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A Formalization of Topical Logic

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Introduction

For Aristotle, logic is the instrument (‘organon’) by which we come to know anything. It reveals the structure apparently common to all reasoning. His formal rules for correct deduction were founded upon the subject-predicate analysis of statements known as Term Logic and the valid forms of the syllogism. These logical writings (350 BCE), with the Categories at their head, were grouped together by later scholars into what became known as the Organon.

There are two types of deductions. In demonstrations (scientific deductions), the premises are true, and the conclusions are therefore also true. In dialectical deductions, the premises are not facts but commonly held opinions, commonplaces of reason upon which all or most agree in principle.

Aristotle’s Topics presents *topoi*, ‘places’ from which such arguments can be discovered or invented and employed in syllogisms to provide support to convince a listener about a conclusion. This process, called invention, was a foundation for Aristotle’s work Rhetoric, treating the art of persuasive speaking or writing.

The Development of the Topics of Invention

The Topics of Invention were developed after Aristotle by orators and philosophers such as Cicero, Quintilian and Boethius.

The liberal arts curriculum in medieval universities was organized according to the Aristotelian model of disciplines - the Trivium (Grammar, Rhetoric and Dialectic) and the Quadrivium (Arithmetic, Astronomy, Geometry and Music). Inventio, the discovery of arguments using the Topics of Invention, was placed under the discipline of Rhetoric.

The Logic of Ramus

Rodolphus Agricola (1444 – 1485) was an early Renaissance humanist who had a revolutionary impact on later writers. He revised and reorganized the system of topics that had been handed down by Aristotle, Cicero, Quintilian and Boethius. The topics were defined as the universal aspects of things - such as genus, whole and part - which apply to all things and enable us to categorize and talk about things.

Petrus Ramus (1515 - 1572) presented Topical Logic as a challenge to Aristotle’s Term Logic. He moved inventio from its traditional location in rhetoric (the study of persuasive speech) into the division of dialectic (the study of arguments). He also added an emphasis upon method, proposing an organization of material from general to particular. The technique of dichotomies for classifying species and subspecies was aided by the new technology of printing. His approach offered a shorter, simpler approach for teaching and a practical technique for organizing and memorizing information. This led to a revolution in the traditional curriculum of many universities in Europe and influenced the Puritans who founded Harvard in colonial America. Many logic books using this approach were printed in the 16th and 17th century.

The art of invention, according to Ramus, embraces the following ten general topics:

causes, effects, subjects, adjuncts, opposites, comparisons, names, divisions, definitions, witnesses and judgment.

References

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The Logic of the Ramchal

Marcus Wendelin wrote a textbook (Logicae Institutiones Tironum Adolescent), first published in 1648, that explains Ramus’ logical method and brings extensive examples, mainly from religious sources. He presents twenty-one topics, most of them occurring in pairs. Using Prof. Manekin’s translations of the terms, these 21 topics are:

cause and effect, subject and adjunct, whole and part, genus and species, denotation and denotandum, definition and definitum, conjugation and conjugatum, division and divisum, comparables, [things that are] diverse, opposites, testimonies and that which is attested.

Rabbi Moshe Chaim Luzzatto (the Ramchal) wrote Sefer HaHiggayon (The Book of Logic) in 1742 for his students in Amsterdam (it was not published until the 1890’s in Warsaw). It is an abridgement and rendering into Hebrew of Wendelin’s book, with the examples modified for Jewish sensibilities. He removed the examples from the body of the work and collected them in a supplement called Knaf Hekeshim. Ramchal refers to the 21 topics as “the terms that are used in logic.”

The Ramchal also published in 1742 Sefer Derech Tvunos (The Ways of Reason) is the title of the English translation) in which he presents twenty-four *havchanos*, general logical aspects by which we can distinguish subjects:

Essence, Parts, Quality, Quantity, Material, Form, Action, Consequence, Genus and Species, Cause, Means, Motivation, Purpose, Result, Attribute, Location, Position, Movement, Time, Relation, Subject, Comparison, Difference, Contrast

Our research involves analyzing the Topical Logic presented in the Ramchal’s Book of Logic and presenting a formalization of Topical Logic.

The Formalization

The Ramchal uses the 21 terms in four ways:

1. building simple statements – by identifying in a subject one of the topics, we build a statement. For example, in the subject ‘the world’ we identify the active cause, which is HaShem. We build from this the statement ‘the world is the creation of HaShem.’

2. building compound statements – by identifying a reason for affirming or denying a predicate in a subject, we build a compound statement that has the strength of a syllogism. Given the statement ‘humility is good’ that affirms goodness of humility and a proof of the affirmation, ‘because it is the product of straight reason’ we build the compound statement ‘Humility is good because it is the product of sound reason’ which contains the following syllogism:

Anything that is the product of straight reason is good
Humility is the product of straight reason
Therefore, humility is good

3. analyzing simple statements – given the statement ‘The head is part of the body’ we identify the subject ‘the head’ and the predicate ‘part of the body’ which is further analyzed into the term ‘part’ and the correlate ‘the body.’

4. analyzing compound statements – given the statement ‘Humility is good because it is a product of straight reason’ we identify the affirmation ‘humility is good’ and the assertion that it is good because it is the product of sound reason. We expand that into a syllogism (as above).

The Ramchal’s uses of the Topics of Invention can be abstracted as follows. The topics of invention are relational terms. They can be identified in the internal structure of statements in the following ways:

1. A simple statement 'A is R of B' that contains a topic in the predicate can be analyzed into its components – subject A and compound predicate with relational term R and correlate B

2. A compound statement with a justification clause ‘A is Z because R of A is Y’ can be analyzed into its components – the subject of the justification clause, ‘R of A’, is a correlate of the subject A of the main clause via the relational term R.

3. The compound statement ‘A is Z because R of A is Y’ contains the following syllogism: All X such that R of X is Y, is Z, R of A is Y. Therefore A is Z.

This logical system opens new vistas of logical exploration. Classical term logic has the limitation that the subject and predicate terms of the categorical statements treated are indivisible and their internal structure cannot be modeled. The logical system presented here overcomes this limitation.