



# Deduction – Two Approaches: Ramchal versus Aristotle

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## Goal of the Research

This research presents Rabbi Moshe Chaim Luzzatto’s (the Ramchal’s) innovative formulation of the rules of valid deduction:

- ❑ Ramchal adds a third type of conversion, conversion by contraposition, to the two types of conversion employed by Aristotle for transforming categorical statements in order to validate a syllogism
- ❑ Ramchal presents a simple rule of syllogistic reasoning: a known statement can be transformed by restricting the subject to what is “under the subject”) or by extending the predicate (“what is inferred from the predicate”). This approach permits reasoning with statements containing either general or singular terms, whereas Aristotle’s approach permits only statements with general terms
- ❑ All valid syllogisms can be transformed, using the Ramchal’s three types of conversion, into a form which can be validated by Ramchal’s rule of syllogistic reasoning. There is no need to resort to Aristotle’s use of indirect proof (Reductio ad Absurdum) to validate a syllogism

## The Types of Inference

**1. Inference** is the process of deriving new ideas from known statements, proceeding step by step from premises to conclusions. There are two primary styles of inference:

**a) Deduction** - inference deriving logical conclusions from premises known or assumed to be true

- **Immediate inference** – one premise
- **Syllogism** – two premises

**b) Induction** - inference from particular premises to a universal conclusion

2. The 3 types of syllogism in classical logic are:

- **Categorical syllogism** – contains three categorical statements of the form:  
**All / Some S are / aren’t P**
- **Hypothetical syllogism** – contains a hypothetical statement:  
**If** statement-1 **then** statement-2
- **Disjunctive syllogism** – contains a disjunctive statement:  
**Either** statement-1 **or** statement-2

## Categorical Syllogisms In the Logic of Aristotle

Aristotle’s system is restricted to categorical statements involving general terms. Given two general terms P and S, there are four different types of categorical statement:

- Universal Affirmative (A) : All S are P
- Universal Negative (E): No S are P
- Particular Affirmative (I): Some S are P
- Particular Negative (O): Some S aren’t P

A categorical syllogism consists of three categorical statements - two premises followed by a conclusion. There are just three distinct terms: two extremes (S and P) which appear in the conclusion and in one premise, and a middle term (M) which appears in both premises but not in the conclusion. The simplest example of a categorical syllogism is AAA-1 (Barbara):

(major premise) All M are P All birds are animals  
(minor premise) All S are M All parrots are birds  
(conclusion) All S are P All parrots are animals

A deductive argument is called valid if, by virtue of the logical form of the argument, it is impossible for the premises to be true and the conclusion false.

24 of the 256 possible forms of categorical syllogism are valid (assuming existential import and allowing subalterns). Aristotle (using three figures without subalterns) counts 14 valid forms.

Aristotle’s proves validity by applying conversion to reduce each valid form to one of the four “perfect” (Figure I) forms (see handout). However, two syllogistic forms (AOO-2 and OAO-3) cannot be reduced, and he resorts to indirect proof (Reductio ad Absurdum) to validate those two.

## References

[1] Luzzatto, R. Moshe Chaim, The Book of Logic and The Ways of Reason in The Way of Torah, translated and annotated by R. David Sackton and R.Chaim Tscholkowsky, Jerusalem: Feldheim Publishers, 2014.

[2] Aristotle, The Prior Analytics, Aeterna Press, 2015

## Ramchal’s Innovation #1: Conversion by Contraposition

Conversion is a kind of immediate inference in which the subject and the predicate of the premise are switched to generate the conclusion. Aristotle [2] considers only two types of conversion:

- **Simple conversion:**  
No S are P → No P are S  
Some S are P → Some P are S
- **Per accidens conversion:**  
All S are P → Some P are S

The Ramchal includes an additional form of conversion, conversion by contraposition:

- **Conversion by contraposition:**  
All S are P → No non-P are S  
Some S are not P → Some non-P are S

Note that the predicate-logic inference rule of contraposition,  $\forall x(Sx \supset Px) \rightarrow \forall x(\neg Px \supset \neg Sx)$ , is equivalent to conversion by contraposition followed by obversion.

## Ramchal’s Innovation #2: Rule of Syllogistic Reasoning

Ramchal presents a simple rule of syllogistic reasoning: a known statement can be yield a new desired statement by applying a “link statement” by one of two methods:

- **by restricting the subject** (replacing the subject of the known statement by “what is under it”):  
(known) All M are P (known) All M are P  
**LINK All S are M LINK All x are M**  
(desired) All S are P (desired) All x are P
- **by extending the predicate** (replacing the predicate of the known statement by “what is inferred from it”):

**LINK All M are P LINK All M are P**  
(known) **All S are M** (known) **All x are M**  
(desired) All S are P (desired) All x are P

In the first two cases, the known proposition is the major premise, and the link statement is applied to yield the desired conclusion with restricted subject (either species of a genus or singular instance). In the second cases, the known proposition is the minor premise, and the link statement is applied to yield the desired conclusion with “inferred” predicate.

For Ramchal’s examples of Talmudic applications of these two methods of syllogistic reasoning presented in Sefer Derech Tevunos [1], see the handout.

## Ramchal’s Innovation #3: Direct Conversion for all Forms

All valid syllogisms can be transformed, using Ramchal’s expanded repertory of three types of conversion, into a form for which his rule of syllogistic reasoning can be applied. We present Ramchal’s examples from Sefer HaHiggayon [1] describing how conversion is used so that his rule can be applied..

Example #1: AAA-1 (Barbara, singular minor term):

All humans are living beings  
Reuvain is a human  
Reuvain is a living being

Proof by applying the transformation of substituting the singular term ‘Reuvain’ for the subject of the known premise, ‘all humans’

Example #2: EIO-1 (Ferio):

All humans are not oxen  
Some living beings are humans  
Some living beings are not oxen

Proof by applying the transformation of replacing the subject of the known statement, ‘all humans’, by the concept ‘some living beings’ which is under that subject.

Example #3: the known statement is the minor premise; in standard form this is EAE-2 (Cesare):

All speaking creatures are humans  
No stones are humans  
All speaking creatures are not stones

Proof by performing simple conversion on the major premise, yielding ‘No humans are stones’ and then replacing the predicate of the known premise, ‘humans’, by what is attached to it, ‘not being a stone’

Example #4: the known statement is the minor premise; in standard form this is EAO-3 (Felapton):

All speaking creatures are physical beings  
All speaking creatures are not stones  
Some physical beings are not stones

Proof by performing per accidens conversion on the minor (known) premise, yielding ‘Some physical beings are speaking creatures’ and then replacing the predicate, ‘speaking creatures’, by what is attached to it, ‘not being a stone’.

For direct proofs of AOO-2 (Baroco) and OAO-3 (Bocardo) using conversion by contraposition (the two forms which Aristotle validated by resorting to indirect proof, Reductio ad Absurdum), see the handout.