A Romp through the Foothills of Logic: Session 1

Lecturer: We're going to get started. We do have rather a lot to work through, I'm completely amazed that there are people here who have been to my Philosophy in 45 Minutes and have chosen Formal Logic as the first… Good for you. I shall do my very, very best. In the first session, I'm going to be going over a lot of the things that I covered in the podcasts on critical reasoning. Can I get a feel for how many people have seen those podcasts? Put your hands up if you…

Okay, and, not you, but you have. Okay, so that will give you a good grounding and you will always be able to go away and look at them if there's anything… So, in the first session, we're really going to gallop through quite a few things that, if you'd like more of, you can get it on the podcasts. Then I'm going to slow down a bit, because we then get to the difficult stuff, this is fairly easy, of course, you know that.

Now, I assume that you're all here because you'd quite like to be able to read leaders in The Times or something like that and immediately see whether they're good arguments or bad arguments, or something like that. (Slide 2) Have a look at those two arguments, and see what you think.

Male: Quotes?

Lecturer: No, that's why I've said, 'with apologies'.

Male: You've made them up; you've made them up.

Lecturer: No, I didn't make them up, but I made the arguments a bit easier than they actually were.

Male: Right.

Lecturer: But you'll see that that argument says that life's not going to be worth living in the future and that argument says life's going to get better in the future. Well, clearly, they can't both be right. Wouldn't it be nice to look at each argument and find out, just by looking at them, which is the right one? I don't promise that you'll be able to do that by the end of this weekend, but you'll certainly have the right tools by which to go about it.

(Slide 3) In the first lecture we're going to be looking rather quickly at what arguments are, how to analyse them, and we'll look at the different types of argument, the fact that all arguments are either inductive or deductive and that any other type of argument falls into one or other of those two categories.

(Slide 4) Let's start by looking at what arguments are. (Slide 5) Here's a definition. This is from a book written by a really wonderful woman, I can't recommend it highly enough. Sadly, it's not yet ready. I was hoping it would be ready for this weekend, but it's not. Because it's my first e-Book, I can't even give you a publisher and

say, ‘It’ll be available on any device like Kindle or iPad’ and so on, so you need to follow me on Twitter (@oxphil_marianne) and find out when it’s coming out, or on my website (www.mariannetalbot.co.uk).

An argument is a set of sentences in which one sentence is being asserted on the basis of the others and you see that I’ve put the ‘s’ in brackets, because there might only be one other sentence. (Slide 6) There are two sorts of sentences in an argument. The sentence that’s being *asserted* and that’s called the ‘conclusion’ of the argument, and the sentences on the basis of which that one is being asserted. Those are called the ‘premises’ and there needn’t be more than one premise.

The premises are offered as *reasons* for believing the conclusion. (Slide 7) It’s particularly important to note that an argument is firstly a set of sentences and secondly that it’s a set of sentences that are *related* in a very particular way. Have a look at this, (Slide 8) I couldn’t get the pagination right, but have a look at that and tell me why that’s not an argument.

Male: It’s a circuit, it just states, quite correctly, to our knowledge, nothing travels faster than light in a vacuum, but it just goes on and on and on and then says exactly the same thing as it did in the beginning.

Lecturer: Lynn is arguing, and she’s trying to put forward reasons for what she’s claiming, but Jim is just stating the same thing, over and over and you end up wanting to hit him about two sentences into the argument, I think. ‘Nothing travels faster than light in a vacuum’,

‘nothing travels faster than light in a vacuum’, ‘nothing travels faster than light in a vacuum’…. That’s not an argument, is it? It may be a *conclusion*, but he’s not giving any reasons for his conclusion, therefore, it isn’t an argument. A single sentence like that can’t be an argument.

(Slide 9) Actually, I’m going to immediately change that, because single sentences *can* be arguments. Have a look at this sentence, ‘Trees only shed leaves if it’s autumn or if they’re sick, and it’s obvious they aren’t ill, so it must be autumn.’ It’s only if a single sentence is a *complex* sentence that can be *analysed* as a set of sentences, and the set of sentences must be related in the right way that we’ve got an argument.

That is an argument in a single sentence. And just to say that a *complex* sentence is constituted of other sentences. A *simple* sentence like, ‘Marianne is wearing red’ is a simple sentence, because all its parts; ‘Marianne’ ‘is’ ‘wearing red’ are sub-sentational, there isn’t a part in that sentence that is itself a sentence.

(Slide 10) A set of sentences can only be an argument if the sentences in the set are related as follows; as of the definition, one of the set, a conclusion, must be being asserted, the others must be being offered as *reasons* for believing that conclusion. If there isn’t *that* relation between the set of sentences, then the set of sentences is a set of sentences, it’s not an argument. (Slide 11) Let’s have a look at these, ‘If it’s Friday the library is open’ is that an argument? Why not? You’re right, it is not, why isn’t it?

Male: [Response from member of the audience]..

Lecturer: It's a statement. That's right. It's only one sentence, actually, isn't it? It's a conditional. Lots of people confuse conditionals with arguments, though, because of the implication, *if* it's Friday the library will be open, and people think of 'if then' statements as arguments, but that's not the case, you have to have an *entailment*, a relation of premises and conclusion between the sentences of an argument.

What about the second one? 'It's not possible to make a good cup of tea without boiling the water', 'you didn't boil the water', 'the cup of tea you made is undrinkable.' Is that an argument? Hold up your hand if you think it is. Okay, hold up your hand if you think it *isn't.* Okay, those who think it isn't, why isn't it? ? [Cross talking]. Steve.

Male: The conclusion isn't like the premises.

Lecturer: Which is the conclusion, do you think?

Male: The conclusion is the first statement.

Lecturer: No, that's *not* the conclusion. The conclusion is the sentence for which we're arguing, the sentence that is being asserted. 'The cup of tea you made is undrinkable' actually, this is a bit of strange one, because it could be either 'the cup of tea you made is undrinkable' or it could be 'you didn't boil the water' couldn't it? Do you see

that…

So, if the argument could be, ‘It’s not possible to make a good cup of tea without boiling the water, you didn’t boil the water, therefore, the cup of tea you made is undrinkable’ or, it could be, ‘It’s not possible to make a good cup of tea without boiling the water, the cup of tea you made is undrinkable, therefore, you didn’t boil the water.’ It’s not necessarily a good argument, but it’s still an argument. Don’t forget, at the moment, all we’re doing is trying to *identify* an argument; we’re not trying to *evaluate* the arguments as well.

Male: In fact, Marianne, would this be correct? I put up a hand saying it was an argument, but, in fact, if you work on that basis, then you’re saying that a *good* cup of tea is the same as, it is *drinkable* and they needn’t be the same.

Lecturer: You’re absolutely right, there’s an implication there that ‘good’ and ‘undrinkable’, or that ‘good’ is the opposite of ‘undrinkable’ and we’ll be looking at that later on. So, you’re quite right on that. No, this is, in fact, an argument and it’s not clear what the conclusion is, it might be either of those two sentences, but there are three sentences here and they are, or at least, could be related in such a way that one is being asserted and the others are being offered as reasons for believing it.

What about number three, put your hands up if you think that one’s an argument. Don’t worry if you’re getting things wrong, by the way, everyone gets things wrong to start off with.

Male: It's very bad. When the bulbs grow.

Lecturer: Well, remember we're not wondering if an argument is good or bad, we're just asking whether it's an argument.

Male: No, but you're saying the main one didn't go with the other. If you take that literally, a flower can't get up and walk. So it can't be.

Lecturer: But you needn't take it literally, need you?

Male: It's a non-sequitur, so it can't be an argument.

Lecturer: Well, a *non sequitur* is actually a bad argument, so a *non sequitur is* an argument, isn't it?

Male: Okay.

Lecturer: Okay, who thinks that's not an argument? Yes, good, you're right. We've got, there, just two sentences, they may be related, but they're not related as premises and conclusion. What about, 'Retrievers are friendly dogs, Amber is a Retriever, so Amber is a friendly dog.' Do you think that's an argument?

Male: Yes.

Female: Yes.

Lecturer: Yes, everyone's nodding there, quite rightly so. Incidentally, I've got a list of… All the exercises have got answers and there's an answer book here, and now, I think, I could hand them out now, or I could keep them and you can check them later, because you've got all the slides, so you might want to go over the exercises again later and you'll have the arguments.

No, the handouts are a different thing and I'll explain the handouts as I go along. You'll see when I need to. You'll see that at the bottom of the slide it says, 'Answers in your answer book, page 2' and when you get one of the answer books you'll see what I mean. Does anyone not have… The handouts are at the back, by the way, all the slides are in the handouts at the back.

