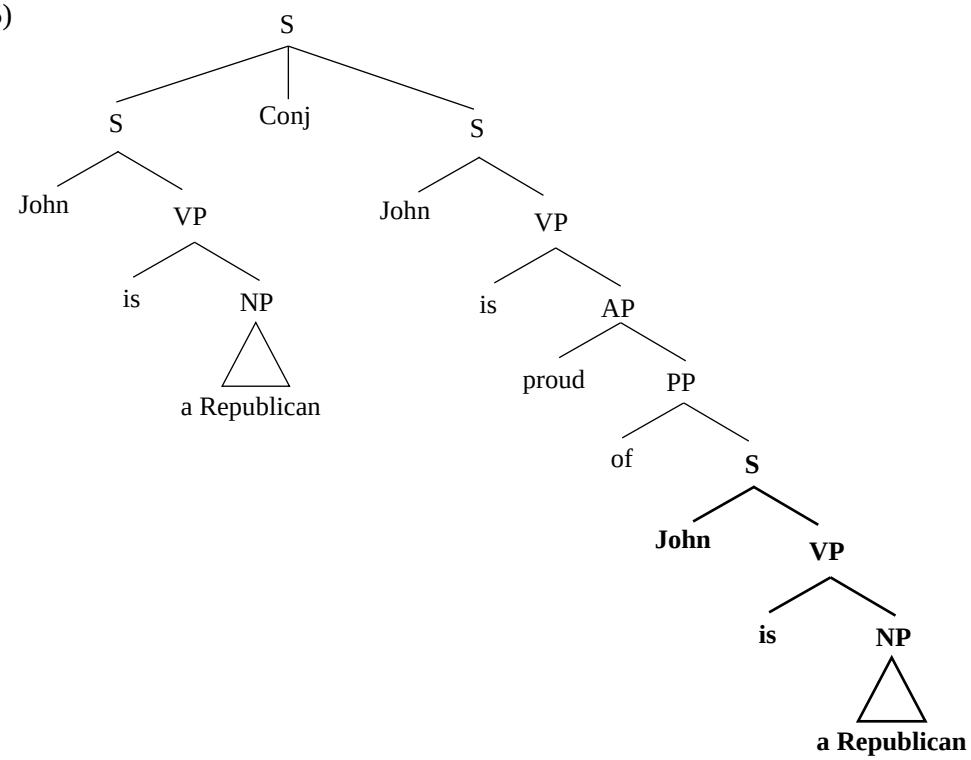
(64)




The second step is to insert the elementary tree (59a) and the derived tree (64) in the coordination schema (56), outputting (65):

[16] Visually, (i) is a self-similar fractal, whereas (ii) is a Möbius strip.

(65)




But recall that the grammar is capable of identifying identical terms: in the derived tree (61), (i) there are two occurrences of *John* and *is* and (ii) there are two occurrences of the elementary tree (59a). As in Sarkar & Joshi's (57), we can simply represent structure sharing as multidominance: *John* and *is* can are shared between conjuncts. Remember that we wanted the antecedent of *it* to be a constituent: this is only possible if coordination takes place at the S level. It is at this point that the structural description for *pronominalisation* is satisfied: given a structure with identical S or NP sub-trees, one or more may be pronominalised. Specifically,

(66) Let ⟦A⟧ and ⟦B⟧ stand for the semantic values of nodes A and B. Then, if ⟦A⟧ = ⟦B⟧ and:

a. A and B belong in the same elementary tree T and A c-commands B in T, B is Spelled-Out as an anaphor[17]

b. A and B belong to different elementary trees T and T', and (i) T' is adjoined to T or (ii) the root of T c-commands the root of T', B is spelled out as a pronominal

A and B may be of arbitrary complexity, in this case, elementary trees. The conditions (66a) and (66b) can be easily illustrated as follows:

(67) a. John admires himself
b. John thinks that Bill admires him

[17] Crucially, this leaves out non-reflexive endophoric devices such as *himself* in

i) Mary finished the whole project herself
ii) The President himself greeted the visitors
iii) You're good at this, and I'm not bad myself

See Krivochen (2019) for an analysis of these cases, which are neither reflexives nor anaphors (in the Binding Theoretic sense).

