

### 3.2. Conditional Clues and Complications

**1. Antecedent and Consequent.** We'll find the conditional pickier and trickier than earlier molecular sentences, calling for distinctions between its parts that the other sentences did without. For this reason we distinguish between what we might call the '*if*' part of the conditional and its '*then*' part. And since these names will not always prove appropriate, we coin two new bits of logical jargon: the (so-called) '*if*' part is the **antecedent** of the conditional, while the '*then*' part is the **consequent**. In our earlier example, "Rex's team lost" was the antecedent, and "Rex is upset" was the consequent.

If Rex's team lost, then Rex is upset.



**Antecedent**



**Consequent**

While antecedent and consequent in this English sentence are each marked by a special word ("if" and "then," respectively), the formal language instead marks them by their location: the **antecedent** of a formal conditional always comes **before the arrow**, the **consequent** always **after the arrow**. In the following formal conditional the location of the parts is sufficient to mark "P" as the antecedent and "Q" as the consequent.

**P:** Rex's team lost

**Q:** Rex is upset

If Rex's team lost, then Rex is upset

**(P → Q)**

Such terminology marks a departure from our more casual attitude in discussing conjunctions and disjunctions; for with those earlier sentences we needed no label fancier than 'left part' and 'right part'. That was due to the **commutativity** of the wedge and vel: so far as truth and validity go, the order of parts makes no difference in a conjunction or disjunction. Whenever it's true that "We're having ice cream and we're having cake," it's true that "We're having cake and we're having ice cream" (and vice versa); and likewise whenever it's true that "Either we're having cake or

we’re having ice cream,” it’s true that “Either we’re having ice cream or we’re having cake” (and vice versa). With order of parts making no difference to truth or validity, we were indifferent to which part was which – and our generic labels for these parts reflected that.

But **order of the parts does make a difference** to a conditional, since swapping antecedent and consequent can change a true conditional into a false one (or a false into a true one). Even if it is **true** that

**If Rex’s team lost, then Rex is upset**

it may well be **false** that

**If Rex is upset, then Rex’s team lost.**

Perhaps lots of things make Rex upset, and here it’s someone keying his car, or the dogs getting into the garbage. In general: **switching antecedent and consequent in a true conditional is *not* guaranteed to yield another true conditional.**

That has immediate consequences for translation. Unless we are painstaking about isolating the antecedent and consequent in English, and placing each in its proper spot in the formal conditional, we may translate a true English sentence into a false formal one.

While that may illustrate how conditionals are picky – about which part is which – it doesn’t make them look especially **tricky**. After all, the antecedent of an “if... then” sentence is marked as such with “if,” and the consequent by “then”; so keeping them straight looks simple.

There’s a second clue here anyway: the order of parts in an “if... then” sentence perfectly parallels the formal language: both languages place the antecedent first, and consequent last. With these two clues in hand, translating English conditionals into formal ones seems trouble-free.

But that overlooks two complications of English, both familiar from the previous chapter. Taking note of these, we will find that neither of the above clues are reliable markers of antecedent and consequent. And

appreciating that point, we will appreciate as well how translating conditionals can indeed be *tricky*.

**2. First Complication: Translation Variations.** In Chapter Two we found that every model example of logical form in English – “and,” “or,” and “not” – came with a variety of cousins meaning the same thing, and translated into the formal language the same way: the **translation variations** on these model cases.

English conditionals are no exception. All the following phrases count as **conditional phrases** of English, translated by an arrow.<sup>1</sup>

***Ordinary Conditional Phrases:***

If P then Q

If P, Q

Provided (that) P, Q

Assuming (that) P, Q

***Exceptional Conditional Phrase:***

P only if Q

(Why we separate “only if” from the other phrases is explained below.)

So the following conditionals are translated into the same formal sentence.

**P:** It’s raining    **Q:** It’s cloudy

**If** it’s raining, **then** it’s cloudy

**If** it’s raining, it’s cloudy

**Provided that** it’s raining, it’s cloudy

**Assuming that** it’s raining, it’s cloudy

It’s raining **only if** it’s cloudy

} (**P** → **Q**)

As the first two examples illustrate, “if” can appear with or without its partner “then” – revealing “then” as a purely optional part (like optional “both” with “and,” and optional “either” with “or”).