(Slide 12) Okay, any questions at the moment about how to *recognise* arguments? I said we're going to do three things today and that's the first thing that we're doing, we've looked at what an argument is. So, any questions about that, or is that straightforward? (Slide 13) Good, okay, we're now going to look at how to *analyse* arguments and two things about that have already come up, so that's good. (Slide 14) To analyse an argument, we set it out logic-book style. Okay, so we're taking the last one of the previous exercise, the first premise is, 'Retrievers are friendly dogs'

the second premise is, ‘Amber is a Retriever’ the conclusion is, ‘Amber is a friendly dog.’ Those premises are *reasons* for believing *that* conclusion.

But you can see that when you set it out like that it makes it much easier to understand which sentence is the conclusion, and which sentences are the premises. It’s much easier to see which sentences are playing the roles; it’s also easier to…

Male: Can I ask a question about the previous slide?

Lecturer: Yes, of course.

Male: The previous slide, ‘Amber is a friendly dog, Retrievers are friendly dogs, therefore Amber is a Retriever.’

Lecturer: That would be another argument.

Male: Okay.

Lecturer: Yes.

Male: Yes.

Lecturer: It would be a *different* argument from this one, but it would be another argument, yes. (Slide 15) Okay, so analysing an argument makes it much easier, as you'll see later, to identify what sort of argument it is, as well as to identify the argument itself. It reveals the logical structure of the argument and again, I'll explain what I mean by that later on. But you can see how the conclusion follows from the premises much more easily when it's set out logic-book style. It's much easier to evaluate.

For example, if we go back to the ones with which we started, (Slide 2) now, can you imagine that if those were set out as premise, premise, conclusion, it would be much easier to see what the argument is, than it is when you look at it like that, when it's just you're hit by all these words and all these sentences and you're not quite sure. You have to work out which one is the premise, which one is the conclusion. By the time you've analysed those, which is something you're going to do later, tonight, maybe, on your own, you'll see what the argument is.

(Slide 16) So, here are the steps to analysing an argument. We're going to go through each of these steps and I've put this in the handout for you as well, it's on page two, because as we go through I'll ask you occasionally what the next step might be and you can refer to your handout and tell me. First, we identify the conclusion of the argument. Can anyone tell me why the conclusion of the argument is what we identify first? Anyone can tell me why that's the case?

Male: Without the conclusion there's no argument there, you must have a conclusion or there's no argument.

Lecturer: Without a conclusion, well, without premises, there isn't an argument either, but it's true, the premises are premises for *that* conclusion. So, the conclusion, actually, what it is, really, is the fulcrum on which the argument turns. If you can identify the conclusion, it gives you a way in to the rest of the argument, if you like. The second thing we do is identify the *premises* of the argument, that's what gives us the logic-book style, or at least the form of the logic-book style, because we know which sentence is the conclusion, which sentences are the premises.

The third thing we do; is we remove ambiguities and cross-references, putting brackets if there are any, because, of course, sometimes there aren't and that's fine. But you should always check an argument to see if there's any ambiguity in it or if there's any cross–reference and I'll explain, again, I'll go through each of the steps, so if there's anything you don't understand about these I hope it will be explained later.

The fourth step is to eliminate irrelevancies. Again, if there are any, but there are often irrelevancies in an argument, because when we argue with each other we tend to do much more than argue, we tend to give an idea of what we *feel* about the argument, for example, or whether we accept the argument. So, sometimes, we have to remove those irrelevancies in order to see what the argument itself is.

Okay, and the fifth step, is it, one, two, three, four, five, is to remove inconsistent terminology. Now you, Alan, you pointed that out in the argument about, because the word ‘good’ and the word ‘undrinkable’, so the word ‘undrinkable’ there was being used to mean ‘not good’, wasn’t it? We wouldn’t have lost anything in the argument if we had changed ‘undrinkable’ for ‘not good’ or, if we’d changed ‘good’ to ‘drinkable.’ Do you see what I mean? It makes the argument much more obvious as we’re doing it if we can get rid of distracting things like inconsistent terminology.

Finally, we want to explicate any suppressed premises. If there is a suppressed premise then we want to bring it out and put it into the argument, because the argument won’t be a good one if, actually, you’ve left out a premise. It might be good if you put that premise in, but without that premise it’s not good, so we need to put the premise in.

Okay, so let’s analyse the argument above. If you remember, I said there’s a complex sentence, it *is* an argument, but we have to analyse it first. (Slide 17) So the first thing we do is identify the conclusions, so what’s the conclusion to that argument? Put your hand up, if you… Put your hands up when you think you know and when there’s a critical mass I’ll… Okay, Shaun, is it?

Male: ‘It must be autumn.’

Lecturer: ‘It must be autumn.’ Does everyone agree?

Male: Yes.

Female: Yes.

Lecturer: (Slide 18) Okay, I think it's clear that that's the answer there, so, 'It must be autumn' is the conclusion and notice that I've taken out the word, I mean, the sentence was actually, 'So it must be autumn' but we don't need the 'so' because it only indicated the conclusion, didn't it, and we've now got 'conclusion' you've got a label 'conclusion' on it, so we don't need the 'so.' One of the ways in which you find a conclusion is that it may be indicated by a conclusion word 'so' is obviously such a word; can anyone think of any others?

Male: 'Therefore.'

Male: 'Ergo.'

Lecturer: 'Therefore' 'Ergo.'

Male: 'Thus.'

Lecturer: ‘Thus.’ Yes, all these are very good conclusion words; they give you an immediate indication that here is the conclusion about to come. Any others?

Female: ‘Hence.’

Lecturer: ‘Hence’ yes, ‘hence’ is a conclusion word. Okay, I don’t think I’m going to say this…

Male: Do you need the, ‘must?’

Lecturer: Sorry?

Male: Do you need the, ‘must?’

Lecturer: The, ‘must’ is probably itself a bit of a give away as well.

Male: ‘It is autumn’, you could just say.

Lecturer: Yes. A, ‘must’ could be, it could be part of a premise as well, so, ‘A good cup of tea must be made with boiling water’ for example, the, ‘must’ there would have not been a conclusion indicator. So you’ve

got to be careful, more careful with ‘must’ than with ‘so’ ‘hence’ ‘thus’ ‘therefore’ etc.

Female: Do you agree, ‘because’ is also one?

Lecturer: Well, ‘because’ can work both ways, actually. So, I can say ‘the trees…’ ‘It must be autumn because.’

Female: But is it that, ‘because’ indicates the conclusion albeit probably [Cross talking].

Lecturer: Well, it’s indicating the premises there, isn’t it? I mean, I suppose in virtue of indicating the premises, it is indicating the conclusion as well. But I tend to think of, ‘because’ as a premise indicator, rather than a conclusion. I take your point. I mean, immediately, you know, ‘because’ can, not always, actually, there’s a one later that I think will be a counterexample to that.

(Slide 19) Okay, a couple of things. Conclusions are not always at the end of the argument. I could have said ‘it must be autumn because trees only shed their leaves if they’re sick or if it’s autumn, and they’re obviously not ill’ Do you see what I mean? I could have put the conclusion… Or, the conclusion could have been in the middle, so a conclusion can be anywhere, you can’t tell that a sentence is a conclusion because it’s at the end of an argument.

Nor can you always… There are not always conclusion indicators in

an argument, so you might see ‘so’ or ‘therefore’ or ‘thence’ etc., but you might not. I could have said ‘trees only shed their leaves if they’re sick or it’s autumn and they’re obviously not ill, it must be autumn’ and just left out the ‘so.’ It would still be an argument, wouldn’t it? The only foolproof way to identify a conclusion is by the role it’s playing in the argument. What is the role played by a conclusion? What is the *role* played by a conclusion in an argument?

Male: It’s being asserted.

Lecturer: It’s the sentence that’s being asserted, that’s right. The others are being offered as *reasons* for that conclusion.

Male: It terminates the argument.

Lecturer: Sorry?

Male: It terminates the argument.

Lecturer: Well, it doesn’t always terminate the argument.

Male: Not in a written sense.

Lecturer: Once you've put it out logic-book style, it terminates the argument, but I think it would be a mistake to think of a conclusion as terminating an argument, when you're thinking about how to identify a conclusion, because the conclusion doesn't always terminate an argument.

Male: Not in the way it's written on the page.

Lecturer: No, but it's only if you've set it out logic-book style that the conclusion will certainly terminate the argument. One way in which you can… Sometimes it's very difficult to tell though with some things, which is the conclusion or not. It can help to read the argument out loud, to actually, with feeling, once more with feeling, because by putting the feeling in, by actually *acting* it out, the sounds of the words will indicate the conclusion to you, quite often, as you do it.

Of course, actually, you would then discover the ambiguity of that one that we saw earlier 'the tea is undrinkable', because actually, you could do it in two ways. (Slide 20) Okay, so the second thing we've got to do is identify the p*remises*. We've got the conclusion 'it must be autumn' what are the premises in this argument? Put your hands up when you've got them.

Okay, I'm sorry, I've forgotten your name already.

Female: ‘Mary’.

