

2.9. Main Form Phrase, Main Connective

1. Deceptively Similar Sentences. We have so far translated sentences no more complicated than a ‘triple-barreled’ English conjunction, or disjunction, which repeat the same type of form phrase (multiple conjunction phrases or multiple disjunction phrases). That much form poses no translation challenge deeper than finding the phrases in a look-up list. But once different types of form phrases – negation, conjunction, and disjunction phrases – are mixed together within the same sentence, we find ourselves in the deep end of the translation pool.

For instance, our earliest discussion of logical form referred to negations informally as “‘not’ sentences”. But it’s dangerously oversimplified to think of a negation simply as ‘a sentence containing “not”’ – for we could add “not” (or one of its variations) to a sentence of English without getting the negation of that sentence.

So consider the following similar-looking pair of sentences.

- Copyright Brian Beakley 2017
- (1) We won’t have **both** cake **and** champagne.
 - (2) We won’t have cake, **but** we’ll have champagne.

Our catalogue of translation variations treated “but” as the equivalent of “both... and”; so both sentences contain a negation and a conjunction phrase. And since both sentences string together the same subject matter sentences – “We’ll have ice cream” and “We’ll have cake” – (1) and (2) are built from all the same logical parts, (apparently) appearing in the same order.

Yet intuitively the two sentences stake quite different claims. For example, they score very differently on the ‘cake test’: does this sentence, if true, rule out our having cake? Sentence (2) certainly rules out cake. But Sentence (1) doesn’t: consistent with (1), we might well have cake (though in that case we wouldn’t also have champagne). For fans of cake, the difference between (1) and (2) is clear enough.

But the point should be just as clear – and just as important – to anyone concerned with validity. For Sentence (2) validly entails that we won't have cake, while Sentence (1) doesn't. That is: Argument (B) is valid, while Argument (A) is invalid.

Argument A	Argument B
(1) We won't have both cake <i>and</i> champagne.	(2) We're won't have cake, but we'll have champagne.
<hr/>	<hr/>
∴ We won't have cake.	∴ We won't have cake.
INVALID	VALID

Against the validity of Argument (A), consider again the situation where we have cake but no champagne. That's a case where the premise (Sentence 1) is true, while the conclusion is false – a validity counterexample for Argument (A). The difference between Sentences (1) and (2) is thus a difference that makes a difference to validity.

2. The Main Form Phrase. The fact that Arguments (A) and (B) are built from the same material, in the same order – a negation phrase, a subject matter sentence, conjunction phrase, second subject matter sentence – should be worrying. For while we've assumed that only logical form makes a difference to validity, the two sentences seem to have the same logical form. To preserve our guiding assumption that only form matters to validity, we need to find, on the contrary, some **difference in form** between Argument (A) and Argument (B).

Intuitively, the difference is that Sentences (1) and (2) are **different types of sentences**. Sentence (2) is a **conjunction**, asserting two smaller claims: (a) that we won't have cake, and (b) that we'll have champagne.

Sentence (1), by contrast, is a **denial**: (1) denies the claim that we'll have both ice cream and champagne. That makes Sentence (1) a **negation**.

And what follows validly from each sentence depends crucially on what type of sentence it is. In particular: one of our earliest examples of a valid logical form was a conjunction entailing its left part.¹

$$\frac{\bullet \text{ and } \blacktriangle}{\therefore \bullet}$$

That explains why Sentence (2) validly entails the conclusion “We won’t have cake”: Sentence (2) is a conjunction, and the conclusion is just the left part of that conjunction.

(2) We’re won’t have cake, but we’ll have champagne.

\therefore **We won’t have cake.**

But while all that makes sense, it seems we’ve only pushed the mystery back a step. For when told that (1) is a negation while (2) is a conjunction, someone might fairly ask: given that both sentences are built out of a conjunction phrase, a negation phrase, and the same two subject matter sentences, **why** do they wind up counting as different kinds of sentences?

Informally we resolve that mystery by saying that in each sentence one of the two form phrases acts as the **main form phrase** of the whole sentence, determining what kind of sentence it is overall. In Sentence (2) the conjunction phrase “but” acts as the main form phrase of the sentence – making (2) a conjunction.

(2) We won’t have cake, **but** we’ll have champagne.

The main form phrase of Sentence (1) is instead the negation phrase “n’t,” making (1) a negation.

(1) We won’t have *both* cake *and* champagne.

