

## Lecture 6: Logical words, ‘illogical’ use

1. Translation into the metalanguage of propositional logic:

$p$  and  $q$        $p \wedge q$   
*It is Wednesday **and** we are learning semantics.*

$p$  or  $q$        $p \vee q$   
*Tom forgot his violin **or** he left it in the taxi.*

if  $p$  then  $q$        $p \rightarrow q$   
***If** it is Monday, **then** Tom is having a violin lesson.*

$p$  only if  $q$        $p \leftrightarrow q$   
*I will go with you **only if** you promise not to tell anyone.*

not  $p$        $\neg p$   
***It is not true that** my cats are malnourished.*

These are sentential connectives of propositional logic

conjunction ( <i>and</i> )	$\wedge$
disjunction ( <i>or</i> )	$\vee$
implication ( <i>if... then</i> )	$\rightarrow$
equivalence ( <i>if and only if</i> )	$\leftrightarrow$
negation ( <i>not, it is not the case that</i> )	$\neg$

= **truth-functional** connectives

2. Examples of English sentential connectives: *and, or, therefore, because, since, but, before, as, even though, if...then, ...*

? Translation for *therefore, because, before*

3. **Conjunction**

The compound sentence with a conjunction is true (**t**) if both of its simple sentences (**conjuncts**) are true. In all other cases it is false (**f**).

$p$	$q$	$p \wedge q$
t	t	<b>t</b>
t	f	f
f	t	f
f	f	f

*It is Wednesday* **and** *we are learning semantics.*

$p =$  *It is Wednesday.*

$q =$  *We are learning semantics.*

$p \wedge q$  is true iff (= if and only if)  $p$  is true and  $q$  is true.

### ***Complications in translation:***

John and Bill own a car.	[together?]
Sue and Bill are divorced.	[from each other?]
He jumped on the horse and rode away.	[in this order?]
I dropped the camera and it broke.	[as a result of dropping it?]
Touch me and I will hit you.	[ = If you touch me, then I will hit you.]

➔ *and* can convey *and then*, *and as a result*

*She became pregnant and got married.* But her father would prefer her to get married and become pregnant.

But in propositional logic:  $p \wedge q = q \wedge p$

? Are English sentences with sentential conjunction ambiguous due to different possible senses of *and*?

? Do all the readings have the same logical form  $p \wedge q$ ?

? Does *and* behave like other ambiguous words in English?

Mary went to the bank.

#### 4. **Disjunction**

The disjunction is false when both the simple sentences (**disjuncts**) are false. If at least one disjunct is true, the disjunction is true.

$p$	$q$	$p \vee q$
t	t	<b>t</b>
t	f	t
f	t	t
f	f	f

This is **inclusive** disjunction, the truth of both disjuncts is allowed.

### ***Complications in translation:***

*Tom forgot his violin **or** he left it in the taxi.*

In English we often use **exclusive** disjunction instead: ' $p$  or  $q$  but not both'. If  $p$  and  $q$  are both true, the disjunction is false. Exclusive disjunction is often used in English but **does not belong to propositional logic**.

He likes either red wine or white wine. (exclusive)

Your money or your life! (exclusive)

She is happy or rich. (inclusive)

Every citizen or permanent resident is eligible for unemployment benefit.

(inclusive)

They appoint coloured people - or should I say blacks - to prominent posts.

(style)

*A rule of conversation:*

When one knows that  $p$ , one does not normally say  $p \vee q$  (e.g. *It is snowing or raining* when one knows that it is snowing).\*

## 5. **Implication**

**If** *it is Monday*, **then** *Tom is having a violin lesson*.

An implication (= a conditional) expresses a causal connection between an **antecedent** ( $p$ ) and a **consequent** ( $q$ ). In propositional logic, an implication is true when the antecedent is false or the consequent is true. It is only false if the antecedent is true and the consequent is false.

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\* Various rules of conversation are the topic of the next lecture.

$p$	$q$	$p \rightarrow q$
t	t	t
t	f	f
f	t	<b>t</b>
f	f	t

$p$  is a **sufficient condition** for  $q$  but not a **necessary** one.  
If the antecedent is false, the implication is true by default.

In English: *if, if ... then, provided, whenever, unless*

### ***Complications in translation:***

? If penguins are birds then semantics is a study of meaning.

? If penguins are mammals then they have wings.

If  $2 + 2 = 5$ , then I am right.

(cf. If  $2 + 2 = 5$ , then I am wrong.

If  $2 + 2 = 4$ , then I am right.)

If you cook the main course, I shall make the dessert.

Use of implication for stylistic reasons:

If you are thirsty, there is some beer in the fridge.

If I may say so, you look tired.

In English, *if* is often used as equivalence (*if and only if*):

If the weather is nice, we will go out. [= if and only if the weather is nice]

$$p \rightarrow q = \neg p \vee q$$

If I am right, I owe you £10.

$(p \rightarrow q)$

= Either I am wrong or I owe you £10.

$(\neg p \vee q)$

## 6. **Equivalence**

An equivalence (= a biconditional) is true only when both sentences have the same truth value.

$p$	$q$	$p \leftrightarrow q$
t	t	<b>t</b>
t	f	f
f	t	f
f	f	<b>t</b>

$p \leftrightarrow q = (p \rightarrow q) \wedge (q \rightarrow p)$  [**bi**-conditional]

Tom will help you if and only if you ask him.

$q$  is the necessary condition for  $p$

In English: *if and only if, exactly when, only when, only if, ...*

### ***Complications in translation:***

In English *if* is often used as equivalence:

If the weather is nice, we will go out. [= if and only if the weather is nice]

## 7. Negation

$p$	$\neg p$
t	f
f	t

In English: *not, it is false that, it is not the case that, it is incorrect that, it is not true that, it is wrong that, ...*

### ***Complications in translation:***

*Non-students* are not allowed.

I *didn't* think that Tom would win.

Toby *didn't* eat your sandwich.

(cf. Toby didn't eat your *sandwich*.)

**METALINGUISTIC NEGATION** (MN, Laurence Horn 1985): a means for objecting to a previous *utterance* on any grounds, including the way it was pronounced. It is **not** analysable as 'It is not true that  $p$ ' because the proposition is not denied there.

Grandma isn't 'feeling lousy', she is indisposed.

Phydeaux didn't 'shit the rug', he pooped on the carpet.

The glass isn't half full – it is half empty.

I didn't catch mongeese – I caught mongooses.

The king of France is *not* bald; there isn't any king of France.

John didn't stop beating his dog; he had never beaten that dog in the first place.

John didn't *manage* to solve the problem; it was quite easy for him to solve.

Bill hasn't forgotten that today is Friday because today is Wednesday.  
I'm not happy – I'm ecstatic.  
*Some* men aren't chauvinists – *all* men are chauvinists.

Test for MN:  
Incorporated negation does not work for metalinguistic negation:  
\* He is *unintelligent* – he is a genius.

Problem to think about:

Are connectives in English and connectives in propositional logic essentially alike or essentially different? To what extent is the translation helpful in discussing the meaning of these English words?

*Suggested reading:*

*Introductory:*

Kearns 2000, ch 2.2  
Riemer 2010, chs 6.2-6.3  
Jaszczolt 2002, ch 4  
de Swart 1998, ch 3.4.1-3.4.4

*More advanced/detailed:*

Horn 1985