Lecturer: ‘Mary’. Good, okay, I think it’s good to put them all together. (Slide 21) So, you’ve got, ‘Trees only shed leaves if it’s autumn or they’re sick’ and the second premise is, ‘It’s obvious they aren’t ill.’ The ‘and’ drops out again, because like the ‘so’ it’s no longer needed. You could leave it in and say this is a one-premise argument, but it’s actually, if it looks more like an argument to take the ‘and’ out. So, premise one ‘trees only shed leaves if it’s autumn or they’re sick’ premise two ‘it’s obvious they aren’t ill’ conclusion ‘it must be autumn.’ Okay, is that straightforward?

Female: Why is premise two not a conclusion? Like, it doesn’t sound… The premises normally seem to be based on some sort of fact, or something, ‘It’s obvious they aren’t ill’ does not really seem to have any fact of any kind about it, it seems a total … [inaudible].

Lecturer: We’re not… One of the things that you often find in an argument is that people will argue for one of the premises at the same time as they argue for the conclusion, but that’s not necessarily the case. When people do that, you actually need to get rid of the argument for the premise when you’re setting out the argument itself. Here, okay, you’re not given a reason to believe this, but that’s the dead giveaway that it’s not the conclusion. That is being used a conclusion, oops, as a *premise* for this.

Female: So a premise can be a non-factually based judgement?

Lecturer: A premise can be *any* declarative sentence, any sentence that's either true or false. You don't have to back it up in any way. So, I can say, oh, God, I can't think of an example. Give me a non-factually based statement and I'll give you an argument for it, or give me an example. [Cross talking], what?

Female: Jabberwocky is a creature.

Lecturer: 'A Jabberwocky is a creature', 'all creatures have four legs', 'therefore a Jabberwocky has four legs'. Okay, it's not a very good argument, and it's certainly the case that the premises aren't true, but it's an argument, isn't it?

Female: So the premises don't need to be true?

Lecturer: Premises certainly don't need to be true.

Female: Okay.

Lecturer: We'll have a look at that later, in quite some depth, I think.

Male: I very much want to…

Lecturer: So…

Male: Sorry.

Lecturer: I just want to say, we're not looking at how to *evaluate* arguments at the moment, it's very important, all we're looking at the moment is how to *identify* an argument. The thing about arguments is they can be good or bad and one reason we want to be able to identify them is we want to be able to evaluate them as good or bad. But, if you can only evaluate good arguments, sorry, if you can only determine *good* arguments, then you're going to miss all the bad arguments, that wouldn't be a good idea.

Male: I very much want to break premise one into two premises.

Lecturer: How would you do that?

Male: 'Trees only shed their leaves if it's autumn''trees only shed their leaves if they're sick' I suppose I'd have to eliminate, 'only' in that case, wouldn't I? Because 'only' applies to…

Lecturer: 'Only' applies to both, exactly. Do you see, you quite rightly answer your own question here. You actually can't make that into two sentences. Mary, you were wondering if you [Cross talking] yes,

you were wondering too. If that were an ‘and’ that would be different. Actually, the ‘only’ would still get in the way a bit there.

Male: It would, that [Cross talking] don’t we, because we have an exclusive clause and non-exclusive clause.

Lecturer: And we’ll look at that later on. You’re quite right.

Male: If the ‘only’ wasn’t there, I think I’d still be tempted to split it.

Lecturer: No. If it’s an ‘and’ it’s almost certainly the case you can split it. If it’s an ‘or’ my advice would be don’t split it.

Male: Fine, yes, okay.

Lecturer: An, ‘and’, ‘P and Q’ well, ‘P, Q’ you don’t really need the ‘and’ as long as you’re asserting, ‘P’ and you’re asserting, ‘Q.’

Male: Yes.

Lecturer: But, ‘P or Q.’

Male: Is a different case, yes.

Lecturer: One of them or the other one might not be true, might it? You can't just assume both of them are there. Okay, so we've got our premises and we've got our conclusions. If that were all black, it would be set out, argument book style, logic-book style. (Slide 22) Okay, so our next task is to remove the ambiguities and cross-references. We remove ambiguities because they threaten clarity. We're not going to… In the book, I go into ambiguity in some detail, because there are lots of different *types* of ambiguity, so if I say… Okay, we're going to do some exercises. (Slide 23)

A word is *ambiguous* if it has two meanings, or two or more meanings, I should say, or a sentence can be structurally ambiguous, in other words, the words could be ordered in different ways.'The black taxi drivers are on strike' is it the *taxi drivers that are black* that are on strike, or is it the (Slide 33) *drivers of black taxis* that are on strike, etc. Okay, I said we were going to do this at home, but I wonder if we've got time to do it now. Let's do a couple of them. "'Every good girl loves a sailor.' Okay, how is that ambiguous? Can you come up with two different ways of saying it?

Male: That sailor is going to be really snowed under.

(Laughter)

Lecturer: So you're assuming *there is a sailor, such that every girl loves him*?

Male: Yes.

Lecturer: There is a sailor such that every girl loves *him*. Okay, just one sailor. But, of course, it needn't be that.

Male: Every good girl loves a…

Lecturer: *Every girl is such that there is a sailor whom she loves*. Are you with me?

Male: Yes.

Lecturer: Okay, so you need quantifiers to disambiguate that. It's where the 'there is' goes. Is it that *there is a sailor such that everybody loves him*, every girl loves him, or is it that *every girl is such that there is a sailor such that she loves him*, which means there are many different sailors, one for each girl. Okay, I'm going to let you do that at home. If we have time at the end of this session, we'll come back to it. But I've given you the answers so you can check those out for yourself later on.

(Slide 24) Cross-references. Now, a cross-reference, or an anaphoric reference, can you see a cross-reference here?

Something that is, once you separate the sentences, as we're doing in putting something together logic-book style, it would be easy to lose the meaning if we don't remove the cross-reference. Can you see the cross-reference?

Male: 'They' those two.

Lecturer: Well done. Yes. What do we mean by 'they?'

Male: The trees.

Lecturer: (Slide 25) The trees, exactly. So, the 'they' is actually referring to the trees. 'Trees only shed leaves if it is autumn or if the tree is…' So, actually there are two. 'They' twice over needs to be changed to 'the trees.' 'It's obvious the trees aren't ill, it must be autumn.' Do you see, again, when you're actually looking at the whether the premise is true…

We're using a very simple example here, for obvious reasons, but if it were a really complicated argument and you need to look at each premise to see whether it's true and you've separated the premise from everything else, it can be quite easy to lose track of what's intended by 'it' or 'he' or 'she' or whatever. Remove that cross-reference so you never lose track of what the 'it' or what the 'they' or what the 'she' or whoever mean. (Slide 26) Now we ought to eliminate any irrelevancies.

Male: Would it not make sense [Cross talking].

Lecturer: Is this about the previous slide?

Male: Yes. Would it not make sense to remove the cross-references before you tease out the premises? [Cross talking].

Lecturer: You could do that.

Male: And stripped out all of the impersonal bits and gave them back their nouns.

Lecturer: You could do that.

Male: You wouldn't… You'd remove the danger of losing track, which is what [Cross talking].

Lecturer: You shouldn't be able to lose track of it by this stage, either. It's as you get further on that you lose track. But, yes, you could do it beforehand. I've never done it like that, but, thinking about it, I can't see any reason at all why not.

Male: Are these… the six points you put here, do they have to be done actually in this order?

Lecturer: No, I think you could… I know this order works. I'm inclined to say, 'do it in that order.' I'm sure you could do it in different orders, but I think as you're learning, I think it's a good idea to start with an order that we know to work.

Male: I have a question, actually, about… [inaudible].

Lecturer: Go on.

Male: It seems like it would be easier to remove the cross-references at the beginning of the pronoun if pronouns are involved. If they're not pronouns, then it would be much harder, it would seem like you have to analyse the premises and get into it before you could figure it out.

Lecturer: I'm sure that you're right. I can't think offhand of an example where that would be difficult, but, yes, I don't know, I wouldn't like to say. I think you would be all right to remove the cross-references earlier. Okay, so we've got to remove the irrelevancies, if there are any. Have a look at that, see if there's anything you think is irrelevant. If there is, put your hands up, don't yell out at the moment, but give other people a chance to find out for themselves. Okay, Sam.

Female: ‘Obvious.’

Lecturer: ‘It’s obvious’ yes. There is no use for that is there? It’s just a little… Who cares whether it’s obvious? What’s important is whether it’s *true*. Okay, is there anything else? I don’t think there is, actually. No. You were going to say? (Slide 27)

Male: All the indefinite articles..

Lecturer: There aren’t any ‘ands’ are there?

Male: Oh no.

Lecturer: There are four definite articles. I wouldn’t want to remove the definite articles because the grammar goes. You want to say, ‘or trees are sick?’

Male: Yes.

Lecturer: ‘Trees only shed leaves if it is autumn or trees are sick.’ I think, ‘the trees’ makes it clear that, yes, I’d prefer leaving, ‘*the* trees’ in there.

