Mereological syntax and successive cyclicity*

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1. Subjoin

In Adger (to appear), I suggest replacing the operation Merge, in both its external and internal forms, with a new operation Subjoin. While Merge combines two syntactic objects into a set, Subjoin essentially inserts one syntactic object into another. Compare (1) with (2):

(1) Merge(α,β) = the object γ, such that $\alpha \in \gamma$ and $\beta \in \gamma$ (i.e. $\{\alpha,\beta\}$)

(2) Subjoin(α,β) = the object β, such that $\alpha < \beta$

The relation $<$ is the (proper) part relation of mereological logics (Coitnoir and Varzi 2021), and is a transitive and irreflexive (hence asymmetric) relation. One advantage of Subjoin over Merge is that no theory of labelling is required for the former, since the label of the target is preserved, while something needs to be said about the label of γ in (1).

The part relation of standard mereology has been used in linguistics mainly to analyse the semantics of expressions such as mass terms, plurals, certain aspectual categories etc. (Link 1983) because it neatly captures the undifferentiated nature the denotata of such items. Syntax is, in contrast, highly differentiated, and standard mereology is unsuited for it. However, alternative mereologies have been proposed by Johnston (2006), Koslicki (2008) and Fine (2010) which provide the required differentiation. In these *hylomorphic* mereologies, an object is not just constituted by its parts, but rather by its parts and their mode of composition. Furthermore, for Fine at least, objects may be parts of another object in different ways: for example, the letter *n* is part of the word *on* in a different way than it is part of the alphabet. I adopt this approach to mereology for syntax: a syntactic object is

*This paper is a condensed version of some ideas from Adger (to appear) and I hereby incorporate the acknowledgements section of that book. Many thanks also to the participants of NELS 54 for comments and suggestions at the conference itself.

constituted by its parts and how they are subjoined, and the parts of an object may be parts in different ways (which I call dimensions).

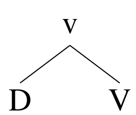
Specifically, let us say the following:

(3) Dimensionality:

a. The first application of Subjoin of an object α to an object β is in dimension 1; we say that α is then a 1-part of β;
b. If an object β already has a part in dimension 1, then an application of Subjoin of α to β will be in dimension 2; we say that α is then a 2-part of β;
c. There are 2 dimensions in syntax.

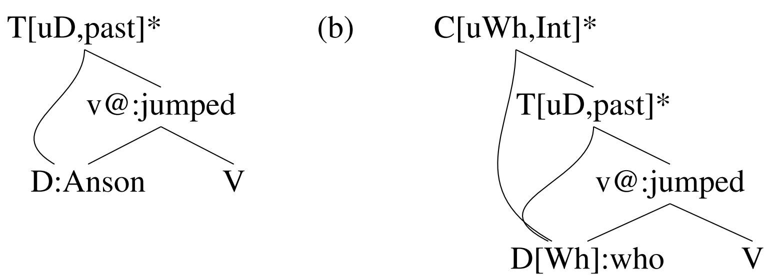
Subjoin will generate telescoped structures, akin to those of Brody (2000). Let us adopt the convention that 1-parts slope to the right, and 2-parts slope to the left, then an unergative verb like *jump* will involve a structure where V subjoins to v as a 1-part, and then the subject (assume it is a D), subjoins to v as a 2-part, as follows:

(4)



The span of categories (V-v, Svenonius 2016) then spells out as the verb *jump*, while the 2-part D acts as the specifier of v. As noted by Brody, there is no head-movement in such a system: the spellout position of the verb is parametrically specified via a feature @ on one of the categories (in English, Brody assumes this to be v, as in (5)). Continuing the derivation, v subjoins to T as a 1-part, and then, for English at least, D subjoins to T as a 2-part deriving the structure for a simple declarative in (5a):

(5) (a)



I assume a very simple checking theory, that requires an uninterpretable feature to be in a 2-part relation with an interpretable one:

(6) Checking: [uF] must be in a 2-part relation with [F]

Checking is the reason that English requires subjunction of the vP internal subject to T. It is also the reason that, in (5b), the wh-expression *who* subjoins to the interrogative C. The system here differs from the standard Merge system in that it involves multiple independent subjunctions of an object to higher objects, as opposed to successive movements from position to position. I return to the * annotation, which, like @, specifies information pertinent to linearization, directly below.

