Reconstructing Coordinations[1]

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Abstract. The debate about the proper analysis of coordination is usually organized around two competing approaches. On the first approach, sentences with apparent DP coordination consist of a coordination of full clauses. On the second approach, such sentences involve a coordination of DPs, in which the coordinator combines two quantificational elements. We introduce them, and subsequently evaluate them, on the basis of apparent subject DP coordinations in raising constructions. The data presents a challenge primarily for the first approach.

Keywords: coordination, disjunction, conjunction, raising, reconstruction.

1. Introduction

One central issue in the work on the syntax-semantics interface is the proper analysis of coordination sentences, namely, what is their interpretation and underlying structure (e.g., Ross, 1967; Montague, 1973). By 'coordination' we mean connectives as *and* and *or*. Traditionally, in logic, connectives are defined as sentential, truth-functional operators. Their applicability to entire sentences as single units is readily found in natural language in cases such as (1):

(1) a. [Roses are red] and [violets are blue]
b. [Roses are red] or [violets are blue]

However, natural language coordination appears to have a much wider distribution – we can conjoin and disjoin noun phrases, verb phrases, verbs, and adjectives, for example:

(2) a. [[Tom] and [Jerry]] are running away
b. Jerry [[ate cheese] or [baked a cake]]
c. Tom [[cursed] or [caught]] Jerry
d. Tom is [[fast] and [furious]]

In light of these apparently disparate uses of coordination, the following question presents itself: Is the (merely) truth-functional characterization of coordination adequate as a characterization of natural language coordination, despite its apparent surface variation? Or does this surface variation reflect greater versatility in coordination operators of natural language?

There are two families of approaches to this question. We present them in a simplified fashion, abstracting away from many details and technicalities. One general approach assumes that natural language coordination does mirror our standard logical representations, and we do in fact only conjoin full clauses or any other t-type elements, as described schematically in (3).

(3) $[_{XP} \ldots]$ $\{\text{and/or}_{CR}\}$ $[_{XP} \ldots]$,
where XPs are of type t

This approach must then account for the surface variation, and it usually achieves this via syntactic movement and ellipsis. In other words, what we see is the surface structure in (4a), which

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has the LF in (4b), where we again abstract away from many of the subtleties of the mechanisms involved (cf., e.g., Ross, 1967; Schein, 2017; Hirsch, 2017). The surface scope of the coordinator, under these assumptions, reveals the minimal possible scope of the coordination.

(4) a. Spike bit Tom $\{\text{or/and}_{\text{CR}}\}$ Jerry.
b. [[Spike bit Tom] [$\{\text{or/and}_{\text{CR}}\}$ [~~Spike bit~~ Jerry]]]

This approach offers multiple benefits: it adopts a single lexical entry for each coordinator, which is the logical coordinator, and avoids the assumption that grammar must incorporate special mechanisms to generate systematic ambiguity in the case of coordination (i.e., type shifting). We will henceforth refer to this approach as conjunction reduction, or coordination reduction ('CR'), to highlight its applicability to disjunction as well as conjunction.

The other family of approaches assumes, instead, that the semantics of coordination constructions aligns with what we get at surface form: what seems like DP coordination, for example, is in fact DP coordination (cf. Partee and Rooth, 1983). A general scheme is represented in (5): hence, sentences like (4a) can have the simple structure in (6) under this approach. We will refer to this type of approach as the flexibility approach, since it takes coordinators to be flexible in being able to coordinate elements of different semantic types.

(5) $[_{\text{XP}} \ldots]$ $\{\text{and/or}_{\text{FL}}\}$ $[_{\text{XP}} \ldots]$
where XPs are of a *conjoinable* type[2]

(6) Spike bit $[[_{\text{DP}}$ Tom] or/and $[_{\text{DP}}$ Jerry]]

This paper presents evidence that challenges the CR approach. We begin by presenting the data and the problem it poses for CR. We then show how the flexibility approach straightforwardly accounts for it. In the last section, we rehearse different strategies of how to solve the problem while remaining loyal to CR, all of which run into some problem or other.