Female: Could you remove ‘leaves?’ They can’t shed anything else.

Lecturer: That’s an interesting thought. I think you probably can, actually, can’t you? You can get rid of ‘leaves’ there, because there isn’t anything else that trees can shed.

Male: There is, [Cross talking] there’s bark

Lecturer: Bark, yes, okay, I take it back, but I like that. If it were true that they could only shed leaves, then yes, you could get rid of that.

Male: Can you [inaudible] words, ‘must be’ and ‘is’?

Lecturer: Well, no, because ‘is’ and ‘must be’ are two very different statements, aren’t they? If something *is* the case, then it could be contingently true that it is the case. If it *must* be the case, then you’re claiming it’s *necessarily* true, either empirically or logically, so I think ‘must’ stays.

Male: Could you not say ‘deciduous?’ I think that’s the word, I’m not sure.

Lecturer: I'm not going to say 'deciduous' no, because I don't need to for the sake of this argument, I don't think. Trees are deciduous when they shed their leaves, aren't they?

Male: Yes.

Lecturer: That's right, because otherwise they'd be evergreen. I've just given away the answer to this question, annoyingly. Are there any irrelevancies? Sorry, we've done that.

Male: We've just done that.

Lecturer: (Slide 28) Now we've got to remove inconsistent terminology, if there is any. Can you see any inconsistent terminology?

Female: I don't think it's inconsistent, but I'm wondering, as you want this to be a tight example, why you fluctuate between 'sick' and 'ill'. Why can't you stick with one?

Lecturer: That's what I mean by ''inconsistent terminology'. That's exactly right. The original example I used was 'undrinkable' and 'bad.' Here, yes, while using 'sick' and 'ill' completely unnecessary. Actually, it didn't sound right, did it, when we read it? That's because I went through and changed the words in order to put an inconsistent terminology in.

Okay, so inconsistent terminology arises when two different words mean roughly the same thing. Get rid of that sort of inconsistency, because all it does is distract us. I know your English teacher told you to try and vary your language as much as possible, because it makes it more interesting. We're not concerned about things being interesting here, all we want to know is whether they are logically correct. (Slide 29) We can get rid of, 'ill' and put, 'sick' or we could have done it the other way round, we could have put, 'ill' for both. Well done.

(Slide 30) So, finally, we need to add any suppressed premise. Many arguments, in fact, most arguments in everyday life are enthymemes, they're incomplete without the addition of an extra premise. A suppressed premise is often a belief so common that we needn't make it explicit. I say, 'Oh, it's raining, do take your umbrella' okay, I'm not going to eke that out with, 'because if you take your umbrella you won't get wet' I'm assuming that you'll know exactly why I'm suggesting that you take your umbrella.

We often leave a premise out in an argument, but, sometimes the premises we leave out are actually controversial and to leave out a controversial premise is not acceptable. To leave out a premise because we can assume that everybody believes it is one thing, but to leave out a premise when, actually, it's because you don't want to draw attention to the fact that this premise is controversial is another thing entirely. (Slide 31) Looking at the argument we're analysing, is there a – never mind whether it's controversial or not – is there a suppressed premise here?

Male: Yes.

Lecturer: Okay, put your hand up if you think… Okay, Bill, go on.

Male: ‘The trees are shedding their leaves.’

Lecturer: Yes, because if the trees weren’t shedding their leaves, we wouldn’t have an argument, would we? (Slide 32) So, there’s a suppressed premise there, but that’s not a controversial one, is it, or at least, probably not, it’s not. Okay, so the premise we’re adding is uncontroversial, it need only be a… If we’re formalising the argument, if we’re setting it out logic-book style, we’d need to add in that suppressed premise, because otherwise the argument won’t be a valid one, if it is valid.

In an informal version of the argument, people are just going to add it for themselves. Most of you didn’t even notice there was a suppressed premise in that and that’s because you had already added it for yourself. (Slide 33) But, without it, the argument is invalid.

Female: Is that a way of looking to find an assumption, an underlying assumption?

Lecturer: There is an underlying assumption in that argument that we’ve made explicit by putting it in there, yes. Now, I thought we had

some exercises on suppressed premises; there is one in the book. Maybe there isn't one here. (Slide 34) Here's the unanalysed argument and there's the analysed argument. I think you'll agree that the logical structure of this, the structure of this argument is much more visible to you than it is here. You can imagine if that were a much more complicated argument, I mean, that's a very simple argument, no body is really going to need to put that out logic-book style.

If that were a more complicated argument, doing this to it would make it much, much easier to evaluate, much, much easier to understand. (Slide 35) Here we are, let's just do a couple, let's do that one. 'Women of childbearing age sometimes get pregnant, women of childbearing age, can't therefore be relied upon.' What's the suppressed premise there?

Female: There's something wrong with being pregnant.

Lecturer: Being pregnant makes you unreliable, or something to that effect, yes, exactly. 'It's dangerous to text whilst driving, it should be made illegal' what's the suppressed premise there?

Male: Dangerous things should be made illegal.

Lecturer: 'Dangerous things should be made illegal'. You can see that that's actually controversial, isn't it? Do we want to make all dangerous things illegal? Some dangerous things, perhaps, we ought to make

illegal, but there are other dangerous things like bungee-jumping and so on and people, for some reason…

Male: I've just been volunteered to do it, [inaudible], they're volunteered to take on these injuries and they're [inaudible], they're jumping big falls.

Lecturer: They have indeed, yes, but do we want to stop them being able to make that choice? Probably not, not in a free country, I think.

Female: Because it's a suppressed premise, not rather… You shouldn't do dangerous things while driving.

Lecturer: You shouldn't do dangerous [Cross talking]. Well, you could say, we could make it stronger by saying, 'one shouldn't do dangerous things whilst driving'. 'Things that are dangerous whilst driving should be banned' or something like that. Perhaps that would strengthen the argument. Yes, perhaps then it becomes quite a strong argument, doesn't it?

Male: It does.

Lecturer: Although, I was listening to something from the States last night, they were really angry about being made to wear seatbelts,

because it interferes with… You're not actually driving when you're…

Female: [inaudible] suppressed premises, because you know, you are assuming definitions of words and context.

Lecturer: One of the things that beginners nearly always do is try and add everything into the argument. You'll find that, actually, as you gain in experience, you'll start to see what could be left out. It's a very common thing to start adding in everything. All you need is the premises going to make the conclusion follow from the premises.

Female: So by suppressed premises you mean facts specifically related into what you're [Cross talking].

Lecturer: Not facts, necessarily. They may not be facts.

Female: Things, then.

Lecturer: Statements or sentences.

Female: But other things that set a context, that aren't related to it, how do you understand it, because they're not part of that argument, they would not be classified as a suppressed premise.

Lecturer: Exactly so. I can feel that what you're doing is, again, something very common in a beginner and there'll be other people in this room who are doing it, which is that you're trying to make an argument water-tight before it can be an argument.

Female: [inaudible] useful. Sorry.

Lecturer: No, arguments can be useful, even if they're not watertight. That would be an argument that would be useful to some people [Cross talking]. That argument has been used very often in the past, hasn't it? It's neither good, nor is it complete.

Male: It's a silly question in this context. I mean it would be daft to argue, 'what do you mean by texting? What do you mean by driving?' But I can see in some complicated arguments, you might want to ask what do you *mean* by this term you've used, what is its definition?

Lecturer: You do, but that's not the job of the argument. When you come to evaluating the argument, you may have to go to your dictionary and look up a word or something like that.

Male: So that's at the evaluation stage…

Lecturer: It's not the job of the arguments to make clear the meaning of every word, if you like. We can assume that educated people will be able to use a dictionary.

Male: But in this case, it clearly is a silly argument, a silly question.

Lecturer: Well, yes, but no, but…

Male: Because you'd never read, is the word you need. If you're going to vest it in the law, [inaudible] Bill of Parliament, you have to be incredibly precise and you cannot leave [inaudible] in an argument. You have to define [Cross talking].

Lecturer: I am not, for one minute saying that definitions aren't important. The reason philosophers think definitions are important, if you utter a sentence, expressing a belief of yours, if I don't understand the sentence I can't get to your belief. If I don't understand your sentence, I can't determine whether it's true or false, can I? I can't evaluate anything as true or false if I can't understand it. So, I'm not for one minute denying the importance of interpretation, but I am saying that it's not necessarily the job of an argument to interpret every one of its terms and if you are arguing, obviously, it's sensible to try and use terms that more people will understand, rather than fewer people.

Female: Just because something is repugnant it doesn't make it a bad argument, does it?

Lecturer: Just because something's?

Female: Repugnant, it doesn't make it a bad argument, the argument could be very good.

Lecturer: That's true.

Female: [inaudible], depending on your point of view, [inaudible] a good argument.

Lecturer: I see. You're saying… Yes. Once you put the suppressed premise in there, it is actually a good argument.