Looking at (5), we see that the sequence of categories in the first dimension constitutes an Extended Projection, while the categories in the second dimension are specifiers. The two dimensions are the means of capturing this distinction in the mereological system. There is no equivalent to a thematic complement position, so all arguments will be specifiers, including CP and PP arguments (I leave adjuncts aside here).

The subjunction of D to T or C in (5) is analogous to Internal Merge (or movement) but does not, like Merge, create copies: it simply adds a new part relation (a 2-part, since T and C already have 1-parts), so that the structure involves multiparthood (cf. multidominant theories like Engdahl 1986). I use * to signify that an object that is a 2-part of multiple objects is spelled out at the position of the * (much as in Adger 2003's version of 'strength'); if there are multiple *s in an Extended Projection, then the object is spelled out at the highest. Informally, we can say the following (see Adger to appear for a more formal statement):

(7) *-Linearization:

a. If an object α is a 2 part of a number of other objects which are in a 1-part (Extended Projection) relation, linearize α with respect to the highest of these that bears *;

b. If no object bears *, linearize α with respect to the lowest object it is a 2-part of.

This essentially forces an object to linearize as the 'specifier' of the highest object in an Extended Projection bearing * that it is a 2-part of, unless no object bears *, in which case it linearizes in its lowest position[1].

2. Angular Locality and cyclicity

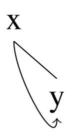
The simplest grammar for a system like human language would not involve any restrictions that impose locality on operations. However, this seems to be empirically wrong, and syntactic theories have accordingly stipulated that certain domains impose limits on grammatical operations (these domains used to be called Cyclic Nodes, and are now called Phases). Phases act as points in a derivation that enforce (almost) all operations to take place within them. The simplest grammar for a system like human language incorporating Phases (or something similar) would not involve any exceptions to the Phases. Again, this is empirically incorrect. We seem to need such exceptions and theories incorporating Phases allow them to be permeable in certain circumstances (Chomsky 2008). Current theories simply stipulate both what may be a Phase, and what the exceptions to phases are (via a list of categories in the first case, and a stipulation about edges in the second, Citko 2014). This is an unsatisfactory state of affairs.

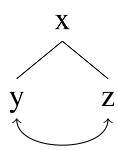
[1]There is a question of analysis here for local subject extraction: is the subject linearized at the T or C positions? See e.g. Pesetsky and Torrego (2001). I leave the complexities of this aside here.

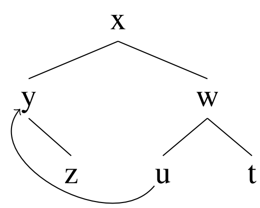
Within Mereological Syntax an alternative is available. I suggest replacing Phase Theory with a more straightforward locality constraint, which restricts (internal) subjunction in such a way that it crosses at most one dimension. Because change of dimension corresponds to an angle in a structure, I call this Angular Locality:

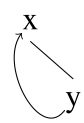
(8) Angular Locality (AL)
If α is a part, then α can subjoin to β iff there is some γ, such that α is an n-part of γ and γ is a 1-part of β.

AL has the effect of ruling out a number of possible subjunctions. For example, it will rule out downward subjunction as in (9a), since AL requires the target of the subjunction to have, as a part, a category which itself has the subjoiner as a part: if x subjoins to y in (9a), it is clearly not the case that there is some category that x is a part of which is a 1-part of y. For the same reason, AL rules out 'sidewards' subjunctions in (9b-c). In neither case is there some object which is a 1-part of the target and which the subjoiner is part of:

(9) (a)


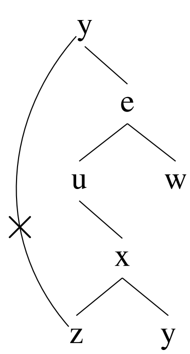
(b)


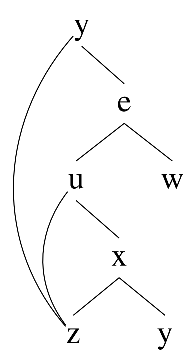
(c)


(d)


AL, in conjunction with the irreflexivity property of $<$ will also rule out super-local subjunctions (those that correspond to movement of a complement of a head to the specifier of that same head). The structure in (9d) shows y subjoining to x. However, AL requires y to be an n-part of some category γ. The only option is that γ = x, but Angular Locality also requires γ to be a 1-part of x. Irreflexivity means that no object is a part of itself, so γ cannot both be x, and be a 1-part of x. This derives the kind of Anti-Locality constraint argued for by Abels (2003) and derived by him via feature checking.

