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ЛОГІЧНА СЕМАНТИКА НА ОСНОВІ ПОВІДОМЛЕНЬ ТА ІНТЕНЦІОНАЛЬНА ЛІНГВІСТИЧНА СЕМАНТИКА ПАУЛЯ ҐРАЙСА

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У статті розглянуто нову логічну семантику для класичної пропозиційної логіки, яка постулює, що пропозиційна формула покликається на особливу структуру, а саме: дерево повідомлень. Воно визначає істиннісні значення елементів пропозиційної формули. Для створення концепції такої семантики використано філософсько-лінгвістичну теорію Г. П. Ґрайса. Ґрайс висунув гіпотезу, згідно із якою значення акту мовлення більшою мірою визначає інтенцію мовця, ніж "словникове" значення виразів. Мовець може мати певні приховані цілі щодо свого акту мовлення. Наприклад, він може маніпулювати своєю аудиторією для досягнення політичної чи економічної мети. Таким чином, справжнє значення виразів, які він використовує, може суперечити буквальним, "словниковим" значенням. Отож, щоб зрозуміти семантику його виразів, необхідно брати до уваги його справжні інтенції.

Повідомлення – це текстове вираження відповідних інтенції. Стверджується, що повідомлення можуть виражати різноманітні мета-правила, які стосуються пропозиційної формули на яке покликається їхнє "дерево". Повідомлення можуть взаємодіяти як між собою, так і з повідомленнями інших дерев, утворюючи специфічні "алгебри". Специфікуючи дані "алгебри", можна на основі описаної семантики створювати інші види пропозиційних логік.

Інтерпретуючи повідомлення та відповідним чином модифікуючи істиннісні значення пропозиційного виразу, можна емулювати ситуацію описану Ґрайсом. Проте, варто визнати, що ідея такої логічної семантики значно ширша, ніж просто емуляція однієї окремої лінгвістичної теорії.

Ключові слова: *аналітична філософія мови, логічна теорія мови, лінгвістична семантика, логічна семантика.*

MESSAGE-BASED LOGIC SEMANTICS AND INTENTIONAL LINGUISTIC SEMANTICS OF PAUL GRICE

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The paper considers new logical semantics for the classic propositional logic which states that a propositional formula refers to a special structure – "the tree of messages". This tree of message determines the truth values for the elements of the propositional formula.

The source of inspiration for creating a concept of such semantics is a philosophical-linguistic program advanced by H.P. Grice. Grice made a hypothesis according to which the meaning of the speech act is defined more by speaker's intention than by the "conventional" meaning of utterances.

A speaker may have hidden intentions towards his speech act – he is manipulating his audience for political or economic aims, for example. Thus, the true meaning of the utterance the speaker uses may even contradict the "conventional" meanings of those expressions. As a consequence, to understand the true meaning of those utterances you should take the speaker's true intentions into consideration. A message is a textual expression of such intentions. In general, messages can express different meta-rules which specify the context for the propositional formula which refers to the "tree". Messages can cooperate between each other as well as with the messages from different trees creating specific kinds of "algebras". By specifying these "algebras" the variety of different alternative propositional logics based on this semantics can be created.

By interpreting messages and accordingly modifying the truth values of propositional formulas the situation described by Grice can be emulated. However, it should be admitted that the idea of such logical semantics is wider than just an emulation of the particular linguistic theory.

Key words: *analytic philosophy of language, logical theory of language, linguistic semantics, logical semantics.*

Introduction

Herbert Paul Grice is a famous and influential philosopher who worked in the field of philosophy of language and is a well-known follower of the Ordinary Language School of linguistic philosophy [Petrus, 2010:16]. His, probably, most cited idea is usage of the speaker's psychological intention for defining the semantics of the utterances [Chapman, 2007:17].

There is an utterer *A* who utters the phrase *B* intending to induce the effect *C* on those who hear him. His words have basic "conventional" meaning but the utterer may have other intentions for his phrases. *A* wants different *C* than the conventional meaning of *B*. *A* may be a deceiver who is manipulating his audience to achieve political, economical and other goals.

A will use his knowledge of both the conventional usage of the phrases and the context of the situation so as to induce the needed effect. For example, he knows that his audience is strongly against certain political decision and he goes into description of the consequences of that decision to enrage the listeners.

A uses neutral description which is neutral conventionally but his intention is to influence the audience emotionally. His intention is prior to the natural meaning so his intention determines the true semantics of the phrase. So you have to add the speaker's intention to understand the true meaning of what is spoken.

