He is a fool **or** a liar. *17.21*
[he is a fool ∨ he is a liar]

We'll go to the seaside **unless** it rains. *17.22*
[we'll go to the seaside ∨ it will rain]

We take (17.20) to be true (but possibly misleading) if there will be *both* a stiff wages policy *and* massive unemployment – this is the top line of the truth-table (17.19). Some people would regard it as false in this situation. They take the strong reading, while we take the weak one (see section 7).

In (17.22), note that the underlying constituent is 'it will rain', not 'it rains'. After **unless**, English uses present tense instead of future; we have to remember to put the verb back into future form when we introduce '∨'.

There are a few unusual sentences in which **or** means something more like **and**, and it should be translated to '∧':

Uri Geller can read your mind, **or** he can bend your spoons. *17.23*
[Uri Geller can read your mind ∧ he can bend your spoons]

(iv) The *arrow* truth-functor '$[\phi \rightarrow \psi]$' (sometimes called *material implication*).

There is no neat and exact way of expressing this truth-functor in ordinary English, though several English expressions come close to it. The best way to define it is by its truth-table, which is

| $\phi$ | $\psi$ | $[\phi \rightarrow \psi]$ |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | T |
| F | F | T |

*17.24*

As the table shows, the only way to make a false sentence out of '$[\phi \rightarrow \psi]$' is to put a true sentence for '$\phi$' and a false sentence for '$\psi$'. '→' is best read as 'arrow'.

Here are some English phrases which can be expressed with this truth-functor:

**If** the paper turns red, **then** the solution is acid. *17.25*
[the paper will turn red → the solution is acid]



The paper will **only** turn red **if** the solution is acid. *17.26*
(or: The paper will turn red **only if** the solution is acid.)
[the paper will turn red → the solution is acid]

You will get a room **provided** you have no pets. *17.27*
[you have no pets → you will get a room]

**Assuming that** the timer is correctly set, the relay will close after two minutes. *17.28*
[the timer is correctly set → the relay will close after two minutes]

**If** there are any more patients, I shall be home late. *17.29*
[there are some more patients → I shall be home late]
NOT: [there are any more patients → I shall be home late]

The first sentence of (17.25) excludes just one possible state of affairs, namely that the paper will turn red and the solution is not acid. As we see from the table (17.24), this is precisely the case which is ruled out by the second sentence of (17.25) too. We can test the accuracy of the other translations (17.26)–(17.29) in the same way. Note the dramatic effect of adding **only** in (17.26) compared with (17.25) – it shifts the **if** to the other clause.

In some of these examples, we have to seek out the underlying constituents. Thus in (17.25) the underlying constituent sentence is 'the paper will turn red'; English drops the future tense after **if**. In (17.29) we have to paraphrase to remove **any**.

Some of these translations may raise doubts. For example, surely the first sentence of (17.25) implies there is some kind of connection between the redness and the acidity? And surely it suggests that if the paper does not turn red, then the solution is not acid? Neither of these things is conveyed by our translation. We take the view that although somebody might well assume these things if she heard the first sentence of (17.25), they are not actually stated in that sentence. In the terminology of section 7, we adopt the weak reading.

There are some cases where **if** should definitely not be translated by '→'. Here are three examples; more are given in section 18.

The choir was sensitive, **if** a little strained. *17.30*
[the choir was sensitive ∧ the choir was a little strained]