Towards a unified asymmetric semantics for *and*[*]

Bronwyn M. Bjorkman, MIT
bmbjork@mit.edu

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1 Introduction

This talk addresses the relationship between **logical** (or **symmetric**) *and* (1a) and **asymmetric** (temporal/causal) *and* (1b-c):

(1)   a.   Water freezes at 0°C, and ethanol freezes at -114°C.
         b.   The lights came on and the singer stepped onto the stage.
         c.   The sniper shot him and he died.

Why 'asymmetric'? (1b-c) do not mean the same thing when their clauses are reversed, as in (2). This contrasts with both 'logical' *and* (3) and to sequences of clauses in a discourse (4).

(2)   a.   The singer stepped onto the stage and the lights came on. ($\neq$ (1b))
         b.   He died and the sniper shot him. ($\neq$ (1c))

(3)   Ethanol freezes at -114°C and water freezes at 0°C. (= (1a))

(4)   The sniper shot him; he died. = He died; the sniper shot him.

The question: What is the semantic relationship between logical and asymmetric *and*?

Previous answers: $[\![and]\!] = \wedge$; asymmetric *and* results from **pragmatics/discourse**. (Grice, 1975; Schmerling, 1975; Carston, 1993, 2002; Blakemore and Carston, 1999, 2005; Txurruka, 2003; Ariel, 2008)

A new answer: The difference between logical and asymmetric *and* is **semantic, not pragmatic** and arises because of a **structural** ambiguity between TP and CP coordination.

Embedded coordination shows that the visible difference between CP and TP coordination tracks the interpretive difference between logical and asymmetric *and* (to be discussed in section 2.1):

These data challenge previous pragmatic accounts, which have implicitly assumed that clausal *and* involves constituents of the same size and type in both logical and asymmetric uses.

The fact that _and_ would behave differently with TPs and CPs is _expected_: given properties of coordination in other domains:

VP coordination has varying properties depending on the size of the coordinated constituents (Ross, 1967; Goldsmith, 1985; Lakoff, 1986).

Nominal coordination is known to have different interpretations depending on the size of the coordinated constituents, i.e. NP vs. DP coordination (Dowty, 1988; King and Dalrymple, 2004; Heycock and Zamparelli, 2005).

So indeed we might have been surprised if there were **no** interpretive difference between TP and CP coordination.

Finally: the position that the connectives of classical logic have precise counterparts in natural language has been losing ground in generative linguistics: for example, the once-widepread view that _if-then_ conditionals express material implication has now been replaced by the modal restriction analysis (Kratzer, 1986, et seq.).

So the argument that theoretical parsimony privileges an analysis of _and_ as ∧ has independently lost some of its force since Grice (1975).

2 The data: interpreting clausal coordination

2.1 Embedded clausal coordination: structure tracks interpretation

In this section we start with **embedded** coordination. We will see that:

- The temporal/causal readings of asymmetric _and_ are available only to **TP** coordination.

- The independent readings of logical _and_ are available only to **CP** coordination.

This **structural** correlation naturally suggests a **semantic** account of the interpretive difference.

TP vs. CP coordination

(5) a. The newspaper reported that a new mayor was elected and there was a riot.
     b. The newspaper reported that a new mayor was elected and that there was a riot.

- **These sentences are _structurally_ different.**

  (5a) involves a single instance of _that_, and an embedding verb that **strongly prefers** complements introduced by _that_. It therefore appears to involve **TP** coordination of the embedded clauses.[1]

$$\text{(i)} \qquad report \ [_{CP} \ that \ [_{TP} \ \dots] \ and \ [_{TP} \ \dots] \ ]$$

  (5b) has two instances of _that_, and so therefore must involve **CP** coordination.

$$\text{(ii)} \qquad report \ [_{CP} \ that \ \dots] \ and \ [_{CP} \ that \ \dots]$$

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[1]Because _report_ prefers an overt complementizer for embedded clauses, we might think that the absence of a second complementizer _requires_ a TP-coordination parse. However, examples in the literature suggest that English coordinated complements can violate subcategorization requirements:

(i)   You can depend on my assistant and that he will arrive on time. (Progovac, 1998, citing Gazdar et. al, 1985)

We therefore cannot necessarily conclude that a TP-coordination parse is _forced_ in (5).