One of the supporting concepts of that linguistic semantics is a system of utterer's meanings which is organized as a complex hierarchy [Chapman, 2007:8]. There are conventional and non-conventional meanings of words and phrases and there is also a possible difference in what an utterer said and what he intended for the audience to understand from his words.

This hierarchy was the inspiration for the idea of the logical semantics which will analyze such contexts. This will be semantics and not particular logical calculus [Milne & Strachey, 1976]. Different variations of particular logical syntactic systems based on that semantics can be built later. The main reason for that is the initial complexity of the idea of such a hierarchy.

Semantics will capture the main idea of such a linguistic semantic concept. In a sense it will be more abstract than a schema provided by Grice. Philosopher builds an exact hierarchy with each level being controlled by higher levels and having sublevels to influence on. However, there can be added additional definitions so as for semantics to mirror these particular linguistic properties as well.

Another reason is that Gricean initial idea concerned linguistics and the semantics of natural language. The project of this paper is logical semantics. Purely linguistic application is still interesting, though. From just the abstract semantics it can be extended easily for the linguistic case.

The semantics will suit different syntactic systems but it will not have the rules for quantifiers (it would be too complex) so the case is for propositional calculi only. At the same time, quantifier is an interesting theoretical problem in the scope of linguistic problems so it deserves a few paragraphs.

Thinking through the content of the article raised an interesting analogy of linguistic semantics of this type and some elaborations in the field of artificial intelligence and computer science. It is both early GOFAI ("Good Old-Fashioned Artificial Intelligence") and contemporary natural language processing [Luger, 2008:520]. Some part of the article will be devoted to this problem too.

Semantic schema

As defined in the introduction, the purpose of the semantics is to establish the hierarchy of intentions of the speaker that will provide the appropriate truth-functional relations for the propositions. How can that be achieved?

It is doubtful that a speaker's intention can be expressed in any way other than through natural language. So it is text (textual information) in some of its forms.

The most suitable way for that are texts divided in certain separate nodes that can cooperate and form a system. The name "message" seems appropriate for such a node of text.

Bertrand Russell was one of the first analytic philosophers who advocated that expressions refer to certain descriptions rather than to particular objects or categories. He proposed that ***denotatum*** of the term is a descriptive phrase accompanying the word itself. Later modifications of the theory provided a different view on what the unity of these phrases should look like. Russell's views remain influential in today's philosophy as well. David Kaplan analyses the view and provides both the Russellian and novel non-Russellian view on the description theory of reference [Kaplan 2005]. His main point of criticism is a contradiction of Russell's semantics and epistemology. Kaplan dates his views to Frege's and compares to the different views on language as a tool for representation.

In theoretical sense messages and their relation to the action and intention is continuation of the descriptivist's view on reference. However, intention is a more specific description and the message it is encoded in serves according to more specified purposes. Thus, establishing a precise link between the two of them poses a problem.

In a sense Grice's ideas on different meanings of expressions of natural language and the importance of context is a "methodological bridge" from descriptions to specified intentions [Grice, 1957]. The philosopher points out the intention of the speaker to be sort of additional explanatory factor for the speech act. Speaker's words as an act presuppose intention of a speaker as a key description of this act according to Grice's theory of conversational implicatures [Grice, 1989:139].

Message determines the context of the speaker's statement through expressing his intention. It is quite easy to see that the notion of a message itself is wider than just intention. A message can communicate not only the speaker's intention but also historical or cultural context, other speakers' disposition etc. So the semantics will be called "message-based semantics".

It is not a disadvantage, though. The exact relations between messages can be specified to mirror the required structure. On the other hand, messages can be specified in other ways to meet different requirements – for the purpose of the mentioned linguistic and not only propositional structures. This way messages as a concepts are more useful.

We should use the model of the classic propositional logic for the start. We will add additional structure that will specify the truth functions of propositions in particular contexts. The first association is, of course, modal logic and especially possible worlds semantics. Modal logic studies different modal contexts of the statements and possible worlds semantics proposes to assess them in different global scenarios ("worlds") [Menzel, 1986:70–72]. The relations between scenarios define the modal operators.

The main difference here is that we agreed that our semantic structure influences truth functions and not any kind of modalities. There were also only separate nodes mentioned and no analogy of modal global scenarios, possible worlds. It is at least conceivable that there are no global scenarios for message based semantics so we just assess the complex propositional formulas based on messages but it is just not logical.

The very idea of such semantics is senseless that way. Why should we take messages in consideration as a formal factor instead of prescribing mathematical values to truth functions already? On the other hand the global scenarios that will allow for comparing the statements in different contexts seem like a very promising idea.

