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## Verbally Expressed Linking Thoughts as Mediators of Text Sense Integration

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*The paper describes an investigation bound up with application of formal models and methods in the research related to semantics of language and thought. Some results of investigations bound up with principles of text sense integration are outlined. A mediator of text sense integration, which is discovered by the authors and known as “a verbally expressed linking thought”, is postulated. Its functions in text semantic binding is demonstrated.*

*Keywords: formal models in semantics; text sense integrity; mediators of text sense integration; linking thought.*

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### 1. Introduction

This paper discusses the principal set of problems related to text sense integrity as well as to finding out and analysis of sense. Not only the senses expressed in natural languages (NLs) and literature in NLs (novels, stories) are implied. Implied are the senses expressed by scientific texts, formulas, tables, diagrams, etc., the senses, which may be extracted from the data obtained in observations and monitoring conducted from or via artificial satellites and spacecraft. These may be diverse data related to the Earth and the Sun, senses essential from the viewpoint of neogeography, neogeology, neogeophysics, neoglaciology, etc. The crucial point is the process of perception and semantic analysis of such diverse data by the tools of contemporary information technologies.

Furthermore, it is well known that nowadays the global network known as *Internet*

is overfilled with texts and data represented in various formats. Every week the WWW sites are complemented with terabytes of new diverse data. In this connection, contemporary information technologies experience an urgent need in tools and software systems, which would allow the researchers to fulfill analysis and synthesis of senses contained in these data in order to be able to retrieve, withdraw, extract pithy information and use it for the progress of knowledge.

Semantic relations of texts have been the objective of research conducted by linguists and specialists in information technologies during the period of 1950 to 1980s. We have to emphasize that the results are hardly ever convincing. The problem has been and is now bound up with the absence of plausible and perspective ideas. Analysis of the available experience related to investigation of text sense integrity in all

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the publications of predecessors, which have appeared from the 1970s to 2009, gives evidence that not all the intra-text have been taken into account in their investigations. Not all factors of text sense integrity have been discovered. The system of logic-semantic relations of in texts is more complex that it has been supposed earlier.

It is advisable to recollect an important conclusion made by A.A.Potebnya, S.D.Katznelson, G.V.Kolshansky, I.R.Galperin, A.A.Strizhenko, E.Coseriu, T.P.Ivanova: *the text semantic content may not be reduced neither to the sense structure nor to a sum of elementary senses* (ES). The text sense is a qualitatively new formation, which is constructed in course of integration (i.e. non-additive combining) of elementary senses of the segments into joint whole. No doubt, in the process of modeling, *text information segments* may be conventionally placed into the nodes of some modeling tree, hierarchy or network, but one can hardly conclude on such a basis that the *text sense structure* (SS) is either horizontal, vertical, hierarchical or intuitively pyramidal.

Our investigations have given evidence that the system of logic-semantic relations inside an extended text is ever more complex than the one supposed earlier. Neither horizontal, nor vertical, hierarchical or intuitively pyramidal models of text sense integrity are good for representing the text SS. Obviously, integration of elementary senses, first of all, provides for the *structural-semantic* and the *content-semantic integrity of texts*<sup>1</sup>. Nevertheless, it was not clear **how** these kinds of integrity are provided. It was natural to assume that semantic integrity may not be reduced to only these two aspects.

It has been discovered in a number of investigations that there may exist various logic-semantic relations between ESs, which are expressed by text segments: i) *relations of spatial interdependence* (say, reciprocal

positions of persons and objects in the world described by the text)<sup>2</sup>, ii) *relations of temporal interdependence* (reflected in the sequence of events), iii) *cause-consequence relations*<sup>3</sup>, r) *implicative relations* (elements of analysis of such relations can be found, for example, in publications by I.V.Arnold), iv) *relations of telicity* (i.e. goal making) (Paducheva, 2008). When analyzing an *integral thought* (a matter of communication), it is necessary to take account of these relations. The reasoning on account of the above set of relations have aided to development of new ideas of text sense integrity. Anyway, the system of logic-semantic relations, which may form inside the text and condition its sense integrity is not reduced to either the above set of relations (i)–(iv) or to the aspects of structural-semantic and content-semantic integrity, or else to context senses.

