# *Introduction to Categorial Logic*

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* I do not claim authorship for all texts and pictures in the presentation.

## *Summary of Previous Lecture*

1. What is logic
2. The difference between rhetoric and logic
3. Difference between a claim and an argument
4. What is an argument and what are its components
5. What is an extended argument
6. How we can identify, reconstruct, and assess an argument
7. How to interpret an argument (ambiguity, vagueness, rhetorical questions, irony, implicit relative statements, quantifiers)

*TODAY'S PLAN*

1. *History of Categorical Logic*
2. *What is Categorical Logic?*
3. *Elements of Categorical Logic*
4. *Quantity*
5. *Quality*
6. *Distribution*

## 1. Historical Overview (Aristotle and the Stoics)

Aristotle forefather of Modern Logic

Aristotelian Logic is known as Syllogistic, Categorical or Term Logic

Aristotle's theory of Syllogism has had unparalleled influence in Western thought

Aristotle’s work on Logic is rich and complex

*- Included in the Organon*

Consists of several treatises, among them:

- *Categories*
- *Prior and Posterior Analytics (+)*
- *Topic*
- *On the Interpretation*
- *Sophistical Refutations (+)*

Aristotelian Logic is based on Deductive Reasoning

AND that is grounded on two ideas/notions or pillars:

- Syllogism (argument with exactly 2 premises)
- 264, Medieval tradition with Boetius, Abelard, Buridano
- Terms (atomic units denoting classes/categories of things*)*

*BIG ISSUE:*

Underlying Aristotle's magnificent work in Logic there is a deep question

*IS LOGIC PART OF PHILOSOPHY (Stoics) OR IS IT A MERE TOOL (Aristotle)?*

Aristotle thought that logic should be used to guide metaphysics. Logic was the cornerstone of knowledge, a tool to investigate basic truths.

## *2. What is Categorical Logic?*

A fairly simple logic of categories or classes

In this logic, we can say something about all members of a class, called a universal sentence, or we can say something about some members of a class, called a particular sentence. We can also make a positive claim, called an affirmation, or we can make a negative claim, called a negation

In categorical logic, important logical terms are the terms “all” and “some.”

In categorical logic we will use capital letters to stand for categories of things in the world, We can represent the statement:

All humans are mortal
as
All H are M

where “H” stands for the category of “humans” and “M” stands for the category, “things that are mortal.” Notice that the categories are nouns or noun phrases.

Categorical logic is the logic that deals with the logical relationship between categorical propositions.

A categorical proposition is simply a proposition about a category or type of thing.

**EXAMPLE: DOGS ARE ANIMALS** (every categorical proposition has two terms)

TWO CATEGORIES/CLASSES HERE

1. DOGS subject term (not in the grammatical sense but in terms of primary class to be related to the second) - The subject term is a the portion of the proposition that refers to a set of persons, animals, places, or things.

2. ANIMALS, predicate term (the secondary class to be related to the first) The predicate term is some quality which the subject is supposed to have.

PROPOSITIONS TYPICALLY COMPARE CATEGORIES OF THINGS OR CLASSES

DOGS ARE ANIMALS…. (ALL) DOGS ARE ANIMALS

How the first category relates to the second, helpful means to compare classes

MEN ARE MAMMALS…. (ALL) MEN ARE MAMMALS

CATEGORICAL PROPOSITIONS essentially explain the relationship between two categories whether or not –for instance- they need to be excluded, included, OR whether they are universal or particular

ARE (verbs in general) = **COPULA**
**(**element that glues predicate and subject term together)

**Yet,**

We are missing how to determine the quantity (How much) the subject of one class is or is not in the predicate class and vice versa

So, we need **QUANTIFIERS –all, none etc-** (the final element of categorical logic which take us to standard categorical propositions…)

# FOUR BASIC ELEMENTS IN CATEGORICAL LOGIC

1. SUBJECT TERM
2. PREDICATE TERM
3. COPULA
4. QUANTIFIERS

QUICK EXERCISE –individuate subject term, predicate term, copula and quantifier

All mice are rodents.

Some basketball players are seven feet tall.

A few scholars are good athletes.

No sailors are bad swimmers.

Most snakes are harmless.

## STANDARD FORMS CATEGORICAL PROPOSITIONS

Since, categorical logic asserts that either all or parts of a class denoted by the subject term is included or excluded from the class denoted by the predicate term we have 4 basic categorical propositions:

1. All S are P
2. No S are P
3. Some S are P
4. Some S are not P

# *4. Quantity – how much?*

The QUANTITY of a proposition is either universal or particular.