In (67a) there is only one lexical predicate anchoring an elementary tree, *admire*. Therefore, if the semantic value of *John* and *himself* is the same, the anaphoric reading is inevitable. In (67b), however, if the semantic value of *John* and *him* is the same, the conditions for anaphoric spell-out are not satisfied, since *John* belongs in the elementary tree anchored by *think* and *him* belongs in the elementary tree anchored by *admire*. The only possibility is a pronominal exponent.

The TAG approach (in particular, *as per* the Fundamental TAG Hypothesis), combined with the idea that anaphors and pronominals arise transformationally, allows us to straightforwardly account for cases like (18) above, repeated here:

(68) a. Prof. Smith$_i$ is a world-renowned expert in Anthropology and very sure of himself$_i$
b. Prof. Smith$_i$ is Bill's$_j$ PhD advisor and very sure of himself$_{i/*j}$

The elementary trees for (68b), for example, are:

(69) a. Prof. Smith is Bill's PhD advisor
b. Prof. Smith is very sure of Prof. Smith

Because there are two nodes with the same semantic value within an elementary tree, the structurally lower one surfaces as a reflexive. Reflexivisation can take place before substitution in the coordination schema, as soon as its structural description is satisfied.

In the analysis of (65), the satisfaction of conditions for pronominalisation depends on coordination affecting S, not VP or smaller terms: the input of pronominalisation requires identical terms in a syntactically asymmetric relation such that the most embedded one gets pronominalised under identity. The basic idea, as mentioned above, is not unlike the treatment of pronominalisation as a transformation in Lees & Klima's (1963) or Hornstein's (2001: Chapter 5) definition of anaphors and pronominals in terms of Spell-Out of NP traces; the main difference with the latter is that we rely on construal and structure sharing rather than on movement[18], thus aligning closer to Gärtner's (2014) approach. The structurally most embedded occurrence gets pronominalised under identity[19], delivering the bound pronoun reading *John is a Republican and proud of being a Republican,* as opposed to, say, *John is a Republican and proud of it* where *it* can bear an arbitrary referential index.

The same derivation applies to cases like (22), repeated here:

(70) a. Jeff became a millionaire and insufferable about it
b. Jeff remained a millionaire and insufferable about it

The elementary trees in this case would be *Jeff {became/remained} a millionaire* and *Jeff {became/remained} insufferable about S*. Note that, given the Fundamental TAG Hypothesis, selectional restrictions of the lexical anchors of each elementary tree must be locally satisfied: the ungrammaticality of Chaves' example

[18] A consequence of this is that locality conditions over the distribution of anaphors and pronominals are not dictated by the theory of movement as in Hornstein's work (since there is no movement; see Krivochen & Padovan, 2021; Krivochen, 2022 for discussion) but by the definition of *elementary tree* and the Fundamental TAG Hypothesis.

[19] Alternatively, along the lines of Krivochen & Padovan (2021) and Krivochen (2022), if elementary trees are defined graph-theoretically, a strict order may be imposed over nodes in the graph and thus a walk in the graph visits one of the S before the other; this second visit gets mapped to a bound interpretation (since it is the same elementary tree that is used twice in a derivation). See also Gärtner (2014).

(71) *Pat grew and remained wealthy and a Republican (Chaves', 2006, ex. 2)

follows from the fact that the selectional restrictions of *grow* are not satisfied in its own elementary tree.

The rigid positioning of conjuncts also follows from our account, assuming conditions on pronominalisation: if pronominalisation applies, it is because there are NP/S in a structurally asymmetric relation. Then, assuming the elementary trees as defined here, reordering the conjuncts is not possible, as it would disrupt the asymmetry required by pronominalisation. The analysis of anaphoric coordination of unlikes is based on the following rule ordering: Substitution > Conjunction > Pronominalisation.