Female: Yes. The fact that you may or may not [Cross talking].

Lecturer: In one sense, and a sense that we'll be looking at later, but not now, let's move on. So, an exercise, again, to do at home and the answers are in your… Or *my* answer is in your answer book. Those are the two ones with which we started. Okay, so, that was… We've looked at what an argument is and how we analyse an argument and the next thing we're going to look at is how to

distinguish types of arguments, but are there any questions about analysing arguments that we haven't looked at? Brian.

Male: I have a question about the suppressed premises, because it seems like there could be a [inaudible], go back to what you said a few moments ago. There could be almost endless suppressed premises, like in the first one you had, 'Women of childbearing age' the suppressed premise is that women can bear children, though…

Lecturer: Well, okay, so why is this not… Why is that a suppressed premise? Let's see what I mean by, it's got…

Male: I see, that doesn't have any bearing on whether it's true or not or whether the [Cross talking].

Lecturer: I mean, you might…

Male: Or it supports…

Lecturer: It's an amplification of what one of the premises, but a premise is a reason for believing a conclusion. If it's not a reason for believing a conclusion, it isn't a suppressed premise, even if it is a reason for believing one of the premises, or all sorts of other things, or an amplification of the premise.

Female: Because in that [Cross talking].

Lecturer: I've just realised the selection of…

Male: But doesn't that cry out for, 'Some?' 'Some women of child bearing age get pregnant.' It's true. You can't say 'all', *not all* women are going to get pregnant.

Lecturer: That's true.

Male: You can say, 'some.'

Lecturer: And, even those who are going to get pregnant are not always pregnant. That's why the, 'sometimes' is in there.

Male: [inaudible], you can [inaudible] even the fact that, [inaudible], I thought that could be thrown out, an adjective and things like that. Adjectives and… Sorry, it's an adverb.

Lecturer: You probably could throw that out of that argument but, I mean, let's see… Okay, the conclusion is, 'women of childbearing age can't be relied upon.' Premise one is, 'Women of childbearing age

get pregnant' okay, so we can leave out, 'sometimes' if you like. Premise two, what are the suppressed ones we said?

Female: 'Pregnant people are unreliable.'

Lecturer: 'Pregnant people' or, 'women.'

Female: 'Women.'

Lecturer: I mean if men got pregnant, maybe they would be reliable.

Female: It's worse for us.

Male: Maybe motherhood should be taken seriously by all?

Lecturer: Maybe, but that's not what this argument… Okay, so the 'women of childbearing age get pregnant', 'pregnant women are unreliable'; 'women of childbearing age can't be relied upon'. Actually, at that point it becomes it [inaudible], it's a bit obvious, isn't it? But I don't think there's anything wrong with that argument, it's a good argument. But, its premises might be questioned, which means that you could question the conclusion.

Again, I stress that we are not, at this moment, evaluating

arguments, all we're doing is learning how to recognise them. Okay, so whether an argument is good or not is something we'll look at later on.

Female: By argument, then you mean the connection between the premise and the conclusion, to get to the premise in the first place is not part of the argument.

Lecturer: No. The definition of argument with which we started is, 'an argument is a…' What is an argument? Somebody tell me. What is an argument?

Female: It has two sentences, in which one sentence is being asserted on the basis of others.

Lecturer: There you are an argument is a *set of sentences*, in which one sentence is being asserted on the basis of the others.

Female: The link between the conclusion and the premise, but not any of that stuff about how you got to the premise in the first place.

Lecturer: No, that's right. I mean there would be another argument for the premise, perhaps. (Slide 37) Okay, any more questions about analysing arguments? No? Good.

(Slide 38) Okay, we're now going to look at distinguishing the different types of arguments. (Slide 39) There are two; I hope you can see that doesn't come out quite as well as I thought it would, two overarching types of argument, deduction and induction. Within those categories, there are lots of other types of argument, so within the category of inductive arguments, there are arguments from analogy, arguments from authority, inductive generalisations, causal generalisations and within the category of Deductive Argument, you've got [inaudible], etc., etc., etc.

So, each category has many sub-categories, but these are the two overarching categories. Sometimes, people add a third category to that; they talk about abductive arguments, which are arguments to the best explanation. I include those in inductive arguments, so I'm not forgetting them, if anyone has thought of arguments to the best explanation. I'm treating them as inductive.

Female: Are they in here?

Lecturer: All the handouts have… There are… You haven't got that handout, but when you get it…

Female: I will get it?

Lecturer: You will, yes, you won't have to write it down. Okay, so these are the differences. (Slide 39 still) Deductive arguments are either good or bad. They're either good or bad, there's nothing in between, if it's

not bad it's good, if it's not good it's bad. That's not true of inductive arguments; they're always good or bad to some degree. They're more or less good.

Deductive arguments are conclusive. They give us absolute certainty, usually a conditional certainty, but they give us certainty. Inductive arguments never give us certainty; they only ever give us probability. It may be a very strong probability, but it's never as high as certainty. Deductive arguments are evaluable *a priori* can anyone tell me what that means? I know some of you…

Male: From the beginning.

Lecturer: Before you?

Male: From the beginning.

Lecturer: Yes, from the *meaning of the terms*, you can do it without experience. You don't need to know anything about the subject matter of the argument in order to evaluate a deductive argument. Whereas, inductive arguments are evaluable only *a posteriori*, in other words, you have to understand something about your subject matter in order to evaluate an inductive argument. Okay, those are the three distinctions between inductive and deductive arguments; let's have a closer look at them.

(Slide 40) The first difference, deductive arguments are either good

or they're bad. Inductive arguments are only ever good or bad *to some degree*. Deductive arguments are either good or they're bad. (Slide 41) If a deductive argument is good, it's called 'valid'. If a deductive argument is bad, it's called 'invalid'. In your handouts, there's a… Have you got the handouts? It's the question thing I didn't give out.

Okay, have a look at your handout, because I think I want to tell you something about this, on page two. It's very, very important that a good deductive argument need not have true premises. If you look at the handout, look at slide 41, see where I am on page two.

Female: This doesn't seem to have…

Lecturer: You've got the wrong handout, [inaudible].

Female: [inaudible].

Lecturer: You will need to have the handout booklet to follow the transcript for the next few pages. It's all right, there are so many handouts, I can quite understand why you're getting confused. Has everyone got the right page? Yes? Good, okay, so, slide 41, validity, the definition of validity tells us… Here's the definition of validity 'a deductive argument is *valid* if, and only if, there is no logically possible situation in which its premises are true and its conclusion false.'

So, listen to that. *If and only if,* in other words, this is a both a

necessary and a *sufficient* condition for an argument's being valid. There is no logically possible situation in which its premises are true and its conclusion false. If there is a situation where its premises could be true and its conclusion false, the argument is invalid. Otherwise, it's valid.

An important implication of that, if you look, people have trouble wrapping their minds around the first two of the following three facts. Arguments with false premises and a false conclusion can be valid and I've given an example of that at the bottom of the page, 'All fish have wings. Whales are fish. Whales have wings.' If those premises were both true, the conclusion would have to be true, wouldn't it? If those premises were both true, are you with me?

Male: Yes.

Lecturer: The conclusion would have to be true. Do you see that?

Male: Yes.

Female: Yes.

Lecturer: That's what makes that argument valid. The fact that the premises are both false and, indeed, the conclusion is false, doesn't stop the argument being valid. We know that IF the premises were true, the conclusion would be true and that's all we need.

Have a look at the invalid one. Here we have another argument, where the premises are both false *and* the conclusion is false, ‘All fish have scales. Whales have scales. Whales are fish.’ Do you see that that’s not a good argument? There is a possible situation, where both those premises are true and the conclusion is false, isn’t there? If we draw a Venn diagram, if I can find a decent pen, ‘All fish have scales.’ So this (circle) is fish and this (circle) is things with scales. ‘Whales have scales, therefore whales are fish.’ Well, no, not if whales are here (in this circle). Fair enough? Okay.

So there’s a possible situation, in which both those premises are true, but the conclusion is false and that argument is invalid. So, you can’t tell anything about the validity or the invalidity of the argument on the basis of the fact that all its premises are false and its conclusion false. It could be valid, but it could be invalid, you don’t know. Validity is not determined by the truth or falsehood of the premises.

Look at the second situation, where the premises are all false and the conclusion is true. Now, that too, is a situation where the argument might be valid or it might be invalid and I’ve given an example of each of those. So, can you see that if it was true that all fish have lungs *and* that whales are fish, whales would have to have lungs, wouldn’t they?

If it were true that all fish have lungs and that whales are fish, whales would have to have lungs. Okay, so that’s a valid argument. On the other side, we’ve got an invalid one, ‘All fish have scales’ so this is the other way around, we’ve got the category of fish and the category of scales, here (again using Venn diagrams), and it says,

‘Whales are not fish.’ Where should I put the whales? Here? I’ve stopped being able to think [Cross talking].