How a separate node, a "message" will define the truth values of a proposition? Assume we have the very simple case of plainly "p" – "The snow is white". The hypothetical truth value for this proposition is "1", "true". Assume it is not the case of a classic semantics but a case of our "message-based" one. So we have a special message associated with the mentioned proposition.

But if there is a complex propositional formula and we have some essentially meta-information about the snow then the described semantics makes sense. For example, there is a formal description of masses of snow in Arctic when the colour is an indicator of important parameters and there is a meta-rule about coherence of these or that propositions that is precisely the case for the message-based semantics.

If we elaborate this situation it is easy to see that the only way to build a coherent system is to consider messages as certain global rules. For example, our message says "the propositions of p-type are all false". Any other way to treat messages is redundant.

If, for example, we just say that messages are some important facts about the context of the proposition then why didn't we just add them as part of the propositional statement, other propositions connected to the initial proposition by classic logic connectors and operators?

So messages give some essential meta-information about the propositional formula. If the example with the "p-type" or "Arctic" seems ad hoc it is easy to find more suitable ones. Let us say we have the propositions that describe some program code [Northover, 2008:90–93]. It is a known fact that there are

mistakes in the code so certain types of propositions are incorrect and have the corresponding truth value. So the message will be about the class of mistakes in the code.

The example with the propositions describing the code is very technical but it can be easily extrapolated for other cases. There are hundreds of situations where there are complex meta-rules that should be taken into consideration and which are perfect for our semantics [Neale, 1992:531–540].

A critic might say that all of it may seem redundant as it is. If you spend enough time formalizing the statements you will end up with the entire context in those propositional formulas. So why look for meta-information and separate meta-rules that messages should determine?

That is not so simple. Not all the cases allow for the context specifications with the help of propositions. And almost all the cases are much easier if there is meta-information and an appropriate apparatus to deal with it. It is a well-known fact that some purely modal statements can be "translated" into more complex FOPL (First Order Predicate Logic) formulas with extensive usage of quantifiers but it does not mean that modal logic is a bad idea.

Now, after we have established the role of the separate nodes we should outline how the separate nodes will cooperate with each other. There can be more than one message for the formula and they will influence each other and the resulting truth values for the propositions. To influence the result of the previous message the next message in line should be connected to its content. The first thing that comes to mind is a contradiction. If the second message contradicts the first one we should define the rules for assessing the main of them.

It may be the case that the second message is more accurate. It is about time we just make the simple rule for messages – a new message is always prior. So in the case of the contradiction the new message cancels the previous one. But it is evident that there may be other cases. Maybe next messages should not be trusted and we have completely different rules for dealing with the meta-information. Or the new message does not contradict the previous one but rather specifies it. Maybe there are more complex cases when we should study the system of messages carefully applying different rules and using probability theory. So it can be said that there is room for the whole message-algebra for the meta-information of the logic. How can it be defined? We may say that there is a special set of symbols ("key") connected to the message-system that defines the rule for interpreting messages. The very simple case can be not for the set but for the ordering defined on the set of messages.

Isn't that too much? There are rules for meta-rules? As was said earlier message-algebra is for more complex cases. As this paper is just a statement of possibility of such semantics, we will look only into the simplest cases. We need just state that this algebra can be elaborated later. Anyway we just state the existence of the "key". The structure of messages as a system is outlined, at least for the case of a separate "global scenario". The logic of this structure is that there are prior messages and messages that either specify them or cancel previous ones. The good name for such a scenario is "tree", "message-tree".

We define a "message tree" as a superset of sets of messages that refer to the same single propositional formula and whose algebra is defined by a separate "key". The message tree will define the truth functions for a designated propositional formula.

It is possible that different trees (trees that refer to different propositional formulas) can cooperate. The messages from one of the trees can refer to the types of propositions of the other tree. Thus, comparing different trees may state the separate mathematical problem and should be guided by a special "global" algebra. The exact relations between different trees will be defined by particular algebra. As with the previous case with the "key" we just state that this possibility exists.

Now we must precise a formal definition of the semantics – the definition of the main parts of the semantics in purely formal terms. We add next elements to the model of the classic propositional logic (A, T, K, G) where A is a superset of sets of textual symbols composing messages, T is a superset of subsets of A constituting the "message-trees", K is a superset of sets of ordering relations on T constituting algebras for "message-trees" and G is a global algebra for cooperation of different trees (or a blank set if there is no global algebra in the system). Different types of this semantics are possible through specification of local and global algebras.

