Transcription between English and Sentence Logic $\overline{2}$

2-1. TRANSCRIPTION VS. TRANSLATION

As we saw in chapter 1, for many English sentences we can find corresponding sentences of sentence logic. For example, if 'A' stands for the sentence 'Adam loves Eve.' and 'B' for the sentence 'Adam is blond.' then 'B∨~A' corresponds to 'Either Adam is blond or he does not love Eve.'

Many logicians use the word 'translation' to describe the relation between a sentence of English and a corresponding sentence of logic. I think that 'translation' is the wrong word to use. If a first sentence translates a second, the two sentences are supposed to have exactly the same meaning. But the correspondence between English and logic is often looser than having the same meaning, as the next examples show.

Consider the sentence 'Adam loves Eve, but he left her.' This English sentence is a compound of two shorter sentences, 'Adam loves Eve.', which we will transcribe with the sentence letter 'A', and 'He left her.' (that is, Adam left Eve), which we will transcribe with the sentence letter 'L'. These two sentences have been connected in English with the word 'but'. So we can get a partial transcription into logic by writing 'A but L'. We are still not finished, however, because 'but' is a word of English, not logic. What in logic corresponds to 'but'?

If I assert the sentence 'Adam loves Eve but he left her.', what am I

telling you? Well, first of all, I assert that Adam loves Eve. In asserting the original sentence, I am also telling you that Adam left Eve. In other words, so far, I seem to be saying: 'Adam loves Eve **and** he left her.'

What's the difference between 'Adam loves Eve **but** he left her.' and Adam loves Eve **and** he left her.', that is, between 'A but L' and 'A&L'? Not much. In English, we tend to use the word 'but' when we want to assert two things (a conjunction), but the first thing asserted may well lead one to expect the opposite of the second thing asserted. 'But' functions much as do the words '. . . and, contrary to what I just said would lead you to expect. . . .': 'Adam loves Eve, and, contrary to what I just said would lead you to expect, he left her.'

Logic has no way of expressing the idea of 'contrary to what the first conjunct would lead you to expect.' So we simply transcribe 'but' as '&'. In sentence logic we can't improve upon 'A&L' as a transcription of 'Adam loves Eve but he left her.' Several other English words function very much like 'but', and should likewise get transcribed as '&': 'however', 'nevertheless', 'although', and 'despite (the fact that)'.

Perhaps you are starting to see why I want to talk about transcribing, instead of translating, English into logic. 'A&L' isn't a very good translation of 'Adam loves Eve but he left her.' If it were a good translation, we would have to say that 'and' means the same thing as 'but', which it clearly does not. However, '&' is the closest we have to 'but' in logic, so that's what we use.

> A *Transcription* of an English sentence into sentence logic is a sentence of sentence logic which expresses, as closely as possible, what the English sentence expresses.

Logicians sometimes use the words 'paraphrasing' or 'symbolizing' for what I am calling 'transcribing' English sentences in logic.

2–2. GROUPING IN TRANSCRIPTION

Here is another problem which comes up in transcribing English into logic. Consider the sentence.

(1)   Eve is clever and Eve is dark-eyed or Adam is blond.

How do we transcribe this? Should we understand (1) as

(1a)   (Eve is clever and Eve is dark-eyed) or Adam is blond.

Or should we understand it as

(1b)   Eve is clever and (Eve is dark-eyed or Adam is blond).

As we know from section 1–5, the grouping makes a difference. The problem here is that (1) is bad English. In English we should also indicate the grouping, which we can easily do with a comma. Thus (1a) corresponds to

(1c)   Eve is clever and Eve is dark-eyed, or Adam is blond.

and (1b) corresponds to

(1d)   Eve is clever, and Eve is dark-eyed or Adam is blond.

Using the following transcription guide

B: Adam is blond.
C: Eve is clever.
D: Eve is dark-eyed.

we get as transcriptions of (1a) and (1c):

(1e)   (C&D)vB

And as transcriptions of (1b) and (1d):

(1f)   C&(DvB)

Notice that by using parentheses in (1a) and (1b) I have used a mixture of English and sentence logic as an aid to figuring out what seems to be going on. Such mixtures often help in transcription. If you don't see a correct transcription right away, transcribe part, or features of, the English sentence. Then go to work on the parts which you did not transcribe in your first pass at the problem.

The expression 'Either . . . or ____' functions in English to indicate grouping in some respects as do parentheses in logic. Anything that goes where you see the '. . .' acts as if it had parentheses around it, even if it is quite complex. (Often something which goes where you see the '____' also acts like it had parentheses around it, but this English device does not always work.) Thus we could write (1a) and (1c) as

(1g)   Either Eve is clever and Eve is dark-eyed, or Adam is blond.