The case of intersective coordination is different. Here, the main arguments for S coordination do not have the same force they did in the analysis of anaphoric coordination, since there is no expression in either conjunct that needs to refer back to a constituent. Thus, the coordination schema may apply directly at the VP level, which is the smallest domain at which it could apply while maintaining categorial identity (a feature shared by the HPSG and LFG analyses; see also Bruening & Al Khalaf, 2020; B&AK). Again, there is no deletion in the analysis: even an approach that does propose a deletion analysis for a restricted set of coordination of unlikes such as B & AK argues that a deletion analysis is not appropriate for the coordination of subcategorised predicates. Specifically, they propose that conjunction affects phrases which are specified for a feature [Mod] or [Pred] (which they refer to as 'supercategories'), in addition to syntactic category (N, V, A, P…). Thus, while categorial features may differ in conjoined phrases, 'supercategorial' features may not[20]; in addition to this, each categorial feature must satisfy the selectional requirements of the lexical verb. For example,

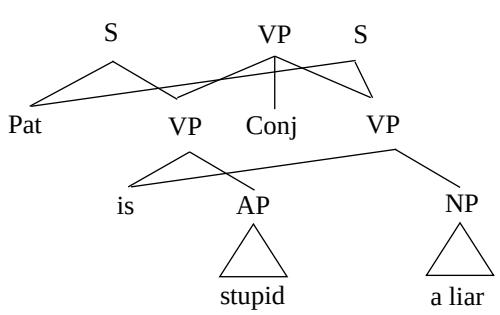
(72) a. Danny became [$_{\text{Pred:NP}}$ a political radical] and [$_{\text{Pred:AP}}$ very antisocial]. (*become* allows both NP and AP)
b. *Danny became [$_{\text{Pred:NP}}$ a political radical] and [$_{\text{Pred:PP}}$ under suspicion]. (*become* selects NPs and APs but not PPs)
(taken from Bruening & Al Khalaf, 2020. Ex. 34)

Our approach departs from B&AK in the amount of structure that is involved in the coordination: whereas in their analysis coordination affects only the supercategories, which must match, in ours matching is checked as part of structure sharing. Note that under the TAG analysis, selectional restrictions are locally enforced by virtue of each conjunct corresponding to an elementary tree[21]. The representation in this case is exactly Sarkar & Joshi's:

[20] Bruening & Al Khalaf (2020) explicitly say: '*Coordination only cares about the supercategory if there is one.*'.

[21] So far as we can see, the elementary trees constructed following the Fundamental Tag Hypothesis delivers the same empirical results as the satisfaction of Przepiórkowski's (to appear) *Distributed Satisfaction of Functional Constraints* if these constraints are syntactic: '*Each conjunct must satisfy all functional constraints on the coordinate structure*'. As he notes himself, the DSFC may be seen as a variant of Wasow's generalisation as well as a (more vaguely formulated) generalisation by Huddleston & Pullum (2002) which constraints replacement of a constituent X by a coordination of X and Y if Y has the same function as X.

(73)




In (68), the linear order of conjuncts makes no structural difference. Two aspects of (71) are noteworthy: one, there is no CR or ellipsis, since coordination applies at the VP level, followed by structure sharing. This approach differs from previous analyses of coordination of unlikes (transformational and non-transformational) in allowing for restricted counter-cyclic operations, which are at the heart of TAGs.

