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COMPLEX ARGUMENTATION IN THE CONTEXT OF RHETORICAL STRUCTURE THEORY IN SCIENTIFIC DISCOURSE

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The idea of the article is to provide the reader with some material on representation of S. Toulmin's argumentation model with regards to rhetorical structure theory. On the ground of this model the concepts of argument and plea are determined. The former is viewed as a single semantic complex. The fundamental notions of discourse analysis associated with rhetorical structures theory are reviewed. The features of rhetorical relations are mentioned. Much attention is given to the distinction between subject matter and presentational relations. The layout of all rhetorical structures corresponding to S. Toulmin's model is discussed. The category of evidentiality is taken into account as a factor to influence the type of rhetorical relation. The difference between deductive, inductive and rhetorical argumentation with regard to syllogism is analyzed. In order to specify the nature of rhetorical relations implicit discursive units were used. The definitions of different complex argumentative types are given. The author draws reader's attention to the difference between the structure of convergent argumentation and several types of linked one. The role of implicit elements in rhetorical structured is determined. The paper is illustrated with the fragments of scientific papers in the field of acoustics.

Key words: argumentation; rhetorical structure; deduction; induction; hierarchical structure; parallelism.

Introduction. Argumentation theory and logic are known to be closely connected. However, the structure of syllogism and that of argumentation are similar but not identical even partially. In the 1980's W. Mann and A. Thompson proposed Rhetorical Structure Theory (RST) as a tool to analyze argumentative discourse dealing with discursive units of different size. Thus, **the aim of the article** is to trace the influence of logic on different types of argumentation in terms of rhetorical structures.

Theoretical background. In this paper we will view discourse as a verbal phenomenon which is characterized by both horizontal and vertical dimensions. Speech is organized as temporal succession of elements. So, discourse is considered to be a linear structure. On the other hand, each element of speech serves as an item of one or several hierarchies. To describe a hierarchical structure one should determine the constitutive units and relevant relationships between them [1, p. 23-54].

The smallest unit of organization is considered to be the clause. RST provides a way to describe both macrostructure and microstructure of discourse. The theory defines a number of semantic relations holding between the units. Most of them are asymmetric i.e. one of two connected elements, satellite, serves as assistant with regard to the other. The independent member of the pair is called nucleus. There are also symmetric multinuclear relations. [4, p. 268] The original set proposed by W. Mann and A. Thompson has been supplemented with some new relations. These are grouped "according to a specific kind of resemblance. Each group consists of relations that share a number of characteristics and differ on one or two particular attributes" [4, p. 249]. In particular, there are such groups as "Relations of cause" and "Condition and Otherwise".

Furthermore, the relations are usually divided into "subject matter" and "presentational" according to hierarchical level of discourse analysis. The indicator of membership is the effect of relation on the reader. Due to subject matter presentations the reader recognizes the relation in question. Presentational relations have to increase some inclination in the reader [4, p. 257].

One of features of rhetorical structures is parallelism. It consists in possibility of more than one relations between two units. A. Susov states that different relations exist parallel at both subject matter and presentational level. Moreover, at the same level a relation can be treated in different aspects.

The essential unit of argumentative discourse correlates to the model of argumentation proposed by S. Toulmin which consists of six items described below [4, p. 258].

Grounds: The information that doesn't raise doubts.

Claim: The statement being convinced of.

Warrant: The logical connection between the claim and the ground.

Backing: The reason to think that the warrant is rational.

Rebuttal: Objections to the claim.

Qualifier: The words expressing the argumentator's degree of confidence concerning the claim.

The first triad is considered to be basic. Generally most of these items are often implicit. Taken altogether, these elements create an integral semantic complex that is referred to as an argument. Separating Claim from the rest of argument we'll call the rest Plea.

Deductive argumentation. One of the basic terms of logic, syllogism, is defined as a deductive form of reasoning basing on two prepositions to draw a conclusion. Its structure consists of Minor Premise, Major Premise and Conclusion, both premises including a common middle term.

It's clear that Grounds and Claim are equal to Minor Premise and the Conclusion respectively while Warrant corresponds to Major Premise. However in effect it is either implicit or represented by the joint of all three elements.

Suppose all elements of argumentation are explicit and each of them is represented by at least one clause. In this case to create a layout of corresponding rhetorical structure one should keep in mind the following considerations.

1. The relations that hold between two premises can be treated as either Elaboration or Generalization depending on which of them is nucleus. Besides, since a minor premise is a special case of a major premise it can be understood as Circumstance.