'Both . . . and ____' serves much as does 'Either . . . or ____', although the complexities of English grammar don't let you say things such as 'Both Eve is clever and Eve is dark-eyed, or Adam is blond.' To speak grammatical English, one has to say

(1h)   Eve is both clever and dark-eyed, or Adam is blond.

which we clearly transcribe as (1e).

Notice that in (1h) we have done some collapsing of English sentence units. When transcribing into logic, you should rewrite 'Eve is clever and dark-eyed.' as a conjunction of two atomic sentences, that is, as 'Eve is clever and Eve is dark-eyed.' or finally as 'C&D'. And, to consider a new example, you should rewrite 'Eve is clever or dark-eyed.' as a disjunction of two atomic sentences, that is, as 'Eve is clever or Eve is dark-eyed.', or finally as 'CvD'.

2-3. ADEQUACY OF TRANSCRIPTIONS

It's your turn to figure out an example. Before reading on, try transcribing

(2)   Adam is neither ugly nor dumb.

What did you get? 'Neither' suggests a negation, and 'nor' suggests a disjunction. But (2) is tricky. If we use 'U' for 'Adam is ugly.' and 'D' for 'Adam is dumb.', '~(UvD)' is a correct transcription. '~Uv~D' is not.

How can you tell which is correct? We want the English sentence and the proposed transcription to say the same thing, as nearly as possible. One way to test for such agreement is to transcribe back into English. Suppose you proposed '~Uv~D' as a transcription of (2). Transcribe '~Uv~D' back into English, as literally as you can. '~Uv~D' is a disjunction of two negations, so we transcribe it back as

(3)   Either Adam is not ugly or Adam is not dumb.

Now, do (2) and (3) say the same thing? **No!** Sentence (2) is stronger. It says that Adam is **both** not ugly and **also** not dumb. Sentence (3) says that Adam is either not one or not the other (or possibly not both). It's enough for (3) to be true that Adam not be ugly. That's not enough for (2). To make (2) true, Adam will have to fail both in being ugly and in being dumb.

If what it takes to make (2) true is that Adam not be ugly and Adam not be dumb, could we also transcribe (2) as '~U&~D'? Yes. To test, transcribe back into English. '~U&~D' transcribes back as

(2a)   Adam is not ugly and Adam is not dumb.

(Or, equally good: 'Adam is not ugly and not dumb.') Compare (2a) with (2) I hope you will see that they say the same thing. Generalizing the moral of this example we have:

First Transcription Test: To check a transcription of an English sentence, transcribe back into English as literally as possible. To the extent that the

original and the retranscribed sentences seem to say the same thing, you have reason to think that you have an *Adequate Transcription.*

Our example also suggests another test for adequate transcription. So far, I have relied on your intuitive understanding of when two sentences do and don't say the same thing. But we can spell out one part of this understanding in more detail. The trouble with transcribing (2) as '~Uv~D' is that there is a situation in which '~Uv~D' is true but in which (2) is false. A situation in which Adam is ugly and is not dumb provides just such a case. But if a first sentence can be true while, in the same situation, a second sentence is false, then the two sentences are not saying the same thing.

Let's make this test for adequate transcription more precise. Consider a proposed transcription. Ask yourself: Is there an assignment of truth values to sentence letters (a case) which makes the proposed transcription true and the English sentence false, or the transcription false and the English sentence true? If so, reject the proposed transcription. If there is no such case, the transcription is as good as it can get. Of course, in applying this test you will have to do the best you can to determine whether or not, for a case described in terms of truth values assigned to sentence letters, your English sentence is true. The structure of English is complicated, so there are no simple rules for determining the truth value of arbitrary English sentences. Nonetheless, this test can often help you to decide whether a proposed transcription is adequate.

We summarize the test by saying:

Second Transcription Test: Given a sentence of sentence logic as a proposed transcription of an English sentence, try to imagine a case, described in terms of an assignment of truth values to sentence letters, which makes one of the sentences true and the other false. If there is such a case, reject the proposed transcription. If there is no such case, you have an *Adequate Transcription.*

This second test and the last example bring out a curious fact. Look back and you will see that both '~(UvD)' and '~U&~D' seem to be adequate transcriptions of (2), for, by our first crude test, they both seem to say the same thing as (2). Are both '~(UvD)' and '~U&~D' adequate transcriptions of (2) according to the second test? If you think it through, you should be able to satisfy yourself that they are. But if so, that is, if both these sentences are true in exactly the same cases as (2), then they will have to be true in exactly the same cases as each other. Any case in which one is true is a case in which the other is true. Any case in which one is false is a case in which the other is false.

We will say that two such sentences are logically equivalent, a notion which I won't dwell on now because it provides the subject of the next chapter. But even this quick description of logical equivalence will help

you pull together the ideas of the last few paragraphs. At least so far as sentence logic goes, two sentences say the same thing if and only if they are logically equivalent. With this way of understanding "saying the same thing," our two tests for adequacy of transcription ultimately do the same work. For if "saying the same thing" just means "being true in exactly the same cases," two sentences say the same thing (our first test for an adequate transcription) if and only if they are true in the same cases (our second test for an adequate transcription).