- **These sentences are also *interpretively* different.**

  In the scenario in (6), where it is made clear that there is no relation between the two clauses, TP coordination is judged to result in an inaccurate report:

(6) *Scenario: the newspaper ran two unrelated stories yesterday. In the first it reported that the incumbent mayor was defeated in yesterday's election; in the second it reported on a riot that occurred in the wake of last night's hockey game.*
   a. #The newspaper reported that a new mayor was elected and there was a riot.

   (= TP coordination)
   b.   The newspaper reported that a new mayor was elected and that there was a riot.

   (= CP coordination)

  Similarly, when the context *does* support a causal link between the clauses, CP coordination (as in (7b)) is felt to be *less informative* than TP coordination (as in (7a)):

(7) *Scenario: An engineer said: "The dam broke. As a direct consequence of that, the valley below the dam flooded."*
   a.   The engineer has confirmed that the dam broke and the valley flooded.

   (= TP coordination)
   b.   The engineer has confirmed that the dam broke and that the valley flooded.

   (= CP coordination)

  Finally, CP coordination does not *exclude* an inferred reverse temporal/causal interpretation. TP coordination *does* exclude such interpretations:

(8) *Scenario: same as (7)*
   a. #The engineer has confirmed that the valley flooded and the dam broke.

   (= TP coordination)
   b.   The engineer has confirmed that the valley flooded and that the dam broke.

   (= CP coordination)

Generalization:
Embedded **TP** coordination asserts an asymmetric relation between events.
Embedded **CP** coordination does not assert a temporal/causal relation between events.[2]

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[2]There is also some evidence that this is true of embedded non-finite clauses headed by *for*:

(i)   a.   The conspirators planned for the White House to explode and the president to die.
      b.   The conspirators planned for the White House to explode and for the president to die.

(ib), but not (ia), seems to be compatible with a plan in which the president is not meant to die in the explosion of the White House.

This generalization is supported by evidence from languages other than English.

- In **Modern Greek**, embedded finite clauses *must* be introduced by a complementizer, as shown in (9):

  (9)   Ksero   *(oti) i   Maria ton apelise
        know.1SG COMP DET Maria him fired.
        "I know (that) Maria fired him."

  The example in (10) therefore must involve TP coordination, because only one complementizer is present. (11) has two complementizers, and therefore presumably two CPs:

  (10) Ksero   **oti** [o   Yanis skondapse] ke [i   Maria ton apelise]
        know.1SG COMP DET Yanis tripped.3SG and DET Maria him fired.
        "I know that Yanis tripped and Maria fired him." (because they're in a dance troupe)

  (11) Ksero   [**oti** o   Yanis skondapse] ke [**oti** i   Maria ton apelise]
        know.1SG COMP DET Yanis tripped.3SG and COMP DET Maria him fired.
        "I know that Yanis tripped and that Maria fired him." (the two aren't necessarily related)

  As in English, TP coordination results in a strong causal reading, whereas CP coordination does not.

- **Dutch** shows the same pattern: the TP coordination in (12) has an asymmetric interpretation, while the CP coordination in (13) has a symmetric/logical interpretation.

  (12) De krant   berichtte **dat** [de minister een nieuwe burgemeester benoemd
        the newspaper reported that the minister a   new   mayor   appointed
        had] en [er   rellen waren.]
        had   and there riots were
        "The newspaper reported that the minister appointed a new mayor and there were riots."

  (13) De krant   berichtte [**dat** de minister een nieuwe burgermeester benoemd
        the newspaper reported that the minister a   new   mayor   appointed
        had] en   [**dat** er   rellen waren.]
        had   and that there riots were
        "The newspaper reported that the minister appointed a new mayor and that there were riots."

Interim summary

- Embedded **TP** coordination produces **asymmetric** interpretations.
- Embedded **CP** coordination produces **logical/symmetric** interpretations.

What about matrix coordination?

2.2 Extending this to matrix clausal coordination

(14) illustrates a range of the temporal/causal interpretations available to *and*:

(14)   a.   The lights came on and the singer stepped onto the stage.
       b.   The sniper shot him and he died.
       c.   The dam broke and the valley flooded.
       d.   We spent the day in town and I went to Harrods.[3]
       e.   The lights were off and I couldn't see.[4]

All of these sentences potentially **also** have logical/symmetric interpretations.

Matrix coordination has **both** logical and asymmetric interpretations. It is also (in English) **ambiguous** between TP and CP coordination.

We therefore tentatively extend the generalization of the previous section as follows:

> **Structural conditions for *and*'s interpretation:**
> All cases of asymmetric *and* involve TP coordination.
> All cases of symmetric *and* involve CP coordination.