Applications: Gricean intentional linguistic semantics and natural language processing

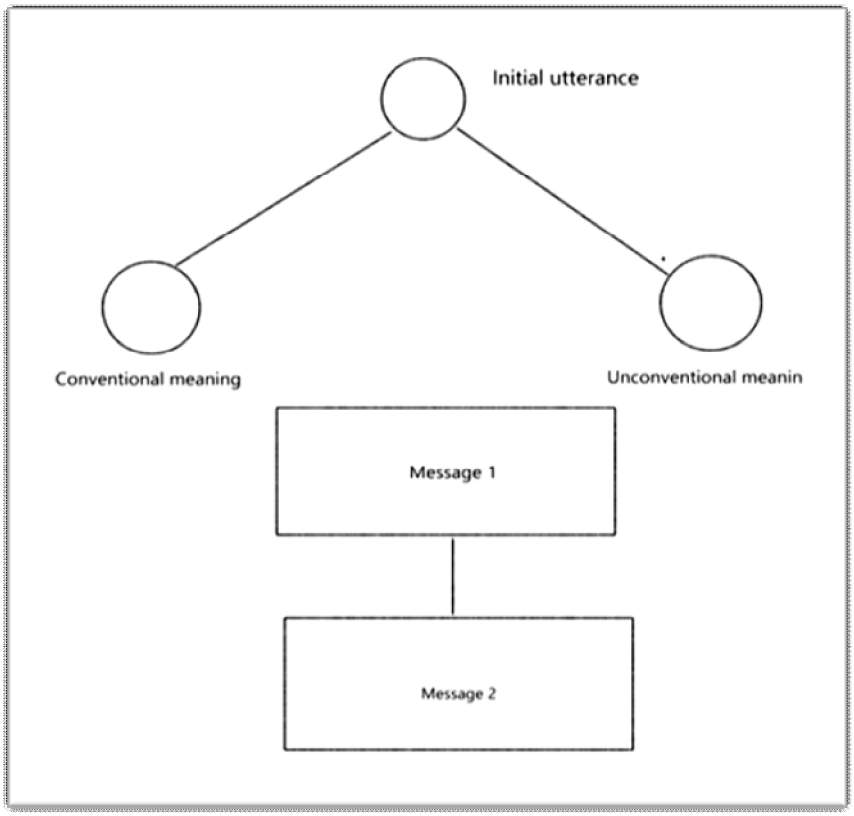
As was mentioned before, the application domain of message-based semantics is wider than just an intentional linguistic semantics of Grice. The domain of message-based semantics is about particular specifications. In this chapter we will outline what such specifications are needed to fit into the Gricean semantics and theorize on further specifications for the case of computer natural language processing.

Textual messages are actually also wider than meta-rules. Textual information may constitute almost any kind of idea. However, the scope of formal logic

presupposes meta-rules as the main content for the messages. Any other kind of textual information would make the relations between different trees chaotic. It will be impossible to build a rigorous algebra.

Though, it is still interesting how such a chaotic system will look like and what will be its parameters. Unrigorised textual information will not define the precise values for the truth function. Instead the influence will be chaotic and extremely complex. In fact, it will be more like the cooperation of two different text messages or pieces of fiction text than mathematical expression. In this sense unrigorised message systems are very promising for natural language processing and artificial intelligence.

Grice states that intention defines the meaning of the utterance. There is also intention of the speaker and these different possibilities constitute a hierarchy of meaning of the utterance [Davis 2007: 50–58]. That schema of course reminds of a simple tree concept outlined in the previous chapters. Compare the figures on the *Diagram 1*.



The initial propositional formula will present the logical structure of the utterance of the speaker and the tree it refers to will present the different meanings of that utterance. “Key” of the tree will determine different outcomes of the speaker’s utterance-act. If the message with an intention of a speaker is prior to messages with other content then the speaker achieves his/her political, economical and other goals. On the other hand, the audience may be well-prepared or the speaker can chose his rhetoric poorly and the only effect he induced is that connected to the usual conventional meaning of his words. The tree’s “key” will define that outcome by making the message with the conventional meaning more prior.

The algebra of the messages may be more complex than that example of course. Different contexts may intersect; some additional factors can be involved. Most of these situations may be modelled by introducing mathematical probabilities of combinatorial rules. It is again about the particular specifications of the “key” and the tree's hierarchical structure. It may be concluded that the Gricean concept of the intentional utterances’ semantics may be emulated using the semantics outlined in this chapter.