2. Reconstructing Coordination

Our data consists of subject DP coordinations in raising constructions. We focus on conjunction and disjunction in two different environments. Importantly, we show that the flexibility approach can easily account for the data, while the CR approach falls short.

2.1. Reconstructing conjunction

We begin with apparent subject DP conjunction. Consider (7a), which has two possible readings, described in (7b) and (7c).[3] The strong (and preferred) reading is represented in (7b), which is that Gali is unlikely to go to the party, and Tali is unlikely to go to the party. Another, weaker reading is represented in (7c), which is that it is unlikely that both go. For this weaker reading to be more readily accessible, rising pitch accent, or 'topic accent', may be required on the conjunction, and falling pitch accent, or 'focus accent', on *unlikely* (cf. Büring, 1997, 2003). This focus marking should also helps one to avoid getting a homogeneity inference that would collapse the readings (see, e.g., Szabolcsi and Haddican, 2004).

[2]Traditionally (Partee and Rooth, 1983), the coordinated XPs are assumed to be of a conjoinable type, where t is a conjoinable type and if τ is a conjoinable type, then for all types σ, $\langle\sigma, \tau\rangle$ is a conjoinable type. For alternatives, see Link (1983), Krifka (1990), and Schmitt (2013), among others.

[3]We assume that *un-* modifies Adj heads (e.g., Collins, 2023), and use the simplified notation of $\neg\ell$ for referring to the meaning of *unlikely*.

(7) a. Gali and Tali are unlikely to go to the party.
b. $\neg\ell$ (Gali goes to the party) $\wedge$ $\neg\ell$ (Tali goes to the party) **(strong reading)**
c. $\neg\ell$ (Gali goes to the party $\wedge$ Tali goes to the party) **(weak reading)**

To show that, indeed, both readings of the sentence are available, consider the felicitous continuation in (8). Clearly, it contradicts the stronger reading in (7b), but it is perfectly compatible with the weaker reading in (7c).

(8) Gali and Tali are unlikely to go to the party, though one will go for sure.

The weak reading in (7c) crucially depends on the embedding predicate outscoping the conjunction, as represented. This is captured by the condition in (9): When raising constructions have apparently coordinated DPs in subject position, an LF must be available on which the coordination is interpreted in the scope of the raising predicate.

(9) Scope Condition:
A raising construction in which a coordinator scopes above a raising predicate at surface form can have an LF where the reverse scope holds.

2.2. Reconstructing disjunction

Before introducing our next data point, we introduce the phenomenon of free choice (Kamp 1973, i.a). Consider the disjunctive sentence in (10), which conveys a conjunctive meaning, also called the free choice ('FC') inference, provided in (11).

(10) Gali is allowed to watch The Thing or Eraserhead.

(11) ($\Diamond$ Gali watches The Thing) $\wedge$ ($\Diamond$ Gali watches Eraserhead)

While there are different theories of how this reading can be derived (cf. Aloni, 2007; Fox, 2007; Franke, 2009; Goldstein, 2019; Bar-Lev and Fox, 2020), what they all have in common is, roughly, the general schema in (12): a mechanism (pragmatic or semantic) applies to an LF in which disjunction takes *narrow scope* relative to the modal. While the specifics of the different derivations are inconsequential to our goal, it is crucial that this scope relation between the modal and disjunction obtains to get the FC interpretation in (11).

(12) ($\mathbf{OP}_{\text{FC}}$) [allowed [... or ...]] $\Rightarrow$ ($\Diamond$ ...) $\wedge$ ($\Diamond$ ...)

We can now return to subject DP disjunction. Consider the sentence in (13a). It has two possible readings: an ignorance reading, as in (13b), on which it is not known which of Gali or Tali is allowed to go to the party; and the FC reading, described in (13c). On this reading, Gali is allowed to go to the party, and Tali is allowed to go to the party (but perhaps it is forbidden that both go).