AL will also rule out subjunction from inside a 2-part (a specifier) to a target outside of that 2-part. Consider (10a):

(10) (a)


(b)


In order for z to subjoin to y, there must be some γ which z is an n-part of. The only option in (10a) is x. But AL then requires x to be a 1-part of the target y, which it is not. Intuitively, the 'path' (Kayne 1984) from z to y crosses dimensions multiple times (from 2 to 1, then to 2, and then to 1). AL, then, would seem to rule out an operation which 'extracts' from inside a specifier.

However, as shown in (10b), if z first subjoins to u, then there is in fact a γ such that z is an n-part of γ and γ is a 1-part of the target y. The object e, by transitivity is an n-part of z, since z is a 2-part of u and u is a 2-part of e. The path from z to y only crosses dimensions once (from 2 to 1). Angular Locality derives as a theorem the fact that it is impossible to subjoin ('extract') from inside a 2-part unless the subjoiner is itself the 2-part of that 2-part. In effect, the system predicts that specifiers are opaque except from their edges.

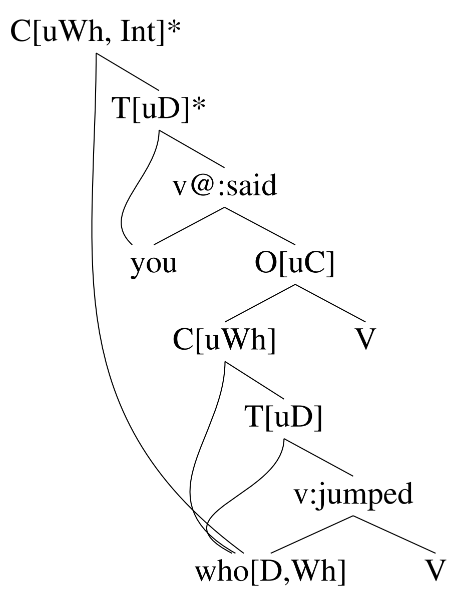
This is, I think, an improvement over Phase Theory as a means of capturing successive cyclicity. Whereas in Phase Theory it is unclear why there are phases, why the Phases are what they are, why they have exceptions (edges) and why the exceptions are what they are, the mereological system provides straightforward answers to these questions: there are locality domains because there are two dimensions in syntax, and there is a natural limit on how many times a single object can cross these dimensions (once); the cyclic domains are 2-parts (specifiers) for this same reason, and the fact that they have edges is a simple consequence of the transitivity of the 2-part relation.

Let us make this more concrete and inspect the analysis of (11):

(11) (guess) who you said jumped?

I will assume a theory of selection where the verb *say* 'spans' a sequence of categories in a 1-part relation that includes a category that licenses a clausal object which I will just call O ($V\frown O[uC]$). The analysis of (11) is then as follows:

(12)



Here the subject of *jump* is initially subjoined as the 2-part of v, it then subjoins to T, because T bears a [uD] (EPP) feature. It then subjoins to the embedded C, so that the [uWh] feature on that C is checked. That subjunction makes *who* a 2-part of the higher O category by transitivity, and that, in turn, allows *who* to subjoin to the matrix C, checking the [uWh] on that C. The [Int] feature on that C ensures that the sentence is interpreted as an interrogative and the * ensures that *who* is linearized high[2]

If the intermediate C lacked the [uWh] feature, *who* would not be a 2-part of O, and would, by AL, be unable to subjoin to matrix C. Successive cyclicity is derived without Phases, but rather via the interaction of transitivity and AL.