## **2. Theoretical prerequisites: peculiar properties of text sense relations and mediators of text sense integration**

We have come to the conclusion that *any text* – at the expense of its inclusion into the cognitive, communicative-pragmatic and emotional-expressive contexts – *on the hole acquires a logical relation to a definite problem (objective), spatial-temporal, social-historic and cultural reality*, and it acquires the corresponding *context-dependent senses*. This conclusion has again indicated to the correctness of the idea of uttered by N.Enquist (1978): *plausibility of conclusions on text sense integration mechanisms necessitates investigations of texts, which describe various spatial-temporal and social-historic reality and differ in functional styles*.

Any text is constructed not only as an information message, but is oriented to the addressee (H.Weinrich 1968; P.Hartmann 1971; Г.В.Колшанский 1974–84). So, for a long time text communicative-pragmatic relations have

been considered as important ones. But the system of such relations for a large text has been found to be ever more complex than the system outlined in papers by N.A.Komina (1983) and R.S.Gazarkh (1987): any text is constructed with the idea of communication of a multi-aspect sense or even as a dialog exchange of senses.

Our preliminary investigation has confirmed I.R.Galperin's hypothesis that *integration of any text is possible only at the logic-semantic level, and aids (mediators) of sense integration are extra-linguistic ones*, furthermore, these may be not obligatorily expressed in verbal form.

*The important tips*, which helped in formulation of a new conception of text sense integration have also included: 1) K.Koževnikova's idea that "integrity of a written text... may be a result of an author's *separate act of thinking*, which joins together a definite set of messages" (Kukharenko, 1978: P.55) (hence, thinking may be subdivided into acts of thinking); 2) reminding about "syntactic figures" described for antique rhetorics and bound up with the superposition of results of the speaker's mental reflection over the text's kernel sense<sup>4</sup>; 3) the concept of *text beacons*.

In the late 1980s, when summarizing the results of psychological analysis related to perception of literary texts, V.P.Belyanin wrote that a reader, in course of perception of some text, "swallows the baits" left to him by the author in the form of verbal units, *text beacon*, which assign a definite direction of the speaker's thought (Belyanin, 1988: P.120). But repetitions of verbal constituents cannot be conditions of sense integration.

Quite useful was the conception uttered by P.V.Chesnokov (1966) and V.R.Sherbik (1983): *there is a complex logic form of thought, which forms the basis of text sense integrity and represents a combination of logemas understood as "acts of thinking"*.

A joint account of the set of above ideas and our analysis have given evidence that not a verbal segment and not the fact of its iteration in the text but *an explicitly or implicitly expressed thought, which conditions such iteration, can be the mediator which integrates the text in the sense aspect*.

Next, it was important to take account of aspects missed (omitted) in investigations of the predecessors. The necessity to construct and adequate, comparatively complete and relatively universal approach to the investigation of sense integrity has provoked us to complement the investigation with the analysis of a more complete set of sense relations characteristic of texts. It appeared obvious that investigation of text sense integrity has to be complemented with analysis of a subsystem of specific logic-sense relations characteristic of the text on the whole: 1) logic relations, i.e.: i) integration relations based on sense associations (in this connection, we have used the technique of finding out the counterpoint<sup>5</sup> (I.R.Galperin (1974: P.38), L.N.Timoshuk (1975: P.11)); and the technique finding out retardation (N.G.Ternovskaya (1988: P.162))); ii) relations of emphasis of separate thoughts; iii) relations of generalization (on the basis of preliminary descriptions), iv) relations of following and implication (based on the ground of logic analysis of one or several generalizations); v) relations of inference (constructed on the basis of logic analysis of generalizations); 2) pragmatic-communicative relations<sup>6</sup>; 3) cognitive relations; 4) emotion-expressive relations. In particular, we have employed analysis of relations of communicative-pragmatic integration between explicitly structurally expressed segments.