Note that this does not entail that the elementary trees are distinct: they still extend to S: it is the coordination schema that applies counter-cyclically. As above, the selectional restrictions of the predicate are satisfied within its elementary tree: this is required by the definition of elementary trees according to the Fundamental TAG Hypothesis. With *be* there is not much of a problem: if its subcategorisation frame goes along the lines of *be*<SUBJ, PREDLINK> (in LFG terms), both grammatical functions are saturated in each elementary tree (*stupid* and *a liar* would be values for the attribute PREDLINK). But things are not always so simple. Consider the case of (74), repeated from (25a):

(74) Jan wanted [$_{NP}$ another doughnut] and [$_{IP}$ to leave Boston by five]

In this example, *want* in the first conjunct subcategorises for a SUBJ and an OBJ, whereas in the second it subcategorises for a SUBJ and an XCOMP. If coordination took place at the level of NP and IP, then there would indeed be a categorial mismatch which would force us to revise the coordination schema (as Dalrymple, 2017 does). But, if selectional restrictions apply within elementary trees, then we have the following elementary structures:

(75) a. [Jan wanted another doughnut]
b. [Jan wanted to leave Boston by five]

Once the grammatical functions required by *want* have been saturated in each elementary tree (satisfying Wasow's generalisation), structure sharing can take place as usual: *want* receives the same interpretation in both conjuncts and there is no structural difference between the position of the NP and the IP since both are VP complements. Structural position seems to be more important than grammatical function, which is unsurprising under the view that coordination of unlikes involves structure sharing. This approach makes the prediction that coordination of unlikes allows for different grammatical categories with different grammatical functions (as in (74)), but only if these categories occupy the same structural position (V complement) (an idea already present in Goodall's 1984 analysis). This prediction seems to be borne out by data like (76):

(76) ?/*John thinks [$_{PP}$ about Susan] and [$_{CP}$ that Bill should kiss Mary]

Here we have a PP and a CP with grammatical functions OBLIQUE and COMP respectively, a mismatch in category *and* grammatical function. But those two variables are controlled for also in (74), so the cause of the ungrammaticality of (76) must be something else: the only difference between (74) and

(76) is *configurational*. In the structural description assigned to (76) the PP is not a V complement but rather a VP adjunct; as such, it does not share the structural position of the CP which is a V complement. This view can also account for the ill-formedness of examples such as the ones in (77), taken from Peterson (2004):

(77) a. *John made Mary [an omelette] and [happy] (double object constructions and causative constructions receive distinct structural analyses)
b. *John sang [beautifully] and [a carol] (adjunct vs. argument)
c. *John drove [the car] and [to Sydney] (transitive vs. intransitive alternations receive distinct structural analyses)

In (77a), *Mary* is an independent constituent from *an omelette* in the DOC, but it must be a constituent with *happy* in a causative construction. In (77b), *a carol* is an argument of *sing*, whereas *beautifully* is not: the former is structurally the complement of V and the latter an adjunct to VP. (77c), like (76) above, involves two distinct alternations for *drive*: an intransitive one with a PP adjunct (*drive to Sydney*) and a transitive one with a DP complement (*drive the car*). A configurational approach also seems to capture the following data, from Patejuk & Przepiórkowski (2021):

(78) a. I feel like my stay in Vienna lasted [both [$_{AdvP}$ forever] and [$_{NP}$ no time at all]].
b. Immunity may last [[$_{NP}$ 10 years] or [$_{AdvP}$ longer]].
c. …not all of us treat our animals [[$_{PP}$ with respect] and [$_{AdvP}$ humanly]]!
d. Many in DC behave [[$_{NP}$ this way] or [$_{AdvP}$ worse]].

Regardless of category, the structural position of the AdvP, PP, and NP is identical: none of these cases involves coordinating a subcategorised constituent and a non-subcategorised constituent. This is important if we establish a correspondence between subcategorisation status and phrase structure: non-subcategorised constituents are Chomsky-adjoined, whereas subcategorised constituents are either first- or second-Merged. In this context, it is predicted that, (79) below, where the unlikes are structurally both VP adjuncts ('modifiers', in Bruening & Al Khalaf, 2020), is grammatical:

(79) He acted [$_{AdvP}$ recklessly] and [$_{PP}$ without thinking]

Configurationally, both the AdvP and the PP are non-complements, and under a structure sharing view the result is predicted to be grammatical. Similarly, in (74) above both conjuncts are V complements (*want* may take a DP complement or an S/IP complement: their position in the structure is the same), regardless of their distinct grammatical function. Phrase structure configuration seems to play a much bigger role than the LFG approach, focused on *f-structure*, predicts.