Male: But your first one was right.

Male: Inside the scales. [Cross talking].

Female: You’re going to overlap the [Cross talking] of the fish.

Male: All fish have scales.

Lecturer: Do you think one person could tell me? It’s getting very confusing. [Cross talking].

Male: It’s the same as in the top diagram.

Lecturer: Right.

Male: Scales is the big circle and fish is the small circle.

Lecturer: Yes, that’s right. ‘Whales are not fish’. Okay.

Male: But you've drawn it the other way around at the bottom.

Lecturer: Which I shouldn't have done. Yes. The important point to get from this, is just as we cannot tell from the facts that all the premises and the conclusion is false whether the argument is valid or invalid. We cannot tell from the fact that the premises are all false and the conclusion is true that the argument is valid or invalid. Validity is not determined by the truth or falsehood of the premises. Or, rather, it is, but the only thing that's ruled out by the validity of the argument is a situation where the premises are true *and* the conclusion false.

Male: But, if those intercept scales it's a null set, there are no elements in that set it doesn't exist, finished.

Lecturer: Irrelevant. Irrelevant.

Male: Why?

Lecturer: Because if it were true…

Male: Yes, whales intercept scales.

Lecturer: Whales what?

Male: Whales intercept scales, there's nothing in that set, so it's a null set and so there are no members of that set, so it doesn't exist, so everything falls down.

Lecturer: Okay. Terrible. Even so, everything I'm saying is true. I've got to the stage where it's quite difficult for me to think, so I put the… The handout is there, so you can go back and check that for yourselves later on. We're not evaluating arguments at the moment, so; again, I don't want to… (Slide 42) But I do want to point out that validity; a deductive argument is valid if and only if there is no logically possible situation in which its premises are true and its conclusion false.

Any other situation, the argument might be invalid. You can see that either an argument's got to be valid or it's got to be invalid. Either there is a situation in which the premises are all true and the conclusion false, in which case the argument's invalid, or, there isn't such a situation, in which case the argument is valid.

It's got to be either valid or invalid, there's no in between for a deductive argument. Importantly, logical possibility differs from empirical possibility and, again, we'll see some more about this later on. So, it may be impossible for a, well, I think I might be anticipating an argument I'm going to give later, so I won't continue with that. In your handouts, there is an explanation of the difference between logical and empirical possibility as well.

Female: Isn't it possible that you could have something that isn't clearly true or false, or that you just don't [Cross talking]?

Lecturer: Well, there's a difference between our ability to *know* that something is true or false and something's *being* true or false. That's the difference between epistemology and metaphysics. The question of whether we know it's true or false is an epistemological question. The question of whether it *is* true or false is a metaphysical question.

This is a metaphysical definition, it's not interested in your knowledge, I mean, often we don't know whether a premise is true or false, so our knowledge from the deductive validity of the argument is conditional. We know that IF this premise is true and IF this premise is true, then this conclusion must be true. Now we've got to go and conduct an experiment or take out our telescope and whatever and find out whether the premises are true.

Female: What if we didn't know that it was true?

Lecturer: Well, that's what I'm suggesting, that we have… So, let's take this as an argument.

Female: Is that how [Cross talking] reasoning to deductive?

Lecturer: No, I'm only talking deduction at the moment. 'There is a planet in between the sun and Mars'. That planet is called Vulcan.'

Male: I think you mean Mercury.

Male: I think you do.

Lecturer: That's fine. I don't think it [Cross talking].

Male: It's not Mars, it's Mercury.

Lecturer: It's Mercury, okay. 'Vulcan is between the sun and Mercury' Okay, when people made this argument, I don't think this is a very good argument, incidentally, but never mind, I hope it will make my point. When people, they believed that this was true, or that it was possibly true. They didn't know it for sure; it was only later on that we found out that this wasn't true and if you have… I mean, this is less interesting than an argument I could have put together, but you can imagine that if this (premise one) is true and this (premise two) is true, then this (the conclusion) must be true.

Female: What if, all I'm saying, is what if one of these, you weren't, you didn't know that it was true or false.

Lecturer: But that's what I'm saying is irrelevant, because, IF that's true, IF that is true, and IF that is true, (the premises) then THAT (the conclusion) must be true. That's got nothing to do with whether we know any of these things are true.

Female: You always assume true to get… You're always assuming that those are true to then…

Lecturer: No, and nobody is assuming. Listen to me, IF that's true, this is *conditional*, IF that is true, and that is true, then that (the conclusion) must be true. I mean, if you're a scientist, you're thinking, well, okay, I've got my hypothesis here, 'All swans are white' forgive the hackneyed example; it's ten past four. If all swans are white and if that animal is a swan, then that animal must be white.

Female: But what if you weren't sure that all swans are white.

Male: No, but that's not the point.

Lecturer: Point, [Cross talking], could somebody explain this to… Or she'll never get it.

Male: I think the problem is, you can answer that question without knowing anything about astronomy. That's a statement of logic. Forget astronomy, we don't have telescopes or anything.

Lecturer: Yes. [Cross talking] the swan.

Male: That is a valid argument.

Lecturer: We, and as swan experts, we use logic to set up our experiment. If we get our logic wrong, then we're going to be looking for the wrong things. We don't need to know the truth of our premises before we… What we're trying to do is find out the truth of our premises, in order to find out the truth of our conclusion.

Female: Validity isn't related to the true or false thing.

Male: No. That's not the point.

Female: Okay. I thought that you were saying it was.

Male: No, because both premises…

Lecturer: This is the definition of validity, so it is related to truth or falsehood. But, look at the definition. *An argument is valid if and only if there is a no logically possible situation, in which the premises are true and the conclusion false*. That can be determined without knowing whether the premises actually are true or are false.

Female: How?

Male: I think that the problem I had last year on the course, was [Cross talking].

Lecturer: Listen, I think that we probably ought to stop this, because I think everybody… I mean, who understands this point?

Male: I do.

Lecturer: Okay, Kirsten, would you mind if Bill or somebody, perhaps Bob were to take you aside and… I think that this is something that I need to continue on.

Male: Maybe if you do that point at the bottom, the asterisk.

Male: Yes, that's what it's all about.

Lecturer: Okay, well, again, the handout deals with that and it isn't strictly relevant to what we're talking about, so actually I'd rather not deal with that now. I hope that there'll be some time for questions, in which I will deal with it. Okay, the important point here is that deductive arguments are either good or they're bad. They're either valid or invalid. What makes the argument valid is that there is no logically possible situation in which its premises are true and its conclusion false. To know whether that's the case or not, it's not necessary to know the actual truth value. All that's necessary is to know the relations between the truth values of the statements.

Female: Could you give Kirsten an example in which one of your premises is…

Lecturer: No, I'm…

Female: Dragons aren't green, because that could be a true statement [Cross talking].

Lecturer: Everyone understands except Kirsten, sorry Kirsten.

Female: Don't worry, it's all right.

Lecturer: (Slide 43) Okay, so, what have I got here? Okay, this is a valid argument, I think, or as I'm going to ask you this. Premise one, 'If the patient has Huntingdon's Disease, the patient will have the HD gene on chromosome four.' Premise two, 'The patient has HD, Huntingdon's Disease' conclusion, 'The patient will have the HD gene on chromosome four.' The second argument, 'If the patient has Huntingdon's Disease, the patient will have the HD gene on chromosome four.' Premise two, 'The patient has the HD gene on chromosome four' conclusion, 'The patient will have HD' One of those is valid; the other is invalid, which is which?

Female: Invalid.

Lecturer: That's invalid (the one on the RHS). Why is that the case?

Female: Because…

Lecturer: You're very quick.

Female: Yes, but I can't explain it. Because the conclusion is wrong. The conclusion should be that the Huntington's Disease exists on the HD… It doesn't automatically… We can't assume the patient has HD, is my conclusion I want to get to.

Lecturer: Yes, okay. So, what we're doing here is we're *affirming the consequen*t of this. We're saying, 'If the patient has Huntingdon's Disease, the patient will have the HD gene on chromosome four, the patient has the HD gene on chromosome four, therefore the patient has HD.' Well, no, because what we're saying is it's *necessary* for having Huntingdon's Disease that you have the HD gene on chromosome four. It's not *sufficient* for having Huntingdon's Disease that you have the HD gene on chromosome four.

I'd just like to point out the difference between logical and empirical possibility. We actually know, some of us, that if you have the HD gene on chromosome four, you *will* have Huntingdon's Disease. In other words, that's empirically possible, sorry, empirically, that's a good claim, because, in fact, it's having the HD gene on chromosome four is both necessary *and* sufficient for having Huntingdon's Disease, is that right? We've got one medic in the room, I think.

Male: Heavens alive, I'm not a medic.

Lecturer: He's not a medic. Okay. But, okay, take it from me, it is necessary and sufficient, but this doesn't *say* it's necessary and sufficient, does it?

Male: No.