The analysis conducted has allowed us to draw the conclusion on the necessity of involving some other, earlier unknown extra-linguistic

mediators of text sense integration into the sphere of our consideration. Such mediators have received the name of *linking thoughts* (LTs). The set of above relations of the type of 1)–4) has formed the ground for a new type of text sense integrity defined as *the text sense integrity provided for by LTs*.

Below, a concept of LT is introduced. LT is compared to other known verbal text sense integrity mediators. Possible forms of representation of LTs and mechanisms of integration (sense binding) texts with the aid of LTs are discussed.

**3. Theoretical results:  
the nature of the linking thought  
as a mediator of text sense integration**

The linking thought (LT) is a definite thought (expressed by the author or via a character), which is *iterated into the text (/text segment)* and *executes the functions of* communicative-sense, emotional-sense and cognitive-sense integration of elementary senses of its parts into a text’s joint *kernel sense* (KS), hence aiding to the process of organizing the text (/segment) in order to efficiently deliver its content to the addressee. When using LTs (as “text sense beacons”), the speaker provides the text with important components (mediators) of integrity (Chernyshov, 2004).

We state that a LT, which is iterated into the text, may be inserted into it either once or many times, while developing in the text side by side with its progress and forming a linking logic-sense sequence. As far as identification of a LT is

concerned, a text’s sense forms a LF only when: a) its iteration are easily identifiable in the text (/segment) via the verbal or structural indicators, b) fulfill the function bound up with organizing elementary senses of the text’s parts into a joint sense in the communicative-sense, emotional-sense and/or cognitive-sense aspects. So, it was not by accident that the following subsystem of logic-semantic relations has been introduced into analysis of sense integration: 1) logic relations; 2) pragmatic-communicative relations; 3) cognitive relations; 4) emotional-expressive relations. Their set forms the basis of text sense integrity mediated by LTs as texts sense integration mediators.

Our approach implies that different forms of text sense integrity constitute a unity: the “basis” of text sense integrity is formed by its *integrity at the level of the kernel sense* (the denotative-semantic and logic-semantic integrity) and its *structural-sense integrity*; “overlying structure” of text sense integrity is formed by *cognitive, emotional and communicative-pragmatic integrity* (see Fig.1). Analysis of integrity, which is mediated by LTs, has given the possibility to take account of the aspects of the “*overlying structure*” of integrity in addition to the aspects of the “*basis*” integrity.

In our investigation we have taken into account that in speech a LT may be expressed in the forms of (i) logic, (ii) verbal, (iii) structural and (iv) intonation indicators, which may be *communicatively, emotionally and cognitively pithy*. Possible forms, in which linking thoughts may be expressed on the verbal and structural levels in texts, are shown in Fig. 2.

	cognitive integrity	Communicative-pragmatic integrity	Emotional integrity
Denotative-semantic integrity	Structural-semantic integrity		Logic-semantic integrity

Fig.1. The system of forms of text sense integrity provided for by LTs

**4. Elements of the technique:  
on the process of synthesis  
of the text sense structure**

We investigated the issue of synthesis of the text sense structure in the mind of the text author. We have managed to show that synthesis of ESs of segments into the text sense is mediated by linking thoughts, which allow one to take account of the integrity aspects earlier unknown.

In (Koževnikova, 1979; Koževnikova, 1979), the authors have proposed a technique of identification of verbally expressed linking thoughts. This technique presumes revealing the indicators allowing one to identify communicatively-valuable, emotively-valuable and cognitively-valuable verbally expressed linking thoughts.