Focus provides evidence that when **CP** coordination is required, only **symmetric** interpretations arise:

- Consider the example in (15), where focus in each of the two conjuncts can invite a listener to infer a reverse temporal/causal relation (an observation attributed to Larry Horn by Carston 1993):

  (15)   A: Did Bill break the vase?
         B: Well, the vase BROKE, and HE dropped it.

  The reverse interpretation in (15) is *less-direct* than the "forward" interpretation usually available to coordination (Carston, 2002, among others) – while asymmetric *and* directly conveys a temporal relation, (15) appears simply to invite the listener to draw a certain conclusion.

- It is reasonable to think that the separate focus in each of the conjuncts in (15) requires that *each* conjunct have a CP layer, given the proposal that focus involves a relationship between a focused element and the left periphery, as in, for example, the articulated proposals for the CP layer in Rizzi (1997).

- We can therefore attribute the availability of the "reverse" interpretation to the fact that focus requires a parse of CP coordination. CP coordination, by the generalization above, results in an interpretation of symmetric or logical *and*. Listeners are free to draw reverse temporal/causal inferences on the basis of logical *and*, because it does not convey any such relation on its own.

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[3]Example originally from Carston (1993).
[4]Example originally from Schmerling (1975).

- Note that parallel reverse inferences are available to **embedded** CP coordination:

  (16) a. WELL, the millionaire DIED, and the butler gave him POISON.
     b. We know that the millionaire died and that the butler gave him poison.
      . . . and so we can conclude that the butler intentionally murdered him.

Moreover, interpretations of *and* can be **manipulated** in a way that parallels known cases of structural ambiguity:

- The fact that the temporal/causal inferences of *and* are *cancelable* has been used to argue that these interpretations arises in the pragmatics (example from Bar Lev and Palacas, 1980):

  (17) If the old king has died of a heart attack and a republic has been formed, and the latter event has caused the former, then Tom will be upset.

- In cases of structural ambiguity, however, subsequent grammatical material can **resolve** the ambiguity – this kind of ambiguity resolution could be what is happening in (17).

  (18) I saw a man with a telescope (. . . though he was close enough to see with the naked eye).

- Similarly, there are cases where world knowledge influences us to infer a reverse temporal relationship (example adapted from Blakemore and Carston 1999):

  (19) She did her PhD in the US and she did her MA in Canada.

  In these scenarios it is world knowledge rather than an explicit cancellation that influences a parse as logical/symmetric *and*, just as it does in (20):

  (20) I saw a man with a teapot.

These kind of data support the conclusion that in matrix contexts, the interpretation of coordination is the result of a **structural ambiguity** between TP and CP coordination.[5]

3 A preliminary asymmetric semantics for *and*

What we have seen so far is that the **interpretation** of coordination tracks its **structure**. Specifically, it tracks the *size* of the constituents being coordinated.

  This generalization is **problematic** for pragmatic approaches to the interpretation of *and*: theories of discourse and pragmatics are not 'built', generally speaking, to be sensitive to syntactic constituency.

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[5]The true state of affairs is likely more subtle than this, because coordinated matrix V2 clauses in Dutch and German have both asymmetric and logical interpretations, despite the fact that V2 is generally accepted to involve movement to the CP domain, and despite the fact that *embedded* coordination in both languages shows the same pattern as in English, with single-complementizer structures being asymmetric while two-complementizer structures have logical interpretations. What this suggests is that finer distinctions must be made than simply 'TP' vs. 'CP', between *sizes* of 'CP' structures, such that matrix V2 CPs in Dutch and German are *smaller* than embedded CPs with complementizers.

This section proposes that *and* has a single denotation, and that its interpretation changes as a function of the semantic types of the constituents it coordinates — not only TP vs. CP, but potentially VP, NP, and DP as well.

This differs from previous semantic approaches to asymmetric *and*:

Bar Lev and Palacas (1980) proposed that *and* had temporal asymmetry built into its meaning, but proposed that logical *and* should be pragmatically derived from asymmetric *and*, while the proposal here is that *and* has a single denotation that can appear in a variety of structures.

Where to begin? The interpretation of asymmetric *and*.

(21), repeated from (14), shows a range of the interpretations available to asymmetric *and*:

(21)   a.   The lights came on and the singer stepped onto the stage.
        b.   The sniper shot him and he died.
        c.   The dam broke and the valley flooded.
        d.   We spent the day in town and I went to Harrods.
        e.   The lights were off and I couldn't see.

Not all of these involve an actual *sequence* of events:

- (21a) involves a sequence of events.