And what determines which form phrase acts as the **main** form phrase of the sentence? Answering that question returns us to sentence construction.

¹ In 2.1, and revisited in 2.4 §4.

3. The Main Connective. Consider the formal translation of Sentence (1). We're reading Sentence (1) as a denial – specifically, a denial of a “both... and” claim. To translate Sentence (1) into the formal language, we first translate that “both” claim, using the following translation key.

P: We'll have cake.

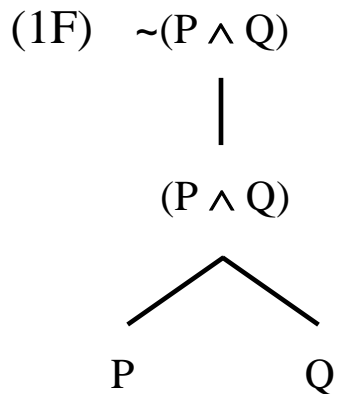
Q: We'll have champagne.

We'll have both cake and champagne $(P \wedge Q)$

For the denial of that formal sentence we then just attach a tilde to the left.

(1) We won't have both cake and champagne $(1F) \sim(P \wedge Q)$

The **construction** of Sentence (1F) follows exactly those steps: first adding a wedge (with parentheses), then a tilde.



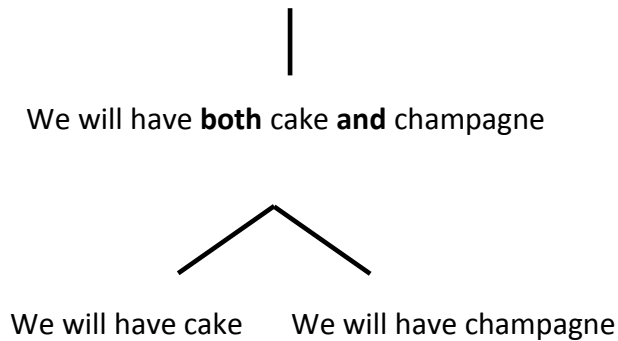
It's no mystery why the tilde is the **main connective** here, making the whole sentence a negation: the tilde is **the last connective added** in construction. In fact, that served as our definition of the “main connective” of a formal sentence.²

The **main connective** of a formal sentence is the last connective added in the construction of that sentence.

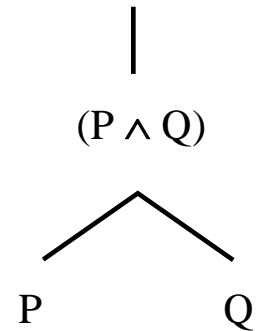
² In 2.8.

But then, reading the construction of Sentence (1) as parallel to its formal translation, “n’t” is the last form phrase added in its construction.

(1) We won’t have both cake and champagne



$\sim(P \wedge Q)$

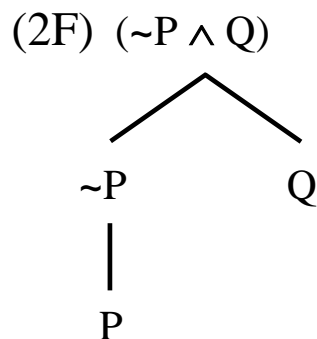


Assuming a parallel construction process illustrates why “n’t” is the **main form phrase** of Sentence (1).

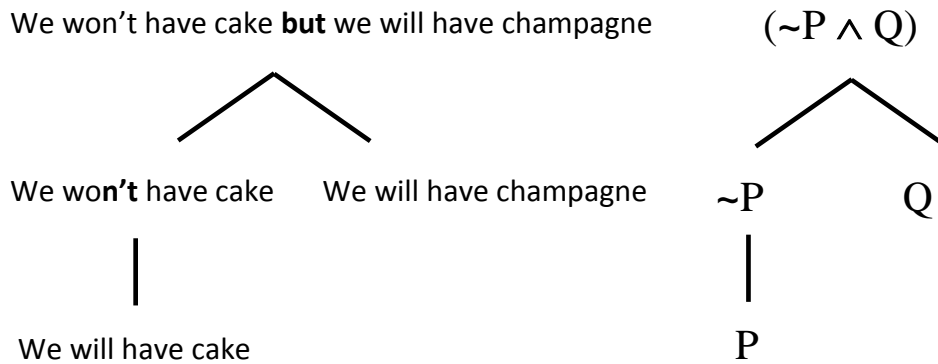
Using the same translation key, we translate Sentence (2) as a conjunction – a conjunction whose left part contains a negation phrase.

