

Short Paper

On Lei Ma's Substitution Logic

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Abstract

According to Lei Ma's substitutionism, one basic characteristic of the human thinking process is the substitution or replacement of thinking elements. Based on this account, a new version of syllogism, namely the substitution logic, can be developed. In this brief comment, I discuss the big advantages of substitution logic over the classical syllogism (including Aristotle's syllogism and the traditional syllogism) and examine some presuppositions implied in the substitution logic.

Keywords

substitution logic, classical syllogism, ordinary thinking process

Lei Ma's substitution logic is overall an original, lucid and stimulating project on new developments of syllogism (Lei Ma, 2019). The present project is based on Lei Ma's previous job (Ma, 2015, 2017), but with a far more ambitious aim: a new foundation for syllogism, namely the substitution logic. For Ma, the initial plausibility of logic is more than the systematic study of inference or the formal analysis of argument, but a theoretical construction that is capable of characterizing our ordinary thinking process in a fundamental sense. Specifically, one basic characteristic of the human thinking process, Ma thinks, is the substitution or replacement of thinking element. For instance, we have a sentence "All men are mortal", if we replace "all men" by "Aristotle", a new sentence "Aristotle is mortal" is obtained. At first sight, this general claim is nothing revolutionary, but when the thought is framed in its original way, with Aristotle's syllogism and the traditional syllogism carefully examined on the one hand, and substitution logic sophisticatedly constructed on the other hand, we will be aware of what the intriguing part is.

The general introduction of substitution logic is followed from the limitations of the classic syllogism (including Aristotle's syllogism and the traditional syllogism) critically exposed and analyzed. For brevity, those limitations can be summarized as follows:

- (a) The classic syllogism tackles merely the categorical proposition without considering, such as relational, hypothetical, disjunctive and conjunctive propositions.

- (b) The possibility that the predicate of a sentence can be quantified is ignored by the classic syllogism, which merely incorporates the quantification of the subject in a sentence.
- (c) The classification of the categorical proposition in classic syllogism into four kinds, i.e., universal affirmative, universal negative, particular affirmative and particular negative, misses out an abundance of terms in ordinary language that can be served as link term of a sentence, such as “like”, “are not”, “know”, “do not know”, etc.
- (d) Classic syllogism doesn’t include the case where a negative term or a contradictory can be introduced, thus there is a limitation of the moods in the classic syllogism.

Given our space restriction, the substitution logic might be better exemplified, rather than demonstrated in detail in this comment. Considering the following inference in substitution logic:

Premise 1: All students of Class One like (all) students of Class Two.

Premise 2: All students of Group One are (all) students of Class one.

Conclusion: All students of Group One like (all) students of Class Two.

This is one of sixteen valid symmetric inferences governed by three certain rules (Note 1) in substitution logic. Let us focus on some points at issue:

- (1) The above inference is a hybrid of a relational proposition and a categorical proposition, in which the categorical proposition determines which term in the relational proposition (“all students of Class One”) being substituted by a substitution term (“all students of Group one”) in the categorical proposition. Firstly, it is obvious that two different kinds of propositions are contained in the syllogism. The deductive reasoning of substitutionism enlarges the constraints of classic syllogism that merely applies to the categorical proposition. In principle, all kinds of propositions can be incorporated. Secondly, considering Aristotle’s account of common term shared by two propositions in two premises respectively, it is a defining feature, which is a great discovery of Aristotle, that the common term will eventually disappear in the conclusion. According to Ma’s account, however, substitution logic has the advantage of making very explicit what is implicit in Aristotle’s account, namely the disappearance of the common term is the result of the substituted term being replaced by the substitution term. Thirdly, what makes the substitution in syllogism function is that the categorical proposition asymmetrically links two terms with the identification of one as the substituted term and the other as the substitution term.
- (2) All subjects and predicates are quantified in substitution logic, which breaks through the barrier of classic syllogism confining itself merely to the quantification of the subject. The quantification of the predicate is essential to substitution logic. It makes it explicit that the substitution takes effect at the level of class operation. Accordingly, it interprets the lack of the quantifier of the predicate in the ordinary expression as the habitual omission. And it also presupposes a certain theory of class as its foundation. However, the quantification of the predicate is not uncontroversial despite the obvious advantage. Take “All sheep have four legs” as an example, according to substitution logic, this sentence might be better interpreted as “All sheep fall entirely within all animals that have four legs.” Such a