Finally, we may need to consider the case where the subject of the coordination of unlikes is itself a coordination. For example,

(80) John and Bill are Republicans and proud of it

In this case, the predicate gets distributed over the entities denoted by the subject, such that John is a Republican and proud of being a Republican himself, and Bill is a Republican and proud of being a Republican himself. For this case, we can propose an underlying structure that includes a number of sentences each of which has been derived from elementary trees like (59a, b). Thus, in derivational

terms we have the following ordered set of operations (we assume that V agreement takes place at the very end of the derivation, once the coordinated subject has been derived[22]):

(81) *Elementary trees:*
a. John is a Republican
b. John is proud of S
c. Bill is a Republican
d. Bill is proud of S

*Substitution and Conjoin:*
e. John is a Republican and John is proud of [John is a Republican]
f. Bill is a Republican and Bill is proud of [Bill is a Republican]

*Apply S-pronominalisation in each derived tree:*
g. John is a Republican and John is proud of it
h. Bill is a Republican and Bill is proud of it

*Conjunction Reduction / structure sharing:*
i. John is a Republican and proud of it
j. Bill is a Republican and proud of it

*Conjoin (Substitution in the coordination schema):*
k. John is a Republican and proud of it and Bill is a Republican and proud of it

*Structure sharing[23]:*
l. John and Bill are Republicans and proud of it

## 4. Conclusions and open issues

The starting point of this paper was the observation that not all instances of so-called 'coordination of unlikes' behave the same, syntactically and semantically[24]. Specifically, we identified two kinds of cases (a classification that is orthogonal to that proposed in Bruening & Al Khalaf, 2020): those where the coordinating conjunction is analogous to the propositional calculus ∧ (and therefore commutative), which we called *intersective coordinations* since the interpretation of the coordinated

[22] To capture variation in subject agreement, Yatabe (2004: 346) assumes that there are two lexical entries for *and*: one whose function is to form an NP with a singular index and another whose function is to form an NP with a plural index; this index is what delivers verb agreement (Pollard & Sag, 1994). His analysis depends on specific aspects of the HPSG theoretical machinery, and we will not delve into it in this paper. See Krivochen & Schmerling (2016) for a proposal that also assumes two distinct *and* (so-called *et* and *que*-coordinators) with different syntactic and semantic properties: only *et*-coordinated terms trigger plural agreement.

[23] We presented conjoin and structure sharing as if they were distinct operations for the sake of clarity in the step-by-step derivation, but in reality since tree composition is taken to be graph union (if G = (V, E) and G' = (V', E'), then G ⋃ G' = (E ⋃ E'), (V ⋃ V')), structure sharing is part of structure composition, not an independent operation. This is also relevant to the argument that structure sharing is not akin to conjunction reduction: in graph union there is no deletion whatsoever.

[24] More generally, it seems highly unlikely that coordination is a syntactically uniform phenomenon given the fact that it is certainly not a semantically uniform one. An adequate syntactic theory of coordination should not, in our opinion, attempt to fit all coordinations (phrasal, sentential, affixal, symmetric, asymmetric, …) under a single structural template (either uniformly asymmetric as in, e.g. Zoerner, 1995; Johannssen, 1998; Chomsky, 2013 among others, or uniformly symmetric, as in LFG), and only assign additional structure in the form of nonterminals where there is syntactic evidence for an asymmetry between conjuncts (e.g., binding effects, agreement, etc.).

phrases denotes the intersection of the sets corresponding to each conjunct, and those where the second conjunct contains an anaphoric pronoun whose antecedent is -apparently- larger than the first conjunct, and which we called *anaphoric coordinations*. Despite the data being well-known, an analysis of the structural conditions under which the reference of a pronominal contained in the second conjunct can be appropriately determined has not been previously formulated in the literature. We pursued an analysis along the lines of Beavers & Sag's (2004) HPSG approach in that the underlying structure is a coordination of likes (sentential constituents, specifically; see also Crysmann, 2003), but instead of ellipsis (or conjunction reduction), our Tree Adjoining Grammar account relies on structure sharing (Karttunen & Kay, 1985; Sarkar & Joshi, 1997). We also showed that, in contrast to the LFG position, the grammatical function of coordinated terms seems to be less important than phrase structure configuration in filtering out possible combinations of terms, when individually all underlying sentences are well-formed (*as per* Wasow's generalisation, which in the present context follows from the Fundamental TAG hypothesis).