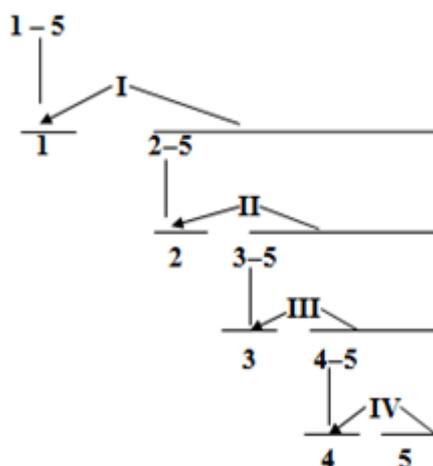
2. The definition guarantees Grounds (i.e. Minor Premise) to be truth. Therefore Backing that answers the question "Why do we believe in Warrant?" must be linked to Major Premise. This causes another question: "Where does the information come from?". Thus, that relation can be treated as Source. According to A. Susov [1] this relation at the presentational level is Evidence. Generally the nature of information source is indicated by the category of evidentiality. There are different types of evidentiality that affect not only verbal expression but also the type of relation.

3. The Rebuttal must be linked to a unit including all previously mentioned elements. It is clear that the relation belongs to "Condition and Otherwise" group.

4. Qualifier doesn't influence the structure because it only describes its strength.

5. The relation that holds between Claim and Plea belongs to "Relations of Cause".

Figure 1 illustrates such a diagram for the case when Minor Premise goes before Major Premise.



**Figure 1. RST diagram of a deductive argument, where:
1 – Claim, 2 – Rebuttal, 3 – Minor Premise, 4 – Major Premise, 5 – Backing.**

In scientific papers, deductive argumentation usually occurs in theoretical inference, for instance in theorem proving or formula derivation. The fragment given below shows the beginning of derivation. It explains why the results of measurement are represented in the form of vector.

Assume the vector M denotes the measured conductivity at NR logging points, M will be a $9NR \times 1$ vector since the conductivity has 9 components at each logging point... [6, p. 387]

The components of this argument are the following.

Grounds (Minor Premise): *the vector M denotes the measured conductivity at NR logging points.*

Claim: *M will be a $9NR \times 1$ vector.*

Warrant coincides with the whole sentence.

The Backing is based on the construction of the measuring device described in the beginning of the article quoted.

Major Premise is implicit: conductivity is measured in 9 points.

Rebuttal and Qualifier are implicit, i.e. it's absent.

So, the diagram of the fragment is the following:

Claim ___ Relation1 ___ (Grounds ___ Relation2 ___ Backing)

It means that Relation1 and Relation2 include all implicit information.

Inductive and rhetorical argumentation. Unlike the previous one inductive conclusion isn't certain but only probable. It is based on the fact that the premises have the common marks of something. Simple induction can be expressed in the following form:

Some elements of A have attribute X.

Individual a is another element of A.

Therefore: there is a probability corresponding to A that a has attribute X.

As a matter of fact, we can reduce this reasoning to that similar to deductive argument due to inserting one implicit statement.

a) Some elements of X have attribute Y.

b) There is a probability that all elements of X have attribute Y.

c) Individual x is another element of X.

d) Therefore: there is a probability corresponding to X that x has attribute Y.

As can be seen from this, the first and third statements are true, the second and the fourth ones are probable. It is clear that the unity of last three statements reminds syllogism. Thus, this reasoning includes two implications and each of them can be expressed by S. Toulmin's model. To build an RST diagram of such an argument it's necessary to add Backing because a person must draw on some knowledge or experience in order to come to conclusion. We'll miss Rebuttal for fear of crowding the diagram. The form of Figure2 illustrating simple induction is a bit different from classic RST diagram because in common case we cannot determine which element of relation is the nucleus.

The relations holding between the units mostly are the same as those of deductive argument. However, there is some difference. Since the statement b is probable Relation IV is treated as a Conjunction in addition to those corresponding to deductive argument. The Relation I belongs to a causal group.

Rhetorical argumentation is rare in scientific papers. The structure of rhetorical argument consists of Grounds, Backing and Claims. In the capacity of Backing we can use traditions or weighty opinion.

Complex argumentation. There are a variety of more complex argument structures that is reflected in their RST diagrams. As regard to RST convergent and linked types argumentation are of interest.

In the first case, different arguments have the same Claim. If herewith each of them is enough to convince the recipient, it is a multiple argumentation.

There has been a surge of interest in human sensitivity to the temporal regularity of acoustic stimuli. One reason for this is clinically motivated. ... normal-hearing listeners studied ...in an effort to simulate neural dys-synchrony show a speech perception deficit resembling that seen in auditory nerve pathology A second reason is that the neural timing of responses to speech stimuli may be impaired by background stimulus noise and so contribute to speech perception difficulty under that circumstance A third reason is the possibility that presbycusis has a central component in the form of "jittered" neural timing that undermines normal perception of stimulus fine time structure; responses of younger listeners to jittered stimuli might thus be models for aging [5, p. 22].

In the context of RST there are two variants to express a convergent argument. If all the Grounds in corresponding pleas are absolutely correct rhetorical structure representing each of them are independent. In the second case, these are united by the relation of Disjunction.