class as “animals having four legs” can be counted as an extensional class, which is defined by listing everything falling under that definition. While it can also be counted as an intensional class, in which specific property is claimed that an object needs to have to be counted as a member of the class. Therefore, a further justification about the theory of class is required for substitution logic that whether it rests itself upon extension, intension or a hybrid read of class.

(3) In classic logic, the quantification is entangled with the qualification of a proposition, thus the categorical proposition is divided into “universal affirmative”, “universal negative”, “particular affirmative” and “particular negative”. In substitution logic, there exists no longer such entanglement. The quantification applies to both the subject and the predicate of a sentence. The qualification is detached from the connection of the subject and the predicate merely in virtue of affirmation or negation. Alternatively, the connection of the subject and the predicate is fixed by a link term, which is the constant part of the proposition. The link term connects a subject with a predicate at the sentential level and refers to a certain relationship between two objects at the ontological level. Accordingly, a large number of words in our ordinary language qualifies such a definition as link term, for instance, “know”, “don’t know”, “like”, “be liked by”, “need”, etc. Specifically, the previous connection term in the categorical proposition, like “is,” “are,” are grouped into asymmetrical link terms together with terms like, “belong to”, “are included in”, etc. Clearly, the extension of the link term characterizes our ordinary thinking much better than the classic syllogism. Despite the abundance of link terms, it is also fair to point out that such an extension is not exhaustive. Terms like “include”, “comprise”, “consist of”, etc., are neglected in substitution logic due to its structural limitation. The concern of completeness requires further investigation if it aims to handle ordinary thinking phenomenon as much as possible.

(4) The substitution logic enlarges the kinds of the proposition in the discussion, which doesn’t mean valid moods in classic syllogism are not covered by the new logic. The A, E, I, O (four kinds of categorical propositions) combined in three propositions with four figures result in 256 possible moods in the classic syllogism. All those moods can be handled by substitution logic with some rules selecting the valid ones. Moreover, substitution logic can also engage in the case where a negative term or a contradiction judgment is introduced.

(5) Let’s switch our attention a bit from substitution logic to the general thought of substitution, which, I think, is what underlies all the above discussions. If the substitution logic is an application of the thought of substitution on the one hand and is demonstrated about the linguistic phenomenon on the other hand, then what is the relationship between linguistic phenomenon and thought process? Could we relate two sides merely by committing to the ordinary sense of thinking and speaking? The ordinary sense will probably lead us to a theory of direct reference at the language level and a direct realism at the ontological level. Surely, this is an open question. There is always a balance between accuracy and efficiency in theory choice. Ma reminds us of being aware of the price we need to pay when we determine whichever dimension we want to emphasize.

In sum, Ma's paper offers an argumentatively original and intriguing treatment of syllogism with the substitution logic as its foundation. He wisely bypasses the complicated, sometimes even perplexing discussions in modern logic. It is essential for anyone interested in serious research on this topic.

References

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Note

Note 1. Rule a1) The universal anterior term (or the universal posterior term) can be completely replaced by its child term, that is, the quantifier of the child term should be retained when its parent term is replaced. Rule a2) The universal anterior term (or the universal posterior term) cannot be completely replaced by its parent term but can be incompletely replaced by its parent term, that is, the universal quantifier of the parent term must be changed into the particular when its child term is replaced. Rule a3) The particular anterior term (or the particular posterior term) cannot be completely replaced by its parent term, but if the particular term has turned into a universal term, the parent term of the universal term can incompletely replace the particular term, that is, the universal quantifier of the parent term must be changed into the particular when its child term is replaced. (Lei Ma, 2019, p. 204)