The first part of this technique (Koževnikova, 1979) (identification of LTs) implies the account of the indicators allowing one to identify the most important linking thoughts. The second part of the technique (Koževnikova, 1979) (*investigation of the sense-related organization of text with the use of LTs*) presumes: 1) analysis of the text sense structure on account of the linking thoughts revealed, i.e. identification of mediators of the associative sense integrity in the text, which are provided for by linking thoughts, and identification of the functions executed by these linking thoughts in the process of constructing associations and integrating the senses; 2) involvement of additional information related to the text, fulfillment of cognitive

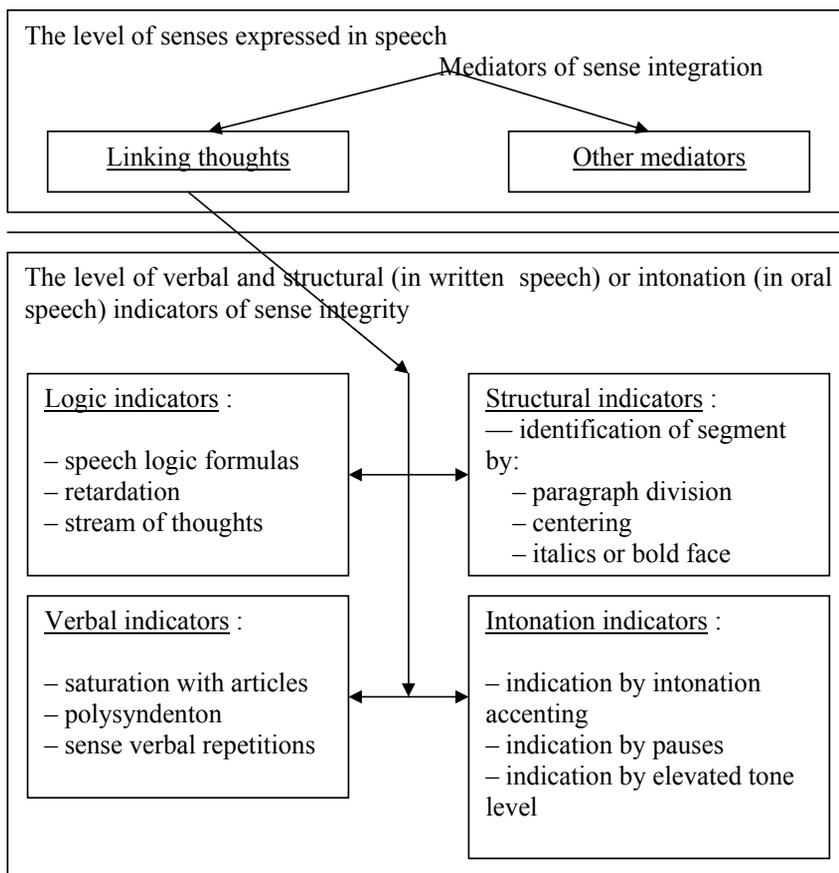


Fig. 2. Linking thoughts: representation at the verbal and structural levels

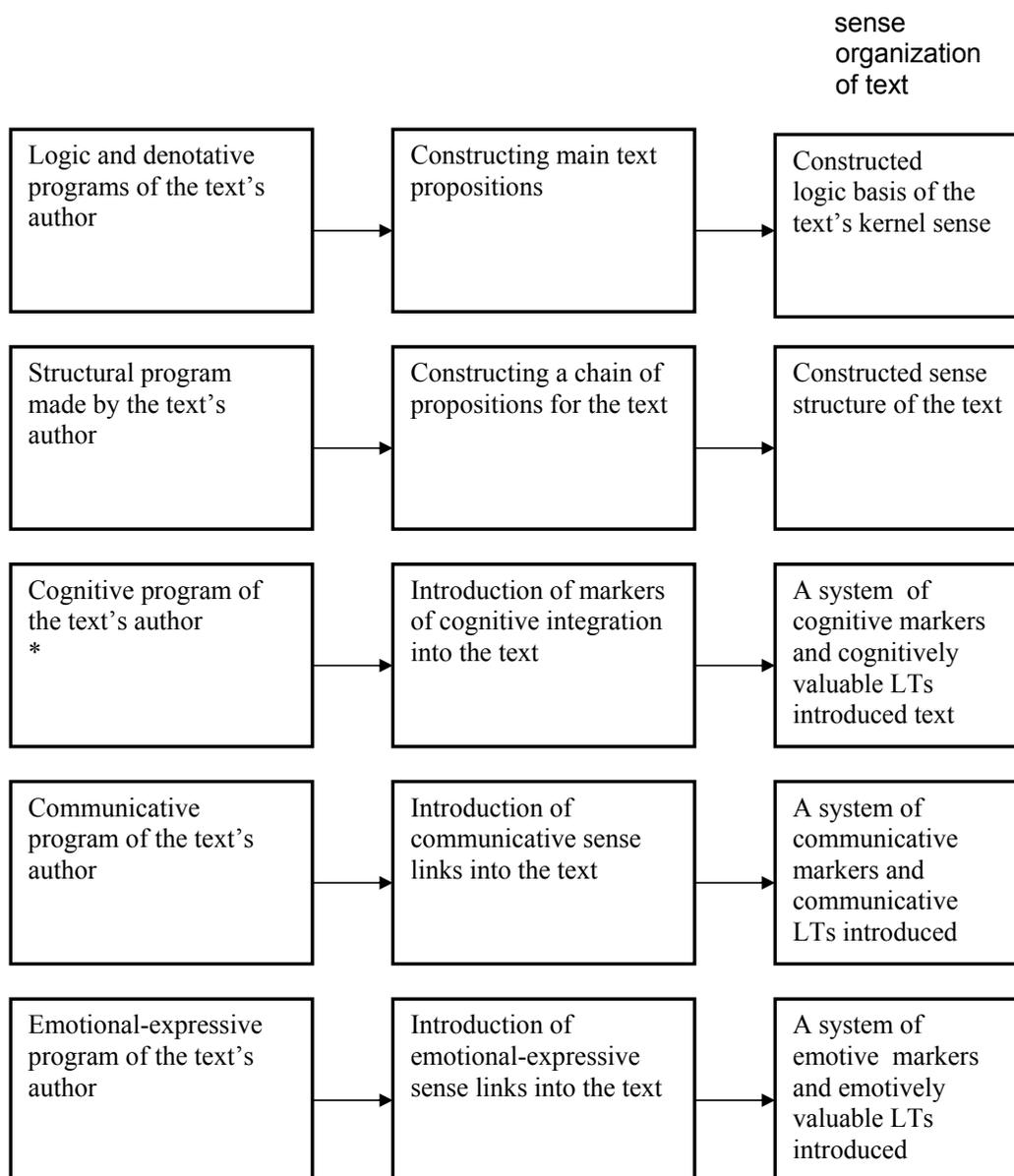


Fig.3. The process of synthesis of the text sense structure in the mind of the text author

analysis of the peculiarities revealed to the end of determination of their extra-textual associative relations and identification of the cognitive-valuable and emotively-valuable LTs; 3) analysis of the text's kernel sense with the use of its LTs (such analysis with the application of logic tools represents a complement to the main objective bound up with investigation of the text sense integrity).

### **5. Practical results: on mechanisms of text integration with the aid of linking thoughts**

On the basis of the experience of formal-logic description of the sense content of sentences available from (E.V.Paducheva 1978–2008), we have proposed our own *logic representation of the linking thought* as an operator and demonstrated its role in binding *text/segment elementary senses*