3. Reflexes of successive cyclicity

In Scottish Gaelic, as is well known, intermediate Cs in an A-bar extraction path take on a special form (Adger and Ramchand 2005). In cases where the extractee is the object of a preposition, there are two possibilities. Compare (13) with (14a-b)[3]:

(13) Thuirt thu gun do bhruidhinn thu rithe
say.PAST you that prt.PAST speak.PAST you to.3FS
'You said that you spoke to her'

(14) a. Cò a thuirt thu a/*gu bhruidhinn thu ris
who that.REL speak.PAST you that.REL/*that speak.PAST you to.3MS
'Who did you say that you spoke to?'

b. Cò ris a thuirt thu a/*gu bhruidhinn thu
who to.3MS that.REL speak.PAST you that.REL/*that speak.PAST you
'Who did you say that you spoke to?'

In (13), the embedding complementizer is *gu(n)*, which takes a particular verb form after it that is preceded, in the past, by the particle *do*. In the extraction construction in (14a), the intermediate (and matrix) complementizer(s) obligatorily appear as *a*, followed by a different verb form that lacks *do*, and the stranded preposition appears in its default 3MS form, irrespective of the number and gender of the extractee. In (14b), the wh-element forms a constituent with the preposition, again in its default form, and again the Cs take the form *a* not *gu(n)*.

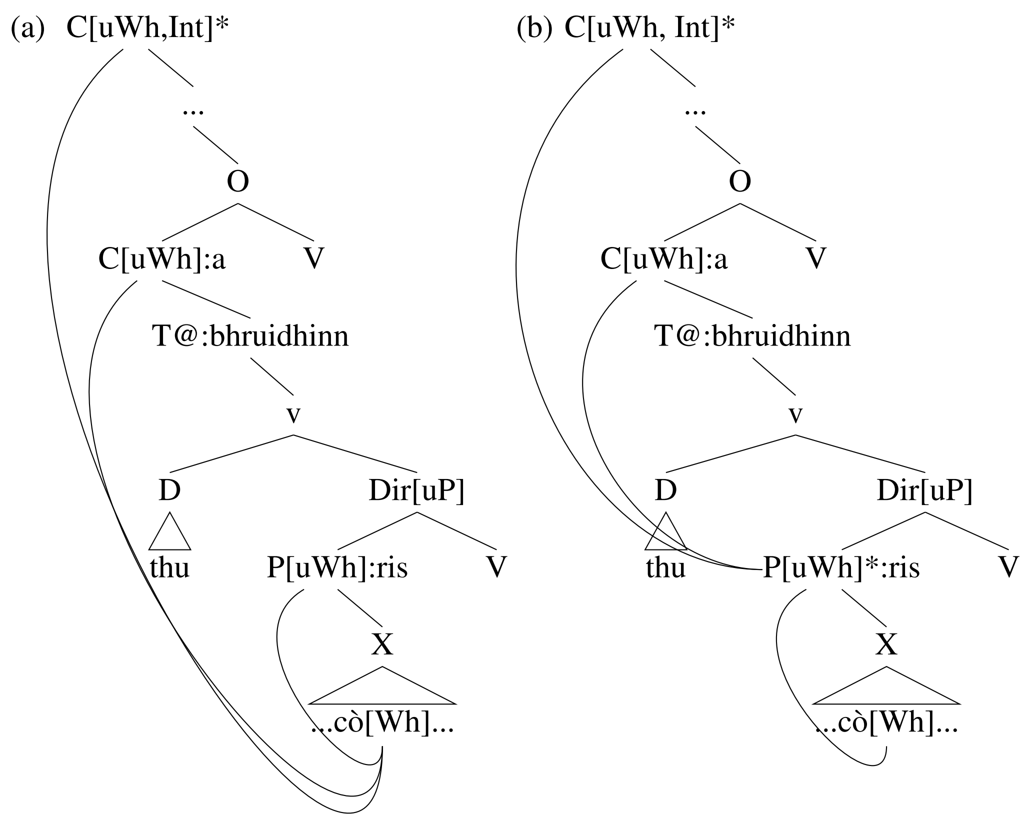
In order to capture the selectional requirements of the verb *bruidhinn*, 'speak' for a prepositional argument, I assume a category, call it Dir[uP], which is part of the span that the verb spells out. The PP argument is a 2-part (specifier) of Dir. The wh-expression *cò* is,

[2] The embedded T[uD] in (12) does not force linearization of its 2-part. I assume that, if it did, the conflicting linearization instructions would give rise to the *that*-trace effect in English. *That*-trace avoiding derivations as in (12) involve a special C[uWh]-T[uD] span that lacks a * on T and cannot be spelled out as *that*). I leave further details for elsewhere.