(2) We won’t have cake, but we’ll have champagne (2F) $(\sim P \wedge Q)$

Construction of that formal sentence follows those steps: first constructing “ $\sim P$,” then ‘wedging’ it together with “ Q ”.



And once again, reading the English original (Sentence 2) as having the same construction resolves any mystery about its main form phrase. Just as wedge is the **main connective** of “ $(\sim P \wedge Q)$ ” because the wedge is added last in construction, so likewise “but” is the **main form phrase** of (2).



Thus construction, far from being a mere formal amusement, is central to which connective is the **main connective** of the sentence; and as we see, that makes a crucial difference to argument validity. Just as with their English counterparts, Formal Argument A is invalid while Formal Argument B is valid.

Formal Argument A	Formal Argument B
(F1) $\sim(P \wedge Q)$ <hr style="width: 50%; margin: 5px auto;"/> $\therefore \sim P$	(F2) $(\sim P \wedge Q)$ <hr style="width: 50%; margin: 5px auto;"/> $\therefore \sim P$
INVALID	VALID

And note: the only formal difference between these two arguments is the **placement of the left parenthesis**. Our earlier insistence on parentheses likewise proves to be more than a grammatical obsession; for now we see that shifting a parenthesis just one click to the left or right can spell the difference between validity and invalidity.

(That’s why the formal language counts the following as a bogus piece of gibberish.

$$(3) \sim P \wedge Q$$

Without parentheses it’s not clear whether (3) is a conjunction or a negation. And for reasons just rehearsed, that makes all the difference in the world to logic.)

These observations add **another dimension** to the translation procedure. Up to now we’ve treated English-to-formal translation as a simple left-to-right sweep in search of form phrases, replacing each English form phrase, x-ray style, with its matching connective(s). But we see now how that overlooks an ingredient crucial to proper translation. It’s not enough just to detect each form phrase of English and translate it; we also need to figure out which of those form phrases is the **main form phrase** of the whole English sentence, and translate into a formal sentence whose **main connective** matches that main form phrase. For as we’ve seen, getting this point wrong – having a mismatch between main English form phrase and main connective – results in a mistaken translation.

4. English Clues. Appreciating the importance of finding the main form phrase, we list here some English clues to that end.

First, “either” in “either... or” and “both” in “both... and” function the way the **left parenthesis** does in the formal language: marking the **left border** of that disjunction or conjunction. While “either” and “both” are optional, their presence can settle matters when different form phrases are competing to be main form phrase of the whole sentence.

So in Sentence (4), “either” is outside (to the left of) “not,” just as the left parenthesis outflanks the tilde in formal Sentence (4F) – making both sentences **disjunctions**.

$$(4) [\text{Either we're } \underline{\text{not}} \text{ having truffles, or we're having grog}] \quad (4F) (\sim P \vee Q)$$

But in Sentence (5) “not” attaches to the left of (outside of) “either,” just as the tilde does with the left parenthesis in (5F) – making both sentences **negations**.

(5) **It’s not the case that** we’re having [either truffles or grog] (5F) $\sim(P \vee Q)$

In fact the same English clue was at work back in Sentence (1): since “n’t” is attached outside of (to the left of) “both” – and hence must have been added in construction after “both... and” – that “n’t” serves as the main form phrase of (1). That’s what made it clear that (1) is a negation.

(1) We won’t have [both ice cream and cake] (1F) $\sim(P \wedge Q)$

Note also that when **inversion** moves a form phrase to the left in an English sentence, this moved phrase can likewise act as a left parenthesis. So in Sentence (6) the negation phrase applies to the entire “unless” sentence that follows; while in (7) the negation phrase is tucked into the left half of the larger sentence.

P: Neko’s asleep **Q:** Neko’s tired

(6) It’s not the case that [**unless** Neko’s asleep she’s tired].
(6F) $\sim(P \vee Q)$

(7) It’s not the case that Neko’s asleep, unless she’s tired.
(7F) $(\sim P \vee Q)$

Second: if **inversion** moves a left-right form phrase (such as “though” or “unless”) to the front of the sentence, that moved phrase **must** be the **main form phrase** of the sentence.

Q: Neko’s tired **R:** Neko will eat fish
S: Neko will work on her inventions

(8) **Unless** she’s tired Neko will eat fish and work on her inventions.
(8F) $(Q \vee (R \wedge S))$

Note that though there are two form phrases jockeying for position in (8) – “unless” and “and” – the sentence translates as a disjunction overall.

