

Relevantized Intensional Semantics For Some Syllogistic Theories

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Abstract

Two possible strategies toward constructing semantics for syllogistic theories are known in literature: extensional and intensional. The former is more customary while the latter received a lot of attention only recently. In this work we present a kind of intensional semantics for Venn's and Vasiliev's syllogistics. The distinctive feature of our approach is to close the interpretation of categorical statements under the notion of logical consequence from the logic of first-degree entailment.

There are many syllogistic theories on the landscape of the modern logic, each of them differ both semantically and syntactically.

Traditionally, the relations between terms of a categorical statement within these systems are treated in extensional way, that is – as the relations between extensions of concepts (e. g. the extension of the concept of 'metal object' is wider than the extension of the concept of 'golden object', hence the statement 'All golden objects are metal objects' is satisfiable).

Taking as the starting point Leibniz's work on syllogistic [2], Markin introduced alternative approach to the explication of the relations between terms of a categorical statements [4]. Leibniz suggested to shift from the extensions of concepts to their contents. Using the aforementioned example we can say that the concept of 'gold object' includes the content of 'metal object', because the first one has more attributes than the last one. Such an interpretation might be called intensional. For recent study on this topic see for example [10]. Further, Shalack [9] introduced another approach to building the intensional semantics. The core idea is that the contents of concepts can be represented by propositional formulae. Thus, we can naturally explicate the relations between the concepts by means of logical consequence (in case of Shalack, the classical one).

It is obvious that if we assume classical consequence, then all of its notorious features hold in the semantics. One of them is that a contradiction implies any other statement. In context of syllogistic this principle transforms in an curious manner. So, the statements like 'All the walking dead are penguins' will be true in the semantics, because the content of the concept 'walking dead' is represented by the contradictory formula. In order to overcome this problem it is natural, following Markin [5], to replace classical consequence with the relevant one. For this purpose **FDE** is well-suited [1].

So, using this kind of intensional interpretation, which is closed under relevant consequence relation, opens up the possibility of constructing semantics for a wide range of syllogistic theories. The aim of our work is to present and discuss such 'relevantized' semantics for two well-known syllogistic theories: Venn's [8, 12] and Vasiliev's [3, 6, 7, 11] ones. For both theories we define a corresponding satisfiability predicate, and δ is a function (interpretation of terms) mapping the set of universal terms into the set of formulae of **FDE** propositional language. Thus, $F(A, \delta)$ should be read as 'the syllogistic formula A is satisfied under interpretation of terms δ '. Thus, the semantical conditions are as follows.

Venn's case:

$$\begin{aligned} V(SaaP, \delta) &\Leftrightarrow \delta(S) \vDash_{rel} \delta(P) \wedge \delta(P) \vDash_{rel} \delta(S); \\ V(SaiP, \delta) &\Leftrightarrow \delta(S) \vDash_{rel} \delta(P) \wedge \delta(P) \not\vDash_{rel} \delta(S); \\ V(SiaP, \delta) &\Leftrightarrow \delta(S) \not\vDash_{rel} \delta(P) \wedge \delta(P) \vDash_{rel} \delta(S); \\ V(SiiP, \delta) &\Leftrightarrow \delta(S) \not\vDash_{rel} \neg\delta(P) \wedge \delta(S) \not\vDash_{rel} \delta(P) \wedge \delta(P) \not\vDash_{rel} \delta(S); \\ V(SeP, \delta) &\Leftrightarrow \delta(S) \vDash_{rel} \neg\delta(P). \end{aligned}$$

Vasiliev's case:

$$\begin{aligned} B(SaP, \delta) &\Leftrightarrow \delta(S) \vDash_{rel} \delta(P); \\ B(SeP, \delta) &\Leftrightarrow \delta(S) \vDash_{rel} \neg\delta(P); \\ B(SmP, \delta) &\Leftrightarrow \delta(S) \not\vDash \delta(P) \wedge \delta(S) \not\vDash_{rel} \neg\delta(P). \end{aligned}$$

The notion of validity for both theories is defined in a standard way. Both semantics are adequately formalized by Markin's system from [5]. In order to show this we use an embedding method.

The motivation of our study stems from different sources. Firstly, we think it is useful and instructive to combine different (but related) trends in logic: Vasiliev's logical ideas (as the forerunner of paraconsistency), and the relevance, which is explicated in terms of contradictory and incomplete information. Secondly, both Venn's and Vasiliev's theories were, at least partly, motivated by distinctive and philosophically grounded views regarding the nature of relations between terms within statements of subject-predicate form. Thus, explicating these relations by modern techniques on the intersection of topical directions might not only clarify some 'blank spots' on the works of these outstanding thinkers but exhibit some new peculiarities of relevance and paraconsistency.

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References

- [1] Dunn, J. M. Partiality and its dual. *Studia Logica*, 66(1), 2000, pp. 5–40.
- [2] Leibniz G. W. Two Studies in the Logical Calculus. In: Loemker L. E. (eds) *Philosophical Papers and Letters*. The New Synthese Historical Library (Texts and Studies in the History of Philosophy), Vol. 2. Springer, Dordrecht, 1989.
- [3] Konkova A. V. Imaginary Logic-2 N.A. Vasiliev as a syllogistic theory, *Logical Investigations*, Vol. 25, No. 2, 2019, pp. 94–113.
- [4] Markin, V. I. Intensional semantics for traditional syllogistic, *Logical investigations*, Vol. 8, Moscow: Nauka, 2001, pp. 82–91. (In Russian)
- [5] Markin, V. I. Interpretation of categorical propositions in terms of relevant entailment, *Logical investigations*, Vol. 22, No. 1, 2016, pp. 70–81. (In Russian)
- [6] Markin V. Modern Reconstruction of Vasiliev's Logical Systems. In: Markin V., Zaitsev D. (eds) *The Logical Legacy of Nikolai Vasiliev and Modern Logic*. Synthese Library (Studies in Epistemology, Logic, Methodology, and Philosophy of Science), Vol. 387, Springer, Cham, 2017.
- [7] Markin, V., Zaitsev, D. Imaginary logic-2: Formal reconstruction of the unnoticed Nikolai vasiliev's logical system. *Logique Et Analyse* 45 (178), 2002.
- [8] Markin, V. I., Legeydo, M. M. Intensional Semantics for J. Venn's Logic of Classes, *Logical Investigations*, No. 2, 2019, pp. 114–137.
- [9] Shalack, V. I. Syntactic interpretation of categorical attributive propositions, [Logical investigations], 2015, Vol. 21, No. 1, pp. 60–78. (In Russian)
- [10] van Rooij R. Leibnizian Intensional Semantics for Syllogistic Reasoning. In: Ciuni R., Wansing H., Willkommen C. (eds) *Recent Trends in Philosophical Logic*. Trends in Logic (Studia Logica Library), Vol. 41, Springer, Cham, 2014

- [11] Vasiliev, N. A. *Imaginary Logic: Selected Works*, Moscow, Science, 1989. (In Russian)
- [12] Venn, J. *Symbolic Logic*. London: Macmillan and Co, 1881.