

Logic

Quantified Propositional Logic

What Propositional Logic Cannot Do

- Propositional Logic leaves certain propositions unanalyzed
 - it analyzes compound propositions (propositions in which other propositions are joined by connectives like “if”, “or”, and “and”)
 - e.g., “If this is fattening, I won’t eat it.”
 - but it begins with “atomic” or unanalyzed propositions
 - e.g., “Dogs are mammals”
 - so, this logic cannot show us the validity of the following syllogism
 - All dogs are mammals.
 - All collies are dogs.
 - So, all collies are mammals.
 - the basic tools of propositional logic do not allow us to see the pattern of recurrence of terms within the propositions

What Aristotelian Syllogistic Cannot Do

- Aristotelian logic goes beyond PL in that it analyzes all propositions
 - all propositions are compounds of two terms—a subject and a predicate—which are related in one of four ways
 - (NB: propositions stating identity might be exceptions to the universality of subject-predicate form
 - e.g., St. Thomas Aquinas is the author of the Summa Theologiae
 - but this logic leaves the terms themselves unanalyzed
 - so, this logic cannot show us the validity of the following syllogism
 - Al is taller than Bob.
 - Bob is taller than Charlie.
 - So, Al is taller than Charlie.
 - the basic tools of Aristotelian logic do not allow us to see the pattern of recurrence of term-parts within the terms
 - “Bob” is the subject of the minor premise
 - but is only part of the predicate of the major

Quantified Logic

- Quantified logic, like Aristotelian logic, allows the logician to look inside propositions
- but it does so differently
 - (1) it symbolizes subject-predicate propositions differently
 - Ps, i.e., s (an individual) has the property P
 - not Xsp, i.e., s (one kind or class of thing) is related to p (another kind or class of thing) in the way X (e.g., “all” or “some”)
 - note that in QL terms are immediately divided into
 - possible subjects—these can only be subjects
 - » all and only names of individuals (or their equivalents, like definite descriptions) can be subjects
 - and possible predicates—these can only be predicates
 - » all and only universals can be predicates
 - contrast this with Aristotelian analyses, where the term dogs is subject of the major, predicate of the minor
 - All dogs are mammals.
 - All collies are dogs.
 - So, all collies are mammals.

(2) it identifies a different number of basic propositions

- perhaps three in ordinary language
 - all — some — none
 - “some ... are not ...” is assimilated to “some”
 - or rewritten as “not all”
- but only two logical types
 - universal — existential

(3) it makes a different fundamental contrast

- universals are treated as conditional
 - $(x) (Sx \rightarrow Px)$
- universals are contrasted with existentials, not particulars
 - $(\exists x) (Sx \wedge Px)$

The Usefulness of Quantified Propositional Logic

- doing all this allows it to analyze terms in several different ways
 - first, it can analyze compound subjects
 - “Some good students are ...”
 - $(\exists x) ((Gx \wedge Sx) \wedge \dots)$
 - “Anyone who is either smart or industrious will do well”
 - $(x) ((Sx \vee Ix) \rightarrow Wx)$
 - second, compound predicates
 - “Anyone who will do well is either smart or industrious”
 - $(x) (Wx \rightarrow (Sx \vee Ix))$
 - third, it can handle direct objects and all terms within relations
 - “Lxy” might mean “x loves y”
 - “Gxy” might mean “x is greater than y”