The approach presented here is not intended to be a complete description of the syntax of coordination of unlikes, let alone a complete theory of coordination. Such an endeavour would require an integration between syntax, semantics, and discourse that greatly exceeds the scope of this paper; (see Altshuler & Truswell, forthcoming for extensive discussion and a semantic-discourse focus). Specifically, there are cases that require a more refined approach to the definition of elementary trees, such as those anaphoric coordinations whose subject is a generalised quantifier:

(82) Every MIT graduate is employed and proud of it

The issue raised by cases like (81) mirrors early objections against a transformation of *equi NP deletion*: just like *Every candidate wants to win* does not mean that *every candidate wants every candidate to win* (but rather that candidate *x* wants candidate *x* to win, candidate *y* wants candidate *y* to win, etc.), in (82) MIT graduate *x* is proud of *x* being employed, not necessarily MIT graduate *y* being employed[25]. Here, the theory of generalised quantifiers can be helpful.

In order to provide adequate representations for natural language quantified NPs, it must be possible to quantify over sets of entities, define functions from subsets to subsets, etc.: natural language quantifiers are *relations between sets*, such that *every politician lies* makes reference to (i) the set of politicians and (ii) the set of liars. *Every politician lies* is true iff the set of liars is a member of the set of sets of which every politician is a member. The theory of generalised quantifiers treats NPs as denoting sets of sets, and the analysis of predication in sentences containing generalised quantifiers is based on determining set membership. In Barwise & Cooper's (1981: 164) terms,

> *The truth of a sentence Qx[φ(x)] is then determined by whether or not the set* $\hat{x}[\varphi(x)]$ [read: *x* such that φ(x); $\hat{x}$ is equivalent to the familiar λ*x* notation] *is a member of the quantifier denotation*

In this approach, generalised quantifiers (which Barwise & Cooper, 1981 define as the combination of a determiner and a set expression, as in $most_{Determiner}\ students_{Set\ expression}$[26]) are functions from sets of

[25] We say 'not necessarily' because some informants have reported that a reading where every MIT graduate is proud of the fact that MIT graduates are employed is available.

[26] Formally,

> *If* ***D*** *is a determiner and η is a set-term, then* ***D****(η) is a quantifier* (Barwise & Cooper, 1981: 168).

entities to Boolean truth values ({0, 1}, or {false, true}). Different quantifiers partition the set of entities differently: if we have a set of entities E, for all subsets *x*, *y* of E, *every x* maps each subset *y* of E to {true} iff *x* is a subset of *y* (in other words, if each *x* is *y*; see Keenan, 1997). Formally, we can define the semantic value of the determiner *every* as follows:

(83) ⟦every⟧ = λS[λT[S⊆T]] (read: S such that T such that S⊆T)

Here, S and T are variables of type <*e*, *t*>, functions from entities to truth values (the type of the characteristic functions of sets): this captures the idea that generalised quantifiers are relations between sets.

As suggested in Krivochen (2022), it is possible that structure sharing affects only the set expression in the generalised quantifier, not the determiner: an operation like QR may be proposed for these cases, where *every* may be raised to take scope over the elementary tree in which the generalised quantifier appears (see Johnson, 2016 for a similar proposal concerning Multidominance rather than QR). So far as we can see, there is nothing inherent to the TAG + structure sharing formalism that tips the scales for or against such an analysis, and we leave this issue open for future research.

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