(13) a. Gali or Tali are allowed to go to the party.
b. ($\Diamond$ Gali goes to the party) $\vee$ ($\Diamond$ Tali goes to the party) **(ignorance reading)**
c. ($\Diamond$ Gali goes to the party) $\wedge$ ($\Diamond$ Tali goes to the party) **(free choice reading)**

To accentuate the availability of the FC reading, consider the conversation in (14). B's answer is a perfectly reasonable response under the FC reading since it expresses that one of the conjuncts in (13c) may be wrong. However, it is not an adequate response on the ignorance reading —

on that reading, A does not convey that Tali is allowed to go to the party, and B's reply does not contradict anything (incl. any ignorance inference).

(14) A: Gali or Tali are allowed to go to the party.
B: You may be wrong, Tali might not be allowed to go.

As previously noted, the FC interpretation requires that the disjunction is interpreted at LF in the scope of the modal predicate, as presented in (15). Only in this case can the LF be strengthened to yield the intended interpretation. Thus, the Scope Condition in (9) is instanced once more.

(15) [allowed [[Gali goes to the party] or [Tali goes to the party]]]

Having illustrated the Scope Condition for both disjunction and conjunction, we move forward to test which approach to coordination, namely CR or flexibility, furnishes suitable LFs.

2.3. Mapping problem for naive CR

The readings of the sentences described above are not obviously expected on the CR approach. This holds because the scope of coordination at LF should be at least as great as the surface scope of the coordinator, all else equal. Starting with the conjunction data set, a straightforward attempt to get at an LF for (7a) (repeated below in 16) under CR assumptions yields (17a). This LF encodes the strong reading, described in (17b): *unlikely* is outscoped by the conjunction, in breach of the Scope Condition.

(16) Gali and Tali are unlikely to go to the party.

(17) a. LF for (6a) under (naive) CR
[Gali ~~be unlikely to go to the party~~] [and$_{CR}$ [Tali are unlikely to go to the party]]
b. $\Rightarrow \neg\ell$ (Gali goes to the party) $\wedge$ $\neg\ell$ (Tali goes to the party) **(strong reading)**

While the strong reading entails the target weak reading, it is too strong, as demonstrated in section 2.1. A similar issue is found in free choice examples. Simple CR assigns the sentence in (13a) (repeated below in 18) the LF in (19a), which consists of clausal coordination. This LF does not adhere to the scope condition in (9): the modal predicate is interpreted in the scope of the disjunction, yielding only the ignorance reading (19b) and not the FC reading (19c), whether we apply the free choice generating mechanisms or not.

(18) Gali or Tali are allowed to go to the party.

(19) a. LF for (13a) under (naive) CR
[[Gali ~~be allowed to go to the party~~] or$_{CR}$ [Tali are allowed to go to the party]]
b. $\Rightarrow$ ($\Diamond$ Gali goes to the party) $\vee$ ($\Diamond$ Tali goes to the party) **(ignorance reading)**
c. $\not\Rightarrow$ ($\Diamond$ Gali goes to the party) $\wedge$ ($\Diamond$ Tali goes to the party) **(free choice reading)**

There is a possible narrow-scope coordination LF for both cases, where each coordinated constituent is truth-value denoting, presented in (20). Crucially, none of the standard assumptions about ellipsis seem to allow us to get (20) from the surface structure in (7a)/(13a), where the coordination scopes over the raising predicate. We are faced with a *scope mapping problem*: the surface scope structures cannot be mapped to the inverse scope LFs on the CR analysis, which assumes the coordination of two truth-denoting constituents.