[3] I have, for clarity's sake, included various elements that would usually undergo phonological deletion such as the complementizer *a* when it follows the wh-expression *cò*. There is also a third possibility, where the selected P appears at the edge of its own clause with a third type of complementizer. I leave this aside for reasons of space here. See Adger (to appear) for discussion.

I assume, inside the complement of the preposition *ri*, ‘to’[4], which I’ll just represent as X, remaining agnostic about its category, though see Adger (2013) for discussion. I’ll assume for simplicity, though probably counterfactually, that the subject remains in situ. Example (14a) is then analysed as (15a):

(15)



In (15a), the wh-expression *cò* bears a [Wh] feature, and, by virtue of it subjoining to P, it becomes a 2-part of Dir. Because it is a 2-part of Dir, it can, by Angular Locality subjoin to the intermediate C. This, in turn, means it is a 2-part of matrix O, by transitivity, which means that it can subjoin to matrix C and linearize there. The obligatory morphological forms of the intermediate Cs signify the subjunctions required by Angular Locality.

The system also makes an alternative derivation available as in (15b): *cò* subjoins to P as before, but rather than *cò* then subjoining to the intermediate C, the PP itself subjoins to the intermediate C. This is allowed by Angular Locality, since only one dimension is crossed, and the transitivity of the 2-part relation allows the [uWh] feature on the (intermediate and) matrix Cs to be checked by the feature [Wh] on *cò*, deriving (14b). The difference between

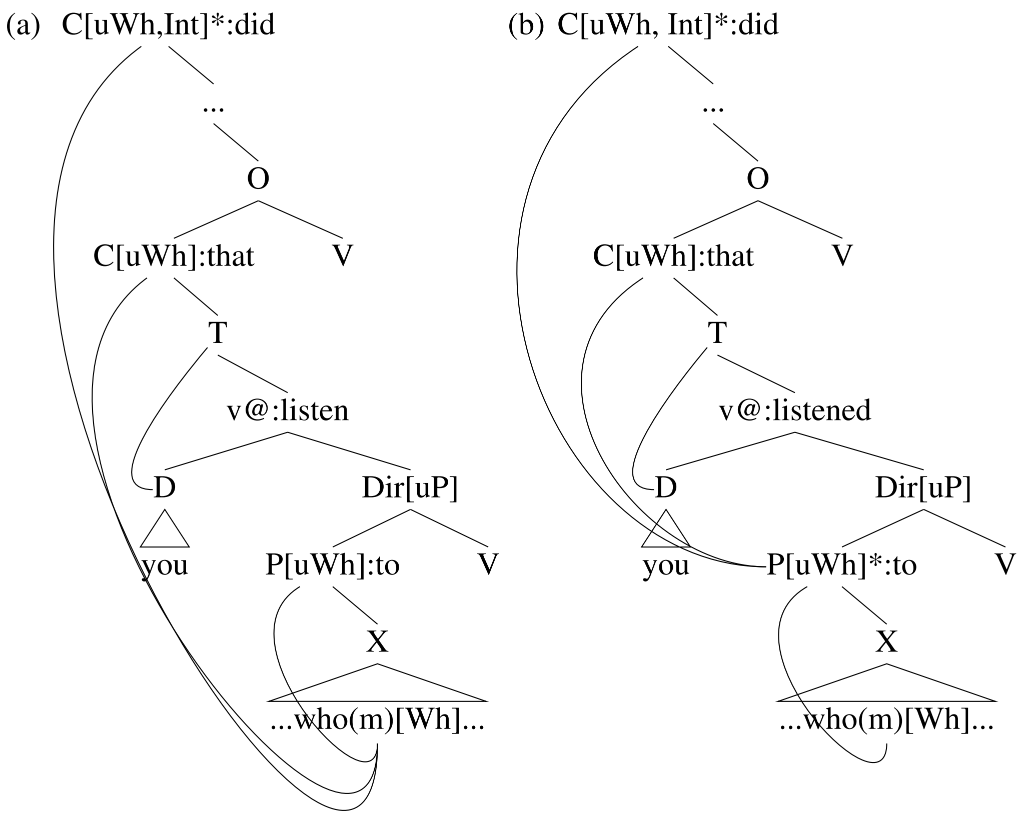
[4]For examples like (14a), Adger and Ramchand (2005) propose a null default pronoun as the complement of the preposition, which connects with the higher C via Agree (and a chain of Agree relations successively operate to connect any intermediate Cs to the matrix C). I still think this is correct for relative clauses and for complex questions with NP restrictions which are build on these, though Agree can be replaced by subjunction, but for simple wh-expression questions such as those discussed here, the pro analysis is unnecessary and unmotivated. Again, see Adger (to appear) for an extended discussion.