Chapter 3 will clarify your understanding of logical equivalence. For the moment, however, you will be served by an intuitive understanding of a summary of this section:

> If two sentence logic sentences are logically equivalent to each other, they provide equally good transcriptions of a given English sentence.

EXERCISES

2–1. Consider the sentence

(2*)   Adam is not both ugly and dumb.

Carry out a study of its transcription into sentence logic which is similar to the study of (2). In particular, show that this sentence has two logically equivalent, and so equally accurate, transcriptions, both of which need carefully to be distinguished from a somewhat similar, but inadequate, transcription. If you have trouble with this exercise, spend a minute guessing at a transcription of (2*). Write down your guess and then reread the discussion of the transcription of (2).

2–2. Using this transcription guide, transcribe the following sentences into sentences of sentence logic.

A: Adam loves Eve.
B: Adam is blond.
C: Eve is clever.
D: Eve is dark-eyed.
E: Eve loves Adam.

a)   Eve is clever or Eve is dark-eyed.
b)   Eve is clever or dark-eyed.
c)   Eve is clever and dark-eyed.
d)   Eve is clever but not dark-eyed.
e)   Eve either is not clever or she is not dark-eyed.
f)   Eve is either not clever or not dark-eyed.

g)   Eve is dark-eyed and Adam loves her.
h)   Either Adam is blond and loves Eve, or he is not blond and Eve loves him.
i)   Eve is both not dark-eyed and either clever or in love with Adam.
j)   Eve is dark-eyed, but Adam does not love her.
k)   Adam is either blond or in love with Eve; nevertheless, Eve does not love him.
l)   Although either Eve is dark-eyed or Adam is blond, Adam does not love Eve.
m)   Despite Eve's being clever and not loving Adam, Adam does love Eve.
n)   Adam loves Eve even though she is not dark-eyed.
o)   Adam not only loves Eve, Eve also loves Adam.
p)   Even though Eve is either clever or not dark-eyed, either Adam is blond or in love with Eve.
q)   Eve is both in love with Adam and not dark-eyed, despite Adam's being either blond or not in love with Eve.
r)   Adam does not love Eve. Also, Adam is blond, and Eve is either clever or in love with Adam.
s)   Adam is either in love with Eve or not.
t)   Adam is either in love with Eve or not. However, although she is clever, Eve is either dark-eyed or in love with Adam.
u)   Either Adam is blond, or it is both the case that Eve loves Adam and is either dark-eyed or clever.
v)   Either it is the case that both Adam is blond or not in love with Eve and Eve is dark-eyed or in love with Adam, or it is the case that both Adam does love Eve or is not blond and Eve is clever but not dark-eyed.

2–3. Using the same transcription guide as in exercise 2–2, transcribe the following into English:

a)   B∨~B
b)   A&~B
c)   ~(A∨C)
d)   B∨(D&~C)
e)   (E∨~C)&(~B∨A)
f)   [(A∨E)&~C]∨(C&~D)
g)   {[(~B∨A)&D]∨~(E&B)}&C   (This is almost impossible to transcribe into English, but do the best you can. I'm giving this problem not to give you a bad time but to illustrate how logic has certain capacities to state things exactly, no matter how complex they are, while English, in practice, breaks down.)

2–4. Make up your own transcription guide and transcribe the following sentences into sentence logic. Your transcriptions should be as detailed as possible. For example, transcribe 'Roses are red and violets are blue.' not with one sentence letter but with two sentence

letters conjoined, like this: 'R&B' (R: Roses are red, B: Violets are blue).

a) Roses are red or Teller will eat his hat.
b) Monty Python is funny but Robert Redford is not.
c) Chicago is not bigger than New York even though New York is not the largest city.
d) Either I will finish this logic course or I will die trying.
e) W. C. Fields was not both handsome and smart.
f) Uncle Scrooge was neither generous nor understanding.
g) Although Minnesota Fats tried to diet, he was very overweight.
h) Peter likes pickles and ice cream, but he does not like to eat them together.
i) Roses are red and violets are blue. Transcribing this jingle is not hard to do.
j) Columbus sailed the ocean blue in 1491 or 1492, but in any case he discovered neither the South nor the North Pole.
k) Either Luke will catch up with Darth Vader and put an end to him or Darth Vader will get away and cause more trouble. But eventually the Empire will be destroyed.

CHAPTER SUMMARY EXERCISE

Give brief explanations of the following terms introduced in this chapter. Again, please refer to the text to make sure you have the ideas right.

a) Transcription
b) Adequate Transcription

Also, give a brief description of how English marks the grouping of sentences, that is, describe how English accomplishes the work done in logic by parentheses.