- (21b-c) involve a temporal sequence with an additional causal element.

- (21d) involves a background event within which the second clause is contained.

- (21e) involves a background event that contains the second clause, with an additional causal element.

Asymmetric *and* appears to express a general relationship between events: the event of the second clause *follows upon* the event of the first clause.

A preliminary proposal adapted from nominal coordination:

- Heycock and Zamparelli (2005) propose that *and* in the nominal domain involves set product, illustrated in (23):

(22)   Set Product (SP)   (Heycock and Zamparelli 2005, p. 241)
        SP $(S^1, \ldots, S^n) =_{def} \{X : X = A^1 \cup \ldots \cup A^n, A^1 \in S^1, \ldots, A^n \in S^n \}$

(23)   ⟦ *A and B* ⟧, where A = {a, b, c} and B = {c, d}
    = { {a,c}, {a,d}, {b,c}, {b,d}, {c}, {c,d} }

- If we assume that TPs denote sets of temporally-located situations (i.e. *propositions*, in a situation-based semantics), this denotation for *and* could be applied to clausal coordination but would not yield the required *asymmetry* between events.

- Imagine that Heycock and Zamparelli's denotation for *and* returned not a set of tuples (sets) but a set of *ordered* tuples. [6]

(24) ⟦ *A and B* ⟧, where A = {a, b, c} and B = {c, d}
      = {⟨a, c⟩, ⟨a, d⟩, ⟨b, c⟩, ⟨b, d⟩, ⟨**c**, **c**⟩, ⟨c, d⟩}

- This would produce an intrinsic semantic order between conjuncts.

- We can assume that this ordering will be semantically meaningful only when the members of the ordered tuples are *orderable*.

- Presumably situations, with temporal extension, can be ordered with respect to one another; perhaps concrete individuals or sets of individuals/situations cannot be.

The core of this proposal:

and is interpreted **asymmetrically** when it coordinates **situations**
and is interpreted **symmetrically** when it coordinates **non-situations**

This looks promising:

TPs = situations   and they have asymmetric interpretations.

CPs = non-situations   and they have symmetric interpretations.

> The semantic literature does not assume a single denotation for CPs, or even for CPs introduced by *that*.

> Embedded CPs can be viewed as *abstractions* over propositions (i.e. sets of sets of situations, Portner, 1992) when they occur under attitude predicates – in this case they would not denote situations, and so fit the generalization above. Embedded CPs can also be viewed as *facts*, which are independent of particular times and so presumably not temporally orderable (Asher, 1993)

> Preliminarily, then, we might propose that embedded CPs denote objects that have no sensible interpretation as 'ordered'. For matrix CPs, we will want to say something similar.

> For matrix CPs, we may have to say something different. We might assume that matrix CPs simply denote truth values (propositions that have been saturated by the utterance context), which have no semantically relevant ordering and so produce symmetric results.

VPs (or *v*Ps) = situations   (Kratzer, 1993, 1996, et seq.) and they have asymmetric interpretations (Ross, 1967; Goldsmith, 1985; Lakoff, 1986).

(25) a. Alice went to the store and bought milk.
      b. Alice bought milk and went to the store.

(26) a. A student can take six courses and stay sane.
      b. A student can stay sane and take six courses.

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[6]This would require some modification to work in Heycock and Zamparelli's analysis of nominal coordination. In general, ordered tuples of individuals would have to behave for all DP-internal purposes just like unordered sets (i.e. plural NPs). Among other details, this would require objects ordered with themselves ($< c, c >$) to behave like singleton sets for the purposes of their cardinality (i.e. $< c, c >$ would need a cardinality of 1). Exploring the details of this unification is beyond the scope of this talk.

DPs/NPs = variable Some nominals denote concrete individuals, and when coordinated these produce symmetric (unordered) interpretations:

(27)   the orange and apple = the apple and orange

Some nominals, however, do denote situations, particularly derived nominals like gerunds (Portner, 1992). These appear to have asymmetric properties in some cases:

(28)   a.   Someone's fall and death was the cause of improved safety regulations.
         b.   ≠ Someone's death and fall was the cause of improved safety regulations.

(29)   a.   Someone's falling and breaking their neck was the cause of improved safety regulations.
         b.   ≠ Someone's breaking their neck and falling was the cause of improved safety regulations.