the two structures is whether * is on P. If * is present on P, *cò* linearizes to the left of P and PP to the left of matrix C. If * is absent on P, *cò* itself linearizes to the left of matrix C.

What of a language like English, where, when pied piping is well formed the wh-expression does not appear in the specifier of P?

(16) To whom did you say you listened?

In this situation, P in English may bear [uWh] just like in Gaelic; *who(m)* subjoins to P but P in English does not bear *, which means that *who(m)* appears in its lowest subjoined position, following *-Linearization in (7), hence to the right of the preposition *to*. The matrix C, however, bears *, so PP subjoins to matrix C (via subjunction to the intermediate C) and is linearized high, deriving (16) with the structure in (17b). The [uWh] on the matrix and intermediate Cs is checked via the [Wh] feature of wh-expression. Because that feature is on a syntactic object that has subjoined to P, and the PP has subjoined to the various Cs, [Wh] on *who* is in a checking relation with [uWh] on C by transitivity of the 2-part relation.

(17)


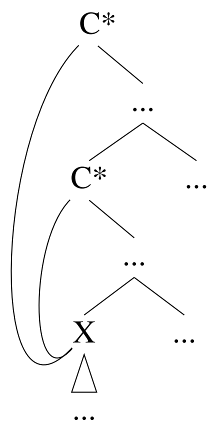
In the derivation in (17a), the wh-expression itself subjoins to the intermediate Cs and to matrix C, checking the [uWh] features directly. Following *-Linearization, it is linearized as the 2-part (specifier) of matrix C, and we derive the stranded version of (16).

Consider now the Afrikaans example reported by du Plessis (1977), where the wh-expression *met wie*, 'with whom' appears not just in its scope position, but also at each intermediate clausal boundary between the scope position and the position where it is selected by the verb *trou*, ‘marry’:

(18) [met wie] het jy nou weer gesê [met wie] het Sarie gedog [met wie] gaan
with who have you now again said with who has Sarie thought with who go
Jan trou?
Jan marry
’Whom did you say (again) did Sarie think Jan is going to marry?’

Examples like this are not amenable to an analysis where the reflex of intermediate movement is a specialized complementizer, rather they suggest that it is possible to spell out a single object in multiple sites simultaneously. Schematically, the structure of examples like (18) is as follows:

(19)



In English, only the C that beats the [Int] feature also bears *, so it is this C that the wh-expression linearizes as a 2-part of. *-Linearization governs the linearization of an object which is a 2-part of multiple objects in an Extended Projection relation, but says nothing about objects which are not in such a relation, allowing cases like Afrikaans, where one object is linearized multiple times via multiple C*s. This appears to be uncommon, as might be expected if a single object is subject to multiple realizations, and I do not have an answer as to why Afrikaans allows it while English does not (e.g. in that trace configurations).

4. Conclusion

The theory of successive cyclicity developed here provides a different approach to the phenomenon than that given by standard Phase Theory. It is, I think, theoretically more elegant, deriving from the core theory of phrase structure what the standard theory stipulates about the identity of locality domains and the reasons why they are permeable. Angular Locality, in particular, is a natural condition on paths, allowing a maximal of one change in dimension, while, at the same time, enforcing dependencies to be upwards and ruling out both sidewards dependencies and Anti-Local derivations. At the same time it blocks dependencies from specifiers except through their edges. When coupled with the interface principle of *-Linearization, it provides an analysis of the morphosyntactic reflexes of successive cyclicity that have been central to much theorizing over the past few decades. It also, as I show in Adger (to appear), provides a new approach to a range of island effects.

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