<sup>1</sup>Adapting the translation variations in Suppes 1957: 8, Quine 1959: 41, and Kalish and Montague 1964: 11.

We see now why we traded in the phrases “‘if’ part” and “‘then’ part”: not all English conditionals contain the words “if” and “then”. But every conditional has an antecedent and a consequent.

We see as well why our first proposed clue for finding antecedent and consequent is not, after all, reliable: since not every English conditional contains “if” and “then,” we can’t count on the antecedent to be flagged by “if,” nor the consequent by “then”.

**3. Second Complication: Inversion.** A further complication comes from inverted English sentences. Inversion is familiar from conjunctions and disjunctions: the ‘standard’ disjunction “We’ll have a picnic unless it rains” can be inverted to become “Unless it rains, we’ll have a picnic.” With disjunctions and conjunctions inversion could be taken in stride, since the order of the parts made no difference to truth or validity. But we can’t be so casual about the order of parts in a conditional: for as noted earlier, “ $(P \rightarrow Q)$ ” may be true while “ $(Q \rightarrow P)$ ” is false.

And this makes inversion a particularly unwelcome complication when translating conditionals. For now the second proposed clue in distinguishing antecedent and consequent – that antecedent comes first in English, consequent after – also proves unreliable. Note that both the standard and inverted conditionals here have the same antecedent (“it’s raining”) and consequent (“it’s cloudy”).

#### **Standard Conditional (Antecedent First)**

Antecedent	Consequent
<b>If <u>it’s raining</u></b>	<b><u>it’s cloudy</u></b>

#### **Inverted Conditional (Consequent First)**

Consequent	Antecedent
<b><u>It’s cloudy</u> if</b>	<b><u>it’s raining.</u></b>

Thanks to translation variations, we can’t trust English to mark the antecedent with “if” and consequent with “then”. And thanks to inversion,

we can’t trust English to put the antecedent first. Yet proper translation still requires us to tell which part is antecedent, which consequent.

With both earlier clues knocked out, translating conditional from English to the formal language looks practically impossible.

**4. A Rule for Translating Conditionals.** But tucked in our last example of inversion is a simple clue. Note that in the examples above, the **conditional phrase** – “if” – **comes right before the antecedent**, in both standard and inverted conditionals.

**P:** It’s raining    **Q:** It’s cloudy

**Standard Conditional** (Antecedent First)

P	Q
Antecedent	Consequent
<b>If</b> <u>it’s raining</u>	it’s cloudy

**Inverted Conditional** (Consequent First)

Q	P
Consequent	Antecedent
It’s cloudy <b>if</b>	<u>it’s raining</u> .

} (**P → Q**)

This holds for ordinary conditional phrases in general: whether the conditional is standard or inverted, an **ordinary conditional phrase** comes **right before the antecedent**.

### Standard Conditional (Antecedent First)

#### Ordinary Conditional Phrases (Before Antecedent)

*If* it's raining, **then** it's cloudy  
*If* it's raining, it's cloudy  
*Provided (that)* it's raining, it's cloudy  
*Assuming (that)* it's raining, it's cloudy

#### Exceptional Conditional Phrase (Before Consequent)

It's raining **only if** it's cloudy

### Inverted Conditional (Consequent First)

#### Ordinary Conditional Phrases (Before Antecedent)

[no inverted form]<sup>2</sup>  
 It's cloudy **if** it's raining  
 It's cloudy **provided (that)** it's raining  
 It's cloudy, **assuming (that)** it's raining

#### Exceptional Conditional Phrase (Before Consequent)

**Only if** it's cloudy is it raining

And now it's clear why we group "only if" phrases separately: it's exceptional because **"only" phrases come right before the consequent.**

**Ordinary conditional phrases come right before the antecedent.**

**"Only if" comes right before the consequent.**

This slim clue will prove sufficient for carving English language conditionals at their joints, and identifying antecedent and consequent.

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<sup>2</sup> Recognizing "if... then" as the one English conditional phrase which **cannot** be inverted, we understand why, when "if... then" was our only example of a conditional phrase, it appeared that the antecedent would always come first: if the only conditional phrase of English were "if... then," there would be no inverted conditionals. The first complication (translation variations) brought the second (inversion) with it.