Male: If you put it the other way around.

Male: Turn it around.

Lecturer: Well, which is what we've done here.

Male: No, no, if you turn that round.

Male: 'If the patient…'

Lecturer: If you say [Cross talking].

Male: On chromosome four, you would have Huntingdon's Disease.

Lecturer: Then it would be valid, yes, that would be right, or, if you did it this way round it would be valid. What's not valid about this is that we've said it's a necessary condition and what we've done is we've assumed it's a sufficient condition too. This argument is not valid. We can determine that without us knowing anything at all about Huntingdon's Disease. Well, I'll convince you of that later on.

Okay, so that's valid because there's no… If that's true (premise one) and that's true (premise two), that (the conclusion) must be true. That's invalid because there's a possible situation in which

that's true… There's a logically possible situation in which that's true and that's true, but that's (the conclusion) not true. Okay? The fact there's no *empirically* possible situation in which that's true and that's true and that's not true is irrelevant. That's why logical possibility is important.

(Slide 44) Okay, so inductive arguments are either strong or weak. The extent to which an inductive argument is strong or weak depends on the extent to which the truth of its premises makes the truth of its conclusion more likely. The strength or weakness of an inductive argument is a matter of degree. (Slide 45) Here are two inductive arguments, 'Every day in the history of the world the sun has risen, therefore the sun will rise tomorrow' I think you can see that's a pretty strong inductive argument. We do expect the sun will rise tomorrow.

Argument two, 'Every time I've seen Marianne she's been wearing earrings' that may be true for you, 'Next time I see Marianne she'll be wearing earrings' well maybe not, maybe it might be my day off from wearing earrings, or whatever, or you've come round particularly early in the morning or something like that.

We can see that underlying both these arguments is something called the Principle of the Uniformity of Nature. This is an assumption that we all make, we cannot not make it, we operate with this all the time. It might not rise tomorrow, tonight might be the night that a meteorite hits the sun and it explodes. So, even though every time, every day in the history of the world we've seen the sun rise, it's still that we can't be certain it's going to rise tomorrow.

So, whereas with a deductive argument, if the premises are true we

can be absolutely certain the conclusion will be true. With an inductive argument, the premises could be true and very strong and yet, there's still a question mark over the conclusion. But that's strong and that's weak. (Slide 46) Again, an exercise to do at home, and I really will let you do that at home, because I can't think straight any more.

(Slide 47) Okay, so deductive arguments are either valid, good, or invalid, bad, but inductive arguments are only ever good or bad to some degree. They're inductively strong or inductively weak. Okay, so that's the first difference. Any quick questions about the first difference? No, good, okay.

(Slide 48) So, the second difference is, deductive arguments, deductively *valid* arguments are conclusively valid. Nothing we could learn could ever change their validity. So, not only are they certain, they're conclusively certain. Inductive arguments give us only probability and, it's always possible to learn something that would change the degree of probability that would enable us to think that, actually, that was a weak argument, but now I know that, it's become a strong argument.

Invalid arguments give us no knowledge at all. If we go back to that, that one, you see we get no knowledge at all from this statement here. It doesn't follow from, or at least, not from the argument itself. It doesn't follow from the premises. Is it true or false, well, how do we know, we have no reason to think it's either. We can, sometimes, by adding further premises, make an invalid argument valid.

(Slide 49) I'm going to give you a new word here, a property is

monotonic if and only if, and that's ('iff') not a spelling mistake, that means if and only if, a property is monotonic if it cannot be changed by the addition of new information, and a property is non-monotonic if and only if it can be changed by the addition of new information.

(Slide 50) Deductive validity is monotonic. If an argument is deductively valid, nothing we could learn will change its validity. There is no premise we could add that will make a valid argument invalid. (Slide 51) Invalidity is non-monotonic, we can add premises to an invalid argument and make it valid and inductive strength in non-monotonic, it's always possible to learn something that will change the strength of an inductive argument.

(Slide 52) Consider this valid argument, 'If it's spring, snowdrops will be out. It is spring, the snowdrops will be out.' Can you see that if that's true and that's true, that must be true? Yes, everyone accept that? Can we add anything to that to change its, change the fact that it's a valid argument to it being an invalid argument? Would anyone like to try? It won't let me write on the screen, I'm afraid.

Male: In Australia.

Lecturer: Where do you want to write, 'In Australia?'

Male: 'If it's spring in Australia the snowdrops are out'

Lecturer: Hang on. Okay. You want to add, ‘In Australia’ to that one.

Male: Yes please.

Male: No, you’ve got to add a new premise, haven’t you?

Lecturer: But then you’d have to add it here as well. Yes, it’s a new premise, not an addition to one of the premises that we’re wanting to add.

Male: You can’t change a premise, you’re saying.

Lecturer: We can’t add a premise here that would change this argument into an invalid argument.

Male: You’re asking the exercise, not to change a premise, but to add a premise.

Lecturer: Add a premise.

Male: Can you add a premise here that the snowdrops are not out.

Lecturer: Yes, let's try that. Okay, so, that originally was a valid argument, so if those two were true, that had to be true. Okay, has it changed to an invalid argument, is it the case that there is no possible… Sorry, there is a possible situation where all of those are true and that's not true? Is there, is it? Is there? I know there can't be.

Male: They're contradictions.

Male: They're contradictions.

Female: Yes.

Male: [inaudible].

Lecturer: If that's true and that's true and that's true…

Female: But there might be some other reason.

Female: [inaudible] snowdrops are [inaudible].

Lecturer: That can't be true, can it?

Male: Yes.

Female: That's right.

Lecturer: If that's true, and that's true and that's true…

Female: Yes.

Lecturer: So that becomes…

Female: Because the snowdrops might not have come out for some other reason [Cross talking].

Male: Spring is over a period of time, isn't it?

Lecturer: Listen, I can do this formally, [Cross talking]. Let me do it formally, because I think I can convince you much more quickly and I can do it formally and I can't do it informally at the moment.

It might be easier to understand this truth table demonstration if you have first watched the short podcast on truth tables.

Here is a truth table; we're going to be meeting truth tables later on. Do you accept the argument, 'If P then Q, P therefore Q'? Would you accept that that's a valid argument? Okay, well here's a truth

table, ‘If P then Q’ ‘P’, therefore, ‘Q.’ Okay? Now this is, I don’t mind doing this, because you’re going to learning this later on, so it’s giving you a little…

This is a tabular representation of all the truth conditions to do with this argument. This is the world in which ‘P’ is true and ‘Q’ is true. Okay? This is the world in which ‘P’ is true and ‘Q’ is false. Okay? This is the world in which ‘P’ is false and ‘Q’ is true and this is the world in which ‘P’ and ‘Q’ are both false. Are you with me, where I’m going on this?

Okay, let’s just fill in, so we know that ‘Q’ is true, false, true, false, I’ve put them lower case just to distinguish them. ‘P’ is true, true, false, false. ‘If P then Q’ now you’re going to have to take this on authority for the moment, that’s true, false, true, true. I’m sorry, you will have to take that on authority for the moment.

Is there a possible situation in which the premises are true and the conclusion false, true, true, but that’s true, so that’s all right. That’s not the situation when the premises are both true, that’s not the situation where the premises are both true and neither is that. So, there is no logically possible situation where the premises are all true and the conclusion false on that one. Okay, it’s a valid argument. Now let’s add in this other, what was it?

Male: Snowdrops are not found.

Lecturer: So it’s ‘Not Q’ in effect, wasn’t it?

Male: Yes.

Lecturer: Okay, let's add it in. I should have left myself some room. Let's add, 'Not Q' there. Okay? So if 'Q' is true, false, so here we've got false, true, false, true, are you with me? Okay, so now, have we got a situation where the premises are all true and the conclusions false, true, true, no, so that turns into a… Doesn't it?

Male: Yes.

Lecturer: False, true, true, true, false, false, true, false, true. So we still haven't got a situation where all the premises are true and the conclusion is false. And how's that? You've done truth tables in the very first session. I'm really impressed. Do you understand that? I mean, yes, can you see what I'm saying, you may need to think about it to understand it. Importantly, it doesn't matter what you add here, you will never change the validity of that argument. It's just impossible, because if you add a false premise, as we did here, you just change it from being a tick to being a dash and if you add a true premise, you just added another true premise. So, then you'd have true, true, true, true. [Cross talking], it's entirely mechanical.

Male: What's the heading at the top?

Lecturer: That's just the original argument.

Male: In that line you've got there, what's that, before, 'Q'? [Cross talking].

Lecturer: Therefore (it's a semantic sequent).

Male: Therefore, okay.

Lecturer: That's the argument claim, which is what I'm either ticking or would give a cross if there wasn't an argument. Good, well, that's saved us some time. (Slide 53) Okay, so if we add a true premise to a valid argument it's not going to change the relation of premises and conclusion, all we do is add another true premise and if we add a false premise, as we did there, we haven't changed the relation between premise and conclusion that makes it valid. (Slide 54) So, validity gives us certainty. If the premises are true and the argument is valid, notice, *IF* the premises are true and the argument is valid, then the conclusion is also true and nothing will ever change this, it's both certain and conclusive.