Third, in a duel for dominance between two form phrases – especially a conjunction and a disjunction phrase – the **comma** is very often the crucial English clue.

For the main form phrase of the sentence marks the biggest **break** in the sentence (the gap, coming between the sentences being glued together). And the comma is a natural English way of marking that main break. Note that the following two sentences are word-for-word identical, differing only in where the comma falls.

- (9) Either we'll have truffles, or we'll have grog and we'll have grappa.
 (10) Either we'll have truffles or we'll have grog, and we'll have grappa.

Yet (9) and (10) make very different promises – for example, grappa is a sure thing with Sentence (10), but not so with (9). The placement of a single comma makes all the difference.

In (9) the comma falls beside “or” – marking that as the main form phrase, and so making (9) a **disjunction**. The left half of this disjunction is the subject matter sentence “We'll have truffles,” while the right half is a conjunction: “We'll have grog and we'll have grappa”. Sentence (9) thus translates as formal sentence (9F).

P: We'll have truffles **Q:** We'll have grog
R: We'll have grappa

- (9) Either we'll have truffles, **or** we'll have grog and we'll have grappa.

(9F) $(P \vee (Q \wedge R))$

In Sentence (10) the comma falls instead beside “and” – pegging it as the main form phrase, and so making (10) a **conjunction**. Its left part is the disjunction “Either we'll have truffles or we'll have grog,” while its right part is “We'll have grappa”. Using the same translation key, Sentence (10) translates as (10F).

- (10) Either we'll have truffles or we'll have grog, **and** we'll have grappa.

(10F) $((P \vee Q) \wedge R)$

Finally, a somewhat subtler clue comes from deleted repetition with negation. For which repeated parts get deleted offers a clue as to which sentence is a part of which.³ The following two sentences provide an example.

P: Suki's going to law school **Q:** Suki's writing a novel

(11) Suki's not going to law school and writing a novel. (11F) $\sim(P \wedge Q)$

(12) Suki's not going to law school and she's writing a novel. (12F) $(\sim P \wedge Q)$

Think of (11) as the denial of the rumor that Suki's going-to-law-school-and-writing-a-novel.

(11) Suki's not going to law school and writing a novel. (11F) $\sim(P \wedge Q)$

Thanks to the deleted repetition in the sentence "[Suki's] writing a novel," (11) treats the sentence "Suki's going to law school and writing a novel" as a unified 'chunk'. Think of the repeated part, "Suki's," as to the left of a list.

Suki's: (i) going to law school and (ii) writing a novel.

That repeated part then acts like a left parenthesis. So when "not" is added to "Suki's", to yield Sentence (11), "not" likewise hangs out on the left border of the sentence. That means "not" falls outside (to the left) of this whole conjunction.

(11*) Suki's **not**: (i) going to law school and (ii) writing a novel.

So "not" beats "and" in the competition to be main form phrase. If (10) is true, Suki may be going to law school or writing a novel, but **not both**.⁴

³ Following an observation in (Quine 1959: 18).

⁴ Other constructions that create such a sealed 'chunk,' locking the negation outside, are "without" sentences and sentences with relative clauses – both discussed in 2.10 §3.

By contrast, (12) can’t be read as the denial of a conjunction.

(12) Suki’s not going to law school and she’s writing a novel. (12F) $(\sim P \wedge Q)$

With no deleted repetition in the right sentence “She’s writing a novel,” we don’t interpret “Suki’s not” as hanging on the edge of Sentence (12) like a tilde and left parenthesis. Instead “Suki’s not” is only in the left part of the conjunction, “Suki’s not going to law school”. Shunted off to the left part, “not” can’t act as the main form phrase of (12) – that role falling to “and”.⁵

Alas, the complexities of English stand in the way of full-proof techniques for translating from English to the formal language. The blame for this falls once again on English; for the formal language is, by contrast, remarkably tidy and well-behaved. But the modest toolbox of clues we’ve assembled here will prove adequate for a wide variety of translation challenges.

⁵ The difference such deleted repetition makes to translation returns in 5.6 § 2, where we find a clear difference in meaning between the unremarkable sentence “Something is a cat and something isn’t a cat” and the far more dubious “Something is a cat and isn’t a cat”. As we’ll see, when faced with deleted repetition we interpret the sentence as having one item hanging off the left edge and applied to both parts – though in this case that item is the quantifier phrase “something”.