It may be said that in this way, the initial propositional expression is redundant again. Why bother codifying the utterance in propositions, if trees and their algebra are the main part of the problem? After all, the initial utterance may be expressed as a message and then we have to deal with the formal system which has the semi-logical structure but is not a propositional logic or logic at all.

Grice uses propositions and propositional attitudes in his argumentation, but it is doubtful that he thought of

switching to the "logic-rails" completely for his theory. However, despite these facts, we should admit that the key problem here is that propositional logic with a message-based semantics is wider than the case of Grice's semantics. In this article, the case is made that message based-semantics exists and it can be used for formalizing the Gricean intentional semantics of utterances.

On its part, the mentioned chaotic message-message system is a perfect candidate for the natural language-related problems and especially natural language processing and artificial intelligence.

Some of the most early developments in the artificial intelligence that are now called GOFAI had to deal with computers interpreting texts composed from natural language [Luger, 2008:562]. Computers could not interpret information coded not in formal commands but in textual information (just like messages in the outlined semantics) but it caused several inventions such as systems of key words and formal computational semantics development.

Natural language interpreting remains one of the most complex and interesting problems in computer science and it is largely unresolved. Modern technologies went far beyond in a sense of technical methods for natural language processing using data-driven processing and neural nets. However, the theoretical foundation is the same – a computer decomposes text into separate words and expressions and uses mathematical methods to emulate the understanding of the text.

All of these mathematical methods are based on semantics – the science that had advanced in the last century but existed for centuries before that. Semantics gives the guiding idea of how the language understanding should be emulated for the computer case. Thus, the semantics outlined in this paper is a new idea for the foundations of natural language processing. It may provide valuable insight for both the GOFAI-related methods and methods connected to the new technologies.

Conclusion

This article describes the project of a new semantics for propositional logic. "Message-based" semantics proposes a propositional formula to refer to the special structure – "tree of messages" that will define its truth values using meta-rules expressed in these messages. The article contains a separate chapter where exact modifications of the model of the classic propositional logic are specified.

Semantics can establish the algebra for messages' relations inside a tree as well as rules for cooperation of different complex propositional formulas with different trees. Specifying the exact algebras or adding other mathematical theories such as a probability theory will create different variants of modification of the original propositional system.

The initial aim of the semantics was to formalize the intentional theory of linguistic meaning proposed by philosopher H. P. Grice. Grice created an influential program about the speaker's intention influencing the meaning of his utterance. Different meanings of the utterance together with the real intention behind the speaker's speech-act create a variety of possible outcomes for the audience.

It is proved that it can be done through this formal model but an idea of such logic is wider than just this one application. Grice's hierarchy of conventional and non-conventional meanings can be emulated using meta-rules expressed by messages. The outlined semantics is also important for natural language processing and artificial intelligence.

The article will be useful for all those interested in philosophy of language, formal logic, computer science, artificial intelligence and natural language processing.

ЛІТЕРАТУРА/REFERENCES

Chapman, S. (2007). *Paul Grice, Philosopher and Linguist*. London: Palgrave Macmillan.

Davis, W. (2007). Grice's Meaning Project. *Journal of Pragmatics, 26,* 41–58.

Grice, P. (1989). *Studies in the Way of Words*, Cambridge: Harvard University Press.

Grice, P. (1957). Meaning. *The Philosophical Review, 66,* 377–388. https://doi.org/10.2307/2182440.

Kaplan, D. (2005). Reading "On Denoting" on Its Centenary. *Mind, 114(456*), 933–1003. https://doi.org/10.1093/mind/fzi933.

Luger, G. (2008). *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, New York: Pearson.

Menzel, C. (1986). On Set Theoretic Possible Worlds. *Analysis, 46(2),* 68–72. https://doi.org/10.2307/3328173.

Milne, R. & Strachey, Ch. (1976). *A Theory of Programming Language Semantics*. London: Chapman and Hall.

Mandy, N., Derrick G. Kourie, D. G., Boake, A., Gruner, S. & Northover, A. (2008). Towards a Philosophy of Software Development: 40 Years After the Birth of Software Engineering. *Journal for General Philosophy of Science, 39(1),* 85–113. https://doi.org/10.1007/s10838-008-9068-7.

Neale, S. (1992). Paul Grice and the philosophy of language. *Linguistics and Philosophy, 15,* 509–559. https://doi.org/10.1007/BF00630629.

Petrus, K. (2010). *Meaning and Analysis: New Essays on Grice*. Hampshire: Palgrave Studies in Pragmatics, Language, and Cognition. https://doi.org/10.1057/9780230282117.