(Slide 55) Invalid arguments can be made valid by the addition of extra premises. I said thanks to Bill here for this example. This is Bill. So, premise one, 'All normal cats are four-legged'. 'All mammals give birth to live young'. 'All normal cats give birth to live young.' (Slide 56) This is invalid, because there's a logic leap, though not an empirically possible situation, in which the premises

of this argument are true, but the conclusion is false. Can you tell me what that situation is?

Male: Well, if the cat's been done.

Lecturer: I don't think that's the one I've got.

Male: Cat's got [inaudible].

Female: Cat's got [inaudible].

Male: I think there are some pets, aren't there, like [inaudible] lizards that aren't mammals that do give birth to live young.

Lecturer: You're over-thinking. I think you're all tired now and I'm going to tell you. If we add 'all four-legged animals are mammals' we'll get a valid argument there, won't we.

Male: Right.

Lecturer: 'All normal cats are four-legged'. 'All mammals give birth to live young'. 'All normal cats give birth to live young' is not valid, is it?

Female: Because there's…

Lecturer: But if we add, 'All normal cats' sorry, 'All mammals are four-legged.'

Male: All cats are [inaudible].

Lecturer: 'All four-legged animals are mammals', then we get a valid argument. (Slide 57) Invalidity is *non-monotonic*, even when validity is monotonic. Inductive arguments can always be weakened. 'Every day in the history of the world the sun has risen. The sun will rise tomorrow' but what if we learn that there's a gigantic meteor about to hit the sun? Okay, that would change our belief that that's a strong inductive argument, wouldn't it?

(Slide 58) Here's one, 'Jones was present at the crime scene. Jones is guilty of the crime.' That's a weak argument. Maybe other people were present at the crime scene. But, if we add, 'Smith, the policeman, who tried to stop Jones kill the man, saw Jones plunge the dagger into the man's heart' that strengthens the argument something rotten, doesn't it?

Male: [inaudible].

Lecturer: So you see that… What?

Male: [inaudible].

Lecturer: No. But do you see that we can take an inductive argument, it doesn't matter how strong and weaken it and we can take a weak inductive argument and we can strengthen it by the addition of more information. (Slide 59) Deductively invalid arguments are conclusively valid and give a certainty. Inductive arguments are never conclusively good or bad; they always rest on this Principle of the Uniformity of Nature. They only ever give us more or less probability and that might change as we learn more about the probabilities there are in the world.

Invalid arguments give us no knowledge at all, but they can sometimes be made valid by the addition of further premises. So, valid arguments are monotonic, deductive validity is monotonic, it will never change. Induction and invalidity are non-monotonic. A nice word for you.

(Slide 60) Oh God, haven't we difference three yet. Never mind, that's an interesting one. We need absolutely no background information about the world; you needn't know anything about the subject matter of a deductive argument in order to evaluate it. Now, isn't that interesting. I can see lots of people frowning here. But we always need background information to evaluate an inductive argument. It can only ever be evaluated *a posteriori*.

(Slide 61) Okay, now you didn't use background knowledge to find out the missing premise in the invalid argument we used before, the

one about the cat. You would have been able to find that premise even if you knew nothing about cats, mammals, four-legged animals or live births. But maybe you don't agree with that, maybe you don't accept that. (Slide 62) Is this argument valid? If not, is there something we can add to it that would make it valid? Put up your hands if you think it's invalid.

Male: The definition is [inaudible].

Male: I don't know what it means.

Lecturer: Do you need to know what it means? Is it a valid or an invalid argument, this one? Put your hands up if you think it's invalid.

Male: This one, or the one before?

Lecturer: Yes.

Male: This one.

Lecturer: Think about a premise you can add to it that would make it valid. Okay, who's got the extra premise? Okay. Martin.

Male: ‘All [inaudible].

Lecturer: (Slide 63) ‘If it is a blogar it is a fellybup. If it is a bledle then it is a condol. If it is a blogar the it is a condol’. Do you see, you were able to do that, I mean, you have no idea what we’re talking about here, that’s because we’re not talking about anything and these are made up words, I made them up. But, do you see, you can do it and the reason you can do it is because you don’t actually… It’s the logical words that matter, it’s the, ‘if’ and the, ‘therefore’ the facts it’s an, ‘if then’ and so on.

Ok, there’s only, ‘if then’ it’s the logical word that appears in that argument. But you could do with any combination of logical words like, ‘if then’ ‘and’ ‘or’ ‘if and only if’ etc. You could always do that with a deductive… It’s surprising, isn’t it? (Slide 64) What about that one, is that a good argument or not? Put your hands up if you think it’s a good argument.

Male: Yes.

Lecturer: ‘If a widgel is a terigore then it is grue, this widgel is a terigore. Therefore this widgel is grue’ It’s valid, isn’t it? Again, you have no idea what it’s about, because it’s not about anything. I made it all up. But it doesn’t matter, because you’ve got the ‘if then’ and you’ve got the ‘is’ that you understand and the relation between premises and conclusion that you understand.

(Slide 66) Okay, so deductive logic, I mean, what this tells us, is

that deductive logic is the ultimate transferable skill. My brother is a geologist and he once rang me up and said that he and one of his pals were having an argument about a paper, would I have a look at it. Now I know absolutely nothing about salt deposits or whatever they were talking about, but that was all right, because I was able to see that the argument that they were using was actually invalid and that in order to be made valid it needed, this (not a particular thing just whatever was needed) whether that was true or not I have no idea, in fact I didn't even know what it meant. But it didn't matter, because he knew what it meant and he was able to go and add that premise. I can't remember what he did.

So, deductive logic is topic-neutral, it can be applied to any subject matter, even if you know nothing about that subject matter. That's because only the logical form of a deductive argument is what counts when it comes to determining its validity, not the actual truth conditions of the premises and conclusions. So, we can always evaluate deductive arguments *a priori*.

(Slide 67) Here is the logical form, just to give you an idea of what I mean. All the previous slides I've used various arguments and here I'm just giving you the logical form, I'm taking out the content, completely, so we've got our one argument that was, 'If P then Q, if R then S' conclusion, 'If P then S' and you can see that's valid, probably.

Female: No, it isn't.

Male: No.

Male: No, [Cross talking].

Female: ‘P then Q and R then S.’ They’re not connected.

Lecturer: That’s valid. ‘If P then Q…’ Oh, sorry, that’s not valid, is it? What should I have?

Female: ‘Q’ [Cross talking].

Lecturer: ‘Q then S’. Good. Well, there you are, you’ve shown me that you understand it, just from doing that. Have a look at those, those are just for you to look at, they are supposed to be a representation in logical form, of the arguments in the other slides.

(Slide 68) Inductive arguments are such that we always need to bring to bear our background knowledge of the world to evaluate them. So, if we look at this, for example, ‘Every time I’ve seen Marianne she’s been wearing earrings, next time I see Marianne she’ll be wearing earrings’ okay, what do you need to evaluate that, whether it’s a good argument or not?

Male: How many times have they seen you?

Lecturer: How many, exactly. If you've seen me only once, that's a much weaker argument than if you've seen me hundreds of times. Good. Anything else?

Male: Something about your personality, I suppose.

Lecturer: Yes, or you could say, 'If you come round and knock on my door at 2 o'clock in the morning, you probably won't see me wearing earrings.'

Male: Unless you are.

Lecturer: So, it could be the times when I have been wearing earrings might have all been during the hours of nine to four.

Male: But if you were, you could be even more sure.

Lecturer: Well, that would be another incident; it's certainly true, yes. Okay, I'm going to move on because all I want to point out there and you can have a look at these at home and see for yourselves that you'll need to know something about Marianne, something about earrings, something Huntingdon's Disease, something about the sun, in order to evaluate all these. You can't do it *a priori* as you can with a…

(Slide 69) So, these are the three things that we've got to ask to determine the difference between a deductive and inductive argument. I'm not going to go through them, because we've gone through them, that's just a summary of all the things we've been saying.

(Slide 70) Here's an exercise to do at home, which is determine whether they are inductive or deductive arguments and the answers are in your answer sheet. (Slide 71) So, we've learnt how to recognise arguments, how to analyse arguments, how to distinguish deductive arguments from inductive arguments and, I realise that that's a real canter through and there all sorts of things like logical and empirical possibility and the nature of validity, that you're probably very hazy about, but you've got the handouts that'll help you with that and the podcasts on critical reasoning, if you've not seen them, there's a session devoted to each of those things. Much more devoted to each of those things than we've able to give it here.

What we're going to do, well, I don't need to tell you that. (Slide 72) Oh, there's a quiz for you too. How about that? And there's an advertisement, as well. And now we're going to have coffee.