4   Conclusion

This talk has argued against the predominant pragmatic account of the difference between logical and asymmetric *and*, by showing that it is possible to find a *syntactic correlate* of the interpretive difference between logical and asymmetric *and*:

- asymmetric *and* involves coordination of **TPs**

- logical *and* involves coordination of **CPs**

This observation was developed into a preliminary semantics for *and*, whose **key property** is that variability in *and*'s interpretation depends not on *and* itself, but on the semantic properties of the constituents it connects:

- asymmetric *and* results from coordinating **situation-denoting** constituents

- logical *and* results from coordinating **non-situation-denoting** constituents

It was suggested that this shows some promise for unification with *and* in other domains, including VP and nominal coordination.

Further topics for investigation:

- Further investigation of this semantic implementation of *and*

- Cross-linguistic properties of asymmetric *and*

- Extension to other asymmetric uses of *and*: conditional *and* (see Appendix), VP coordination.

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A   Extension to conditional uses of *and*

An advantage of treating *and* as asymmetric comes in the domain of another asymmetric use of *and*.

So-called **left-subordinating *and*** ($_{LS}and$, Culicover and Jackendoff, 1997) is interpreted conditionally:

(30)   a.   The snake bites him and he'll die.
        b.   I lose my travel documents and my visa will be voided.
        c.   Big Louie sees you with the loot and he puts a contract out on you.[7]

- $_{LS}and$ has been discussed mostly in light of the fact that its first conjunct can be an *imperative* (Bolinger, 1967; Han, 2000; Russell, 2007; Schwager, 2005).

- It has also been noted that its first conjunct can be a DP (Culicover, 1970), and that the only modal that can occur in the first conjunct is a sufficiency modal (von Fintel and Iatridou, 2007).

(31)   a.   Move and I'll shoot!
        b.   One more drink and I'm heading home.
        c.   You *(only) have to pay attention and you'll get a good grade in that class.

A full understanding of left-subordinating *and* must account for these types of examples, but our concern here is with cases like those in (30), where both clauses are simple declaratives.

We want to unify $_{LS}and$ with other uses of *and*, because $_{LS}and$ exists in a wide variety of languages without using a different connective (Han, 2000; Iatridou, 2010) – it shouldn't be an accident that this is the case.

And indeed, $_{LS}and$ is very similar to the temporal/causal *and* that has been the focus of this talk:

1. $_{LS}and$ shares asymmetric *and*'s limitation to TP coordination.

    Culicover and Jackendoff observed that in a sentence like (32), the conditional interpretation is available *only* in the absence of the second *that*:

    (32)   You realize, of course, that you have one more drink and (*that) you'll be kicked out.

2. minimal pairs can be created between asymmetric *and* and $_{LS}and$ by controlling the interpretation of the tense in the first clause: $_{LS}and$ requires a generically-interpretable tense.

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[7]Example drawn from Culicover and Jackendoff (1997).

If we take the sentences from (30) and alter them so that we have non-generic tenses, we convert $_{LS}and$ to asymmetric *and*:

(33) a. The snake bit him and he died.
      b. I lost my travel documents and my visa was voided.
      c. Big Louie saw you with the loot and he put a contract out on you.

This suggests the following connection between the two uses of *and*:

> **left-subordinating *and* = asymmetric *and* + generic operator**

- If we're talking about two particular situations, *and* can order them with respect to one another.

- Interpreted generically, this asserts that events of a certain type *always* (or rather *generically*) lead to events of another type.

- This generic interpretation is similar, though not identical, to a conditional interpretation, and might explain a difference between $_{LS}and$ and *if-then* conditionals noted by Bolinger (1967): $_{LS}and$ requires that the second conjunct be an *intrinsic consequence* of the first conjunct:[8]

(34) a. A dog has blue eyes and it's probably a husky.
      b. #A dog has blue eyes and it's intelligent.

(35) a. A man buys a horse and it's his.
      b. #A man buys a horse and he pays cash for it.

This contrast makes sense if $_{LS}and$ requires *generic* truth to be felicitous: relationships that do not hold generically (or generically within a restricted domain) cannot be communicated using $_{LS}and$.

Some details of this unification remain to be worked out,[9] but the proposed asymmetric semantics for temporal/causal *and* provides greater chance at unification than previous analyses of $_{LS}and$, which have rested on the idea that *and* is essentially semantically vacuous in these constructions (in particular Schwager, 2005).

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[8]Examples adapted from von Fintel and Iatridou 2009.

[9]In particular, we would hope to explain some of the other conditional-like properties of $_{LS}and$, such as NPI-licensing and backwards variable binding (Culicover and Jackendoff, 1997).