**5 Comma Clue, Revisited.** In the previous chapter we noted that the comma was a particularly useful clue for identifying the main break in a sentence. That continues to hold with conditionals, where the gap between antecedent and consequent (in either order) is frequently marked by a comma.

So, for instance, we identify the conditional phrase “assuming” as the main form phrase in the following sentence because the comma appears right before that phrase.

**Both** Suki and Neko will go to dinner, **assuming** there's sushi.

Whereas in the next sentence the conditional phrase “if... then” isn’t the main form phrase (that honor going to “but”) – as the comma makes clear.

Elvis isn't employed, **but if** the casinos are hiring **then** he'll work as a blackjack dealer.

But beware: even when a conditional phrase is the main form phrase of the sentence, it will often **not** appear at the comma-marked gap – as in the following examples.

**If** Rex's team lost, he's upset.

**Provided that** he left before noon, Jack avoided the rush-hour traffic.

**Assuming** there's sushi, **both** Suki **and** Neko will go to dinner.

So while the comma remains an important clue in our toolbox for isolating the main form phrase of a sentence, we can't rely on conditional phrases to show up beside the comma even when they are indeed the main form phrase. (Instead we may have to appeal to a process of elimination, as in that last example: while "both" appears right at the comma break, "both" isn't the sort of form phrase that appears between two parts being glued together.<sup>3</sup>)

<sup>3</sup> This is the same sort of reasoning applied in our discussion of inversion in 2.5. For example, in the sentence “**Unless** there won’t be sushi, **both** Suki **and** Neko will come to dinner” “both” appears at the comma gap; but since “both” isn’t the sort of phrase to glue together left and right parts, we conclude that this sentence is instead an inverted “unless” sentence.

**6. “Otherwise”: A More Complex Form Phrase.** In closing we note a more complex phrasing involving conditionals. The following sentence poses no surprises for current translation methods.

**If** Suki passed the quiz, then she’ll get an A in Psychology; **but if** she didn’t pass the quiz she’ll get a B.

We translate the sentence as the conjunction of two conditionals.

**P:** Suki passed the quiz

**Q:** Suki will get an A in Psychology

**R:** Suki will get a B in Psychology

**If P, then Q; but if n’t P R.**

$((P \rightarrow Q) \wedge (\sim P \rightarrow R))$

And a slight rewording (with an inverted conditional on the left) makes the same claim.

Suki will get an A in Psychology **if** she passed the quiz, **and** a B **otherwise**.

“Otherwise” here signals the negation of the previous antecedent (just like “she didn’t” in the earlier sentence). So, using the same translation key, we translate this sentence the same as the earlier sentence.

**Q if P, and R otherwise.**

$((P \rightarrow Q) \wedge (\sim P \rightarrow R))$



Though the following “otherwise” sentence leaves out the middle conjunction phrase entirely, it’s translated the same as the previous two.

**P:** Suki passed the quiz

**Q:** Suki will get an A in Psychology

**R:** Suki will get a B in Psychology

Suki will get an A in Psychology **if** she passed the quiz; **otherwise** she’ll get a B.

**Q if P; otherwise R.**

$((P \rightarrow Q) \wedge (\sim P \rightarrow R))$

We thus recognize “**otherwise**” as signaling the **conjunction of two conditionals** – where the antecedent of the first conditional returns, negated, as antecedent of the second.

We will revisit “other” as a kind of negation phrase in the more complex sentences of Chapter Six.<sup>4</sup>

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<sup>4</sup> Some computer languages use the sentence form “If P then Q else R” which is equivalent to “If P then Q; otherwise R”. As will appear in Chapter Six, “else” likewise acts a sort of negation phrase.

### Summary

#### English Conditionals:

- **Ordinary conditional phrases** come right before the **antecedent**
- **“Only if”** comes right before the **consequent**

#### Formal Conditionals:

- The **antecedent** goes **before** the arrow
- The **consequent** goes **after** the arrow

#### “Otherwise”:

- “If P then Q; otherwise R” is translated as a **conjunction of two conditionals** (where the antecedent of the first conditional returns, negated, as the antecedent of the second conditional).

$$( (P \rightarrow Q) \wedge (\sim P \rightarrow R) )$$