(20) [⟨unlikely/allowed⟩ [[Gali goes to the party] [⟨or/and$_{CR}$⟩ [Tali goes to the party]]]]

In Section 3, we explore various mechanisms aimed at resolving this issue, all of which ultimately fall short. It is important to note that this mapping problem is inherent only to the CR approach. In contrast, the flexibility approach doesn't encounter any such issue, as we will illustrate in the following section.

2.4. Straightforward account: Flexibility

Our data present a challenge specifically to the CR approach to coordination, while alternative approaches readily account for it. One such alternative is the flexibility approach we mentioned earlier, positing that coordination can compose with various constituents, and is not strictly limited to truth-value denoting ones.

One formulation of this approach assumes that the grammar possesses the capacity to shift the meanings of coordinators and other components, allowing them to properly combine (cf. Partee and Rooth, 1983).[4] Flexibility easily captures the target LFs we seek for our data, thus yielding the required interpretations. For the conjunction example in (7a) flexibility can assign it the LF in (21).[5] This LF is attained by reconstructing the coordination phrase from its subject position at the surface level (21b).

(21) a. Surface: [[[Gali] and$_{FL}$ [Tali]]$_1$ unlikely [t$_1$ to go to the party]]
b. LF: [unlikely [[[Gali] and$_{FL}$ [Tali]] to go to the party]]

On this LF, *unlikely* outscopes the conjunction, in alignment with the scope condition in (9). The same reconstruction process can be applied to the disjunction example in (13a), as illustrated in (22). As mentioned earlier, strengthening (or other means) can provide the desired FC interpretation on the basis of the LF in (22a).

(22) a. Surface: [allowed [[[Gali] or$_{FL}$ [Tali]] go to the party]]
b. LF: [[[Gali] or$_{FL}$ [Tali]]$_1$ allowed [t$_1$ go to the party]]

Additionally, under this account, the parses on which the subject does not reconstruct yield the other readings available for these data (the strong reading for conjunction, 7b, and the ignorance reading for disjunction, 13b).

3. Towards a CR derivation

As was mentioned before, there is a possible LF for the narrow-scope of coordination, where each coordinated constituent is truth-value denoting, repeated here (schematically) in (23). However, the standard mechanisms assumed to be available to CR do not obviously allow (23) to be an LF of (7a)/(13a). Let us elaborate more on that matter.

(23) [*Raising predicate* [[...] [{or/and$_{CR}$} [...]]]]

[4] Alternative theories of semantic flexibility can be found in Link (1983), Krifka (1990), Winter (2001), Schmitt (2013), Champollion (2016), and others. We suppress their discussion here for brevity.

[5] While we aim to abstract from the specifics, or_{FL} can be formally analyzed as the propositional logic disjunction type-shifted to combine with quantifiers $[\![\text{or}_Q]\!] = \lambda Q_{\langle\langle et\rangle t\rangle}.\lambda Q'_{\langle\langle et\rangle t\rangle}.\lambda P_{\langle et\rangle}.Q(P) \vee Q'(P)$, and the proper names Montague Lifted (Partee, 1986), i.e., $[\![\text{Gali}\hat{}]\!] = \lambda P_{et}.P(\text{Gali})$.

3.1. Right Node Raising?

Usually, in discussing conjunction reduction, the focus is on coordinated DPs in object position. However, all of our examples have coordination in the subject position. It is independently hard to deal with subject coordination in a way compatible with the theories of ellipsis. To illustrate this, consider again the CR derivations of (7a) and (13a), repeated here as (24) and (25), respectively.

(24) [Gali ~~be unlikely to go to the party~~] [and$_{CR}$ [Tali are unlikely to go to the party]]

(25) [[Gali ~~be allowed to go to the party~~] or$_{CR}$ [Tali are allowed to go to the party]]

These structures not only have the unintended meanings, as we mentioned above, they are also ill-formed for an independent syntactic reason. In all these cases, the Backward Anaphora Constraint (BAC) is violated, which intends to block ellipsis from applying to an element that precedes its antecedent in a coordinate structure (Langacker, 1969: 171).