In the case of linked argumentation, several Pleas together support one Claim. It means that they have some elements of Warrant in common. Besides, there are different types if linked argument shown by the three fragments below.

1) *... it is well established that individual talkers can make their speech more intelligible by using a "clear" rather than a "conversational" speaking style ..., comparatively little research has investigated the acoustic-phonetic properties related to differences in intelligibility across talkers. Initial studies with relatively few talkers implicated factors such as word and vowel duration, and fundamental frequency ... Interestingly, profiles of individual high and low intelligibility talkers revealed considerable differences in the patterning of various acoustic-phonetic measures for talkers of similar intelligibility. Thus, it appears that while, at least for normally-hearing listeners, ... high intelligibility can result from various combinations of characteristics [2, p.223].*

2) *These algorithms were able to somewhat improve CI users' performance in noisy listening conditions. However many NH speech enhancement algorithms have not been tested in a CI speech-processing contest. Our purpose in this study is to develop a speech enhancement algorithm for CI patients by modifying some of the most recent and most powerful speech enhancement algorithms developed for NH persons [7, p. c.1001].*

3) *(1) As of June 2013, smartphone penetration in the U.S. market has reached more than 60% of all mobile subscribers with more than 140×10^6 devices. ...*

(2) *Smartphone developers now offer many sound measurement applications (apps) using the devices' built-in microphone_.... Several government and research organizations have commissioned participatory noise pollution monitoring studies using mobile phones.* (3) *The ubiquity of smartphones and the sophistication of current sound measurement apps present a great opportunity to revolutionize current data collection and surveillance practices for noise.* [3, p.186]

In the argumentation of the first fragment, the Pleas supporting their Claim are equally weighted and complement one another. They have one implicit Major Premise.

In the second fragment, two Pleas are not independent and contradict one another in some aspects. The relation holding between them is Antithesis. The first sentence is the advantage of cochlear implants (CI). The second sentence deals with the disadvantage. Both Minor Premises of this argument also match the same implicit Major Premise.

The third fragment also deals with differently weighted Pleas. One of them is the main and independent. The others are subordinate and dependent. Moreover, it was the fact of wide expansion of smartphones (1) that led to the development of the applications (2). The relation holding between them is causal, however, both Pleas support their Claim (3) through implicit Major Premise.

Conclusions. Implicit components help to understand the nature of rhetorical relations inside an argument in more detail. In particular, deductive and inductive types of arguments include discursive unit consisting of Major Premise linked to Backing. The latter realizes the category of evidentiality.

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Н.С. Доронкіна. Складна аргументація у контексті теорії риторичної структури у науковому дискурсі. Головна ідея статті полягає у тому, щоб познайомити читача з способом представлення моделі аргументації С. Тулміна з точки зору теорії риторичної структури. На основі цієї моделі у статті визначені поняття аргументу та доводу, причому аргумент розглядається як єдиний семантичний комплекс. У статті також розглядаються базові терміни дискурсивного аналізу, а також описуються властивості риторичних відношень, у тому числі особлива увага приділяється існуванню презентаційного та об'єктного рівнів. Стаття аналізує макети всіх типів риторичної структури, що відповідають моделі С. Тулміна. враховано вплив категорії евіденціальності на тип риторичної структури. Здійснено співвіднесення дедуктивного, індуктивного та риторичного аргументів з структурою силлогізму. З метою детального визначення природи риторичних відношень, які пов'язують компоненти аргументу використано імпліцитні дискурсивні одиниці. Розглянуто різні типи складної аргументації. Головний акцент зроблено на різниці між структурою множинної та різними типами сурядної аргументації. Висвітлено роль імпліцитних одиниць у структурі дедуктивного та індуктивного аргументів. Стаття містить фрагменти аутентичних наукових текстів в області акустики.

Ключові слова: аргументація; риторична структура; дедукція; індукція; ієрархічна структура; паралелізм.

Н. Е. Доронкина. Сложная аргументация в контексте теории риторической структуры в научном дискурсе. Статья посвящена отражению логической основы аргументации в риторических структурах. Определены понятия аргумента и довода, причем первый рассматривается как цельный семантический комплекс. Автор анализирует базовые термины дискурсивного анализа и основные свойства риторических структур. При этом основное внимание уделено существованию презентационного и объектного уровня риторических отношений. Учтено влияние категории эвиденциальности на тип риторической структуры. Дедуктивный, индуктивный и риторический типы аргументов соотнесены со структурой категорического силлогизма. С целью уточнения природы риторических отношений использованы имплицитные дискурсивные единицы. Проведен анализ структур множественной и трех типов сочинительной аргументации. Показана роль имплицитных элементов модели аргументации в структуре индуктивного и дедуктивного типов аргумента. Статья проиллюстрирована отрывками из научных статей в области акустики.

Ключевые слова: аргументация; риторическая структура; дедукция; индукция; иерархическая структура; параллелизм.