A proposition is UNIVERSAL if its quantifier is ALL or NO.

A proposition is particular if its quantifier is SOME.

1. All S are P
2. No S are P
3. Some S are P
4. Some S are not P

# *5. Quality – in which way?*

In what way Are the classes being related?

- **Affirmative** – something is the case

Claim about existence, all the members of one class are related to the members of the second class in a positive sense

Example: all humans are mammals; all mice are rodents

- **Negative** - something is not the case

out of all the class of the first class none of them are members of the second class – they are excluded

Example: No dogs are fishes; no mice are rodents

The QUALITY of a proposition is either affirmative or negative.

A proposition is NEGATIVE if the quantifier is NO or the copula is ARE NOT.

A proposition is AFFIRMATIVE if it is not negative, therefore if the quantifier is ALL or the copula is ARE

1. All S are P
2. No S are P
3. Some S are P
4. Some S are not P

a. Porphyry's *Isagoge*

b. Boethius' *On the Categorical Syllogism*

c. Abelard's *Dialectica*

d. Richard of Campsall' *Questions on the Books of the Prior Analytics*

e. William of Ockham's *Compendium of Logic*

# FOUR BASIC FORMS

## Summing up:

| Proposition | Letter name | Quantity | Quality |
|---|---|---|---|
| All *S* are *P*. | **A** | universal | affirmative |
| No *S* are *P*. | **E** | universal | negative |
| Some *S* are *P*. | **I** | particular | affirmative |
| Some *S* are not *P*. | **O** | particular | negative |

EXERCISE

Identify the form of the categorical statements expressed by the following sentences.

1. All heroes are brave people.
2. No brave people flee from danger.
3. Some people who face danger are brave.
4. Some who flee from danger are not brave.

5. Philosophers have all studied logic.
6. Many pre-law students study logic.
7. There haven't been any philosophers on the moon.

## *6. Distribution*

Unlike quality and quantity, which are attributes of *propositions*, **distribution** is an attribute of the *terms* (subject and predicate) of propositions. A term is said to be distributed if the proposition makes an assertion about every member of the class denoted by the term; otherwise, it is undistributed. Stated another way, a term is distributed if and only if the statement assigns (or distributes) an attribute to every member of the class denoted by the term. Thus, if a statement asserts something about every member

A term in a claim is DISTRIBUTED when it says something definite about all members of a certain category

Distribution is a formal feature. Does not depend on the terms used. The pattern of distribution is the same

The A proposition [All S are P] says that every member of the subject class is a member of the predicate class.

Example: All dogs are animals

But is reference being made to every member of the predicate class?

NO.

Example: "All artists are eccentric."

You are only saying that if a person is an artist, he is a member of the class of eccentric people (which includes, but goes beyond artists; philosophers are eccentric too!).

The E proposition [No S are P] makes reference in a negative way to every member of the subject class. E propositions also assert that not a single member of the S class is a member of the P class, and thus the reference is to the whole of the predicate class.

Example:
no cats are dogs,
no dogs are fishes

In the I proposition [some S are P] the quantifier [some] makes it clear that only some members of the subject class are being referred to, so the subject is undistributed (Some S … ).

What about the predicate class?
It is also undistributed because reference is being made to only some of the members of that class not the whole of it.

Example: some men are wealthy

What about women?

In the O proposition [Some S are not P] the quantifier "some" shows that the reference is being made to only some of the subject class (Some S …).

What about the predicate class?
It is distributed, because to say that Some S is not P, we have to know the sum total of the P class to make this assertion.

Examples:

Some Men are not Happy

You have to know the sum total of the happy people in order to know that some are not part of it

All those who are not happy will go away . All those in the category who remain are happy

**SUMMARY**

| Proposition | Letter name | Quantity | Quality | Terms distributed |
|---|---|---|---|---|
| All *S* are *P*. | **A** | universal | affirmative | *S* |
| No *S* are *P*. | **E** | universal | negative | *S* and *P* |
| Some *S* are *P*. | **I** | particular | affirmative | none |
| Some *S* are not *P*. | **O** | particular | negative | *P* |

## WHAT WE LEARNED TODAY?

1. *History of Categorical Logic*
2. *What is Categorical Logic?*
3. *Elements of Categorical Logic*
4. *Quantity*
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