For cases where there seems to be an operation of backward deletion (particularly in verb-final languages like Japanese), it was suggested that a different operation than standard ellipsis takes place: Right Node Raising (Hankamer, 1979: 103-123). Hirsch (2017) utilizes this operation to derive *subject* DP coordination, as the one in (26a). He assumes that the underlying structure of such coordinations would be TP coordination, as in (26b). In order to get the surface structure, he then suggests that RNR takes place, by which the rightmost shared material may be pronounced once at the end of the sentence, as seen in (26c).

(26) Derivation of subject DP coordination in CR:
  a. Every student and every professor came.
  b. [$_{\&P}$ [$_{TP}$ every student [$_{VP}$ came]] [and$_{CR}$ [$_{TP}$ every professor [$_{VP}$ came]]]]
  c. [[$_{\&P}$ [$_{TP}$ every student t_1] [and$_{CR}$ [$_{TP}$ every professor t_1]]] [$_{VP}$ came]$_1$]

As Hirsch points out, there is no consensus regarding what the syntax of RNR involves, so we will remain vague about the details as well - whatever mechanism is available for (26) should also be able to apply in our examples. Unfortunately, simply transferring RNR to the derivation of (7a)/(13a) would not yield the required readings. Consider again the conjunction example in (7a). Although we can derive the correct surface form through RNR movement, as in (27b), because at LF, represented here in (27a), *unlikely* does not scope over the conjunction, there is a violation of the scope condition we need for deriving the intended reading.

(27) a. Possible CR underlying structure of (15a):
  [$_{\&P}$ [$_{TP}$ Gali [allowed to go to the party]] [or$_{CR}$ [$_{TP}$ Tali [allowed to go to the party]]]]
  b. RNR to get surface form:
  [[$_{\&P}$ [$_{TP}$ Gali t_1] [or$_{CR}$ [$_{TP}$ Tali t_1]]] [allowed to go to the party]$_1$]

But let's assume that the raising predicate, *unlikely*, originates above the conjunction and not below it, as in (28a) – this LF is the one required to get the intended meaning. Now, in order to get the surface form, the verb phrase RNRs out of each conjunct, as in (28b-i), and finally, the remaining clause that now contains overtly only *Gali and Tali* raises to the subject position (28b-ii).

(28) a. Required CR underlying structure of (15a):

[unlikely [[[Gali to go to the party] [and$_{CR}$ [Tali to go to the party]]]]]

b. Movement to surface form:
   (i) RNR:
   [unlikely [[[Gali t_1] [and$_{CR}$ [Tali t_1]]][to go to the party]$_1$]]
   (ii) Remnant movement:
   [[[Gali t_1] [and$_{CR}$ [Tali t_1]]]$_2$ [are unlikely [t_2 [to go to the party]$_1$]]]

This derivation is problematic for several reasons. For example, this account makes at least one false prediction: the subject of the structure is a clause, and, hence, we should find singular agreement on the verb. However, the original sentence crucially requires plural agreement. Something else is needed.[6]

3.2. Predicate movement?

Another logical possibility is that the raising predicate originates inside each clause and moves across-the-board at LF (cf. Simons, 2005; Meyer and Sauerland, 2017). Take the disjunction example from (13a). Its CR base structure is provided in (29a). Now, we assume that *allowed* can move out of both disjuncts, as represented in the LF in (29b). This LF can yield the free choice reading as all that is needed is strengthening.

(29) a. Base structure:
   [[Gali [allowed to go to the party]] [or$_{CR}$ [Tali [allowed to go to the party]]]]
   b. Covert movement of the modal:
   [allowed$_1$ [[Gali [t_1 go to the party]] [or$_{CR}$ [Tali [t_1 go to the party]]]]]

However, we face again a number of problems. In particular, Meyer and Sauerland (2017) note that overt full clausal coordination with predicates like *allowed*, i.e., the overt counterpart of (29a), lacks the FC reading we derive here (see, e.g., Zimmermann 2000; Geurts 2005, for a different type of wide-scope disjunction examples). One puzzling question that arises from this observation is why should the described covert across-the-board movement require CR ellipsis.

