Introduction to Modality

I. Lesson

"*Modal* logic is concerned with the relationships among *may be* and *is*, and *must be*, or possible and actual and necessary. Modal logic goes right back to the beginnings of logic, with Aristotle."

(John P. Burgess, *Philosophical Logic*, 2012)

1) Operators

The word 'modality' comes from the Latin *modus* (= 'way'). Put simply, it refers to certain ways in which things could be. We saw how a proposition is composed of a *subject*, a *predicate*, and a *copula*, each of which serves a different function. A fourth element that we can add to a proposition is the *operator* – simply put, these are words that operate on the proposition in certain ways. For instance:

Necessarily, Beth is happy.

Possibly, Beth is happy

2) **Necessity:** this expresses that something *must be* a certain way. The apple, for example, *must* fall down, and not up! The corresponding modal operator is "*necessarily*".

3) **Actuality:** this expresses the way certain things *are*, with no further claim about whether they could be otherwise or not. The corresponding modal operator is not always *explicit* in sentences: while we may use 'actually' to emphasize the fact that the apple is red, the statement with no such emphasis -- 'this apple is red' -- would also be a statement about actuality (*actually*, this apple is red)

4) **Possibility:** this expresses a way certain things *may be*, with no further claim about their being that way in actuality. For example, it is *possible* for apples to be red, green, or yellow. The corresponding modal operator is "*possibly*".

II. Examples

1. Necessity

Take the following simple example: "Beth is happy." Here, we are predicating happiness of the subject, Beth. Compare with the following example: "Necessarily, Beth is happy." A part of our initial proposition has stayed the same, but we have added an extra word. The content of the proposition has thus changed; we are not merely saying that Beth is happy,

but that Beth *must be* happy, that she could not be feeling in any other way than happy. "Necessarily" in this instance is the operator.

1. <u>Actuality</u>

We have already seen instances of this: "Trees have leaves", for example, expresses that, as a matter of actual fact, trees have leaves. We are not saying whether there could be trees with leaves, or whether trees *must* have leaves, or anything of the sort. There need not be any *explicit* modal operator linked to it, since actuality is just what we normally express with any proposition without a modal operator attached to it.

1. <u>Possibility</u>

As an example, consider the following propositions: "Humans walk." and "It is possible that humans walk." The first one expresses the proposition as a matter of actuality – that humans walk. The second one expresses a slightly different mood. It merely expresses that humans *could* walk. Importantly, the second proposition is concerned with *how things might have been*; the first is concerned with *how things actually are*.

<u>Some Important Implications</u>

Here are some important implications for *any* proposition, using "Beth is happy" as an example:

(1) "Necessarily, Beth is happy" implies "Actually, Beth is happy"

(2) "Necessarily, Beth is happy" implies "Possibly, Beth is happy";

(4) "Possibly, Beth is happy" does *not* imply "Actually, Beth is happy";

(5) "Possibly, Beth is happy" does *not* imply "Necessarily, Beth is happy".

Perhaps the least intuitive of these is (2). But consider, if Beth is *necessarily* happy, then it can't be *impossible* that she's happy. That is, if Beth is *necessarily* happy, then it must be *possible* that she is happy.

III. Exercises

Exercise 1

Take the following six propositions, given in regular speaking terms, and write whether they are an expression of *necessity, actuality,* or *possibility*. Explain your answers.

a) Pepper has got to be spicy.

b) Green is a color.

c) Logic could be fun.

d) It's necessary that Beth is not happy.

e) It might be that trees have leaves.

f) The trees have leaves

Exercise 2

(Challenge) Extend what we know about operators to *temporal* operators (operators expressing temporal notions) and *epistemic* operators (operators expressing notions pertaining to certainty or epistemic possibility). Identify the operator(s) in the following propositions. If the proposition is an expression of actuality, write "actuality."

Example 1) Trees are plants

Answer 1): actually

Example 2) They are often skilled

Answer 2: actually, often

a) He is necessarily a human

b) Rutgers is a university

c) Possibly, summers are hot

d) Dogs are sometimes brown

e) The beach is fun

f) She is definitely the valedictorian

IV. Conclusion

Modal language – language that uses operators like possibly, actually, and necessarily – concerns how things could be. All the time, we make claims about various things being possible or impossible (not possible), necessary or not. In order to better understand what we mean and how these various claims are interrelated, we try to develop a logical framework that can characterize this type of propositions. We introduced the notion of an operator to clarify the three kinds of modal statements that we can make. Aristotle developed these ideas in his *On Interpretation* and *Prior Analytics*; in future lessons, as we talk about *syllogisms*, it will be clear that these facts about modality are relevant to a wide variety of logical arguments.

V. Lesson Goals

At the end of this lesson, students will be able to:

- Understand the notion of modality and explain its importance
- Explain the notion of an operator and how they affect the content of a proposition
- Define the three kinds of modal notions: necessity, actuality, and possibility
- Define some relationships of implication between different modal notions

Answer Key:

Exercise 1

a) Necessity; "has got" is an operator to denote that pepper is necessarily spicy. b) Actuality; this is simply an expression of what green is. c) Possibility; here, "could" is used as a casual operator to convey that it is possible that logic is fun. d) Necessity; explicit use of the "necessary" operator. e) Possibility; "might" is used as a casual operator to convey that it is possible that trees have leaves. f) Actuality; this is simply an expression that the trees have leaves.

Exercise 2

a) necessarily b) actually c) possibly d) actually, sometimes e) actually f) actually, definitely