Moreover, if we can move the predicate so that it outscopes the disjunction, we are likely to overgenerate. To see this, consider (30a), where we added the modifier exactly twice to the original sentence. Allowing for the predicate to move should make it possible for the sentence to convey (30b), which is not the case; we only get the meaning paraphrased in (30c) (cf. Gotzner et al. 2020 for the derivation of FC interpretations in non-monotone environments).

(30) a. Gali or Tali have been exactly twice allowed to go to a party.
   b. (It's allowed that Gali goes to a party exactly twice) and (it's allowed that Tali goes to a party exactly twice)
   c. Exactly twice was it the case that (Gali was allowed to go to a party) and (Tali was allowed to go to a party)

Once again, something else is needed.

[6]The failure of RNR can be presented for the disjunction case in (13a), too. However, as McCawley (1998: 301) already observed, among others, *or* can trigger singular agreement as well as plural agreement. Thus, we chose to highlight the issue in the conjunction case alone.

3.3. Clausal nominals?

Finally, the CR approach may allow for coordination of proper names if these are underlyingly clausal nominal (cf. e.g., Stowell 1981, Heim and Kratzer 1998, for such an analysis of nominals outside the context of coordination). Consider the structures in (31)/(32) for the sentences in (7a)/(13a), respectively, where the subject of the clauses, variable x, is a PRO that is abstracted over. These structures yield the desired readings.[7]

(31) [unlikely [[$\exists$ [λx [$x \geq$ Gali and$_{\text{CR}}$ $x \geq$ Tali]]] go to the party]]

(32) [allow [[$\exists$ [λx [$x \geq$ Gali or$_{\text{CR}}$ $x \geq$ Tali]]] go to the party]]

While this route is *prima facie* promising, free choice readings and reconstructed conjunction readings are also possible with coordinations of full quantificational DPs. Two examples are in (33)/(34), which have the reconstructed conjunction and free choice readings, respectively.

(33) Most professors and all lecturers are unlikely to go to the party.
$\Rightarrow \neg\ell$ (most professors go to the party $\wedge$ all lecturers go to the party)

(34) Most professors or all lecturers are allowed to go to the party.
$\Rightarrow$ ($\Diamond$ most professors go to the party) $\wedge$ ($\Diamond$ all lecturers go to the party)

These examples resist even the extended CR analysis that we sketched in (31)/(31), since an analogous clausal analysis of quantifiers would require yet further mechanisms, which we will not explore here.

4. Conclusion

We have presented a new family of observations that are, on the face of it, not compatible with a coordination reduction approach. The observations and the arguments capitalize on the ability of DP coordination to reconstruct in raising constructions.[8] Crucially, the observations we described cannot be captured if each junct of a coordination reconstructs separately — rather, the coordinator itself (hence, the full coordination phrase) must reconstruct. This can, of course, be easily accounted for on a flexibility approach to coordination. It goes without saying that a wealth of other data must be explained on an adequate theory of coordination, none of which we could attend to here (see, e.g., Schmitt 2013; Hirsch 2017; Schein 2017; Champollion 2016, for some recent advances).

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[7] We take $\geq$ to be a primitive parthood relation. For more details see, e.g., Champollion and Krifka (2016).

[8] We focused only on two combinations of coordinators and embedding predicates: conjunction + a downward-entailing predicate (*unlikely*), and disjunction + an upward-entailing predicate (*allowed*). Our reasoning extends to various other combinations that we set aside for brevity. We also skipped the discussion of how adverbial modification in coordinated phrases, which is often taken to argue for coordination reduction (e.g., Schein 2017, Hirsch 2017), affects the availability of the reconstructed readings – on the face of it, it seems not to affect it.

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