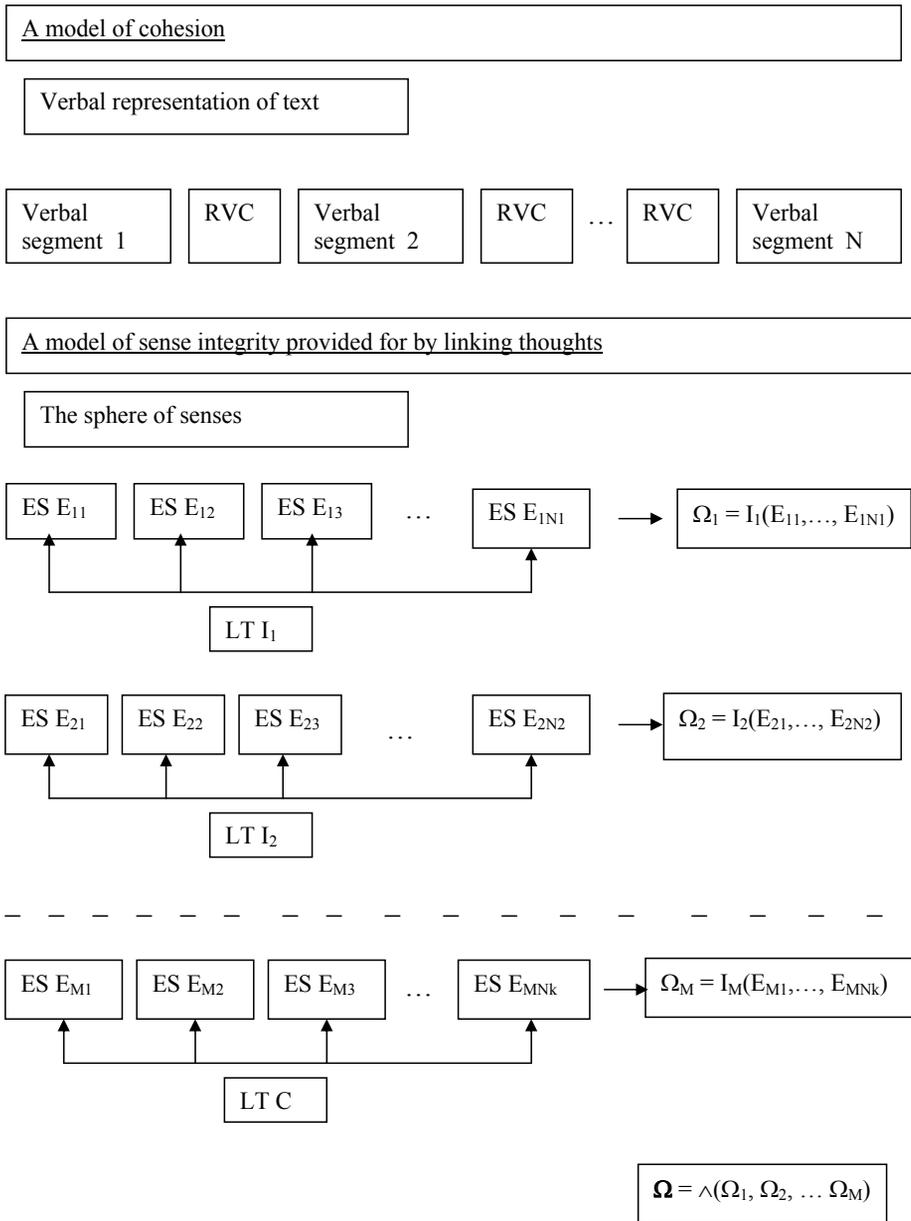


Fig.4. A model of text sense integrity provided for by linking thoughts (RVC – repeated verbal connective; ES – elementary sense of a small segment (utterance);  $\Omega_i$  – kernel sense of a large text segment (chapter, paragraph, etc.);  $\Omega$  – kernel sense of the text on the whole)

(ESs) into a joint kernel sense. From the logic viewpoint, a linking thought  $I$  of a segment  $\{S_i\}$ , which binds elementary senses  $S_i$  of the chain of its utterances-sentences (US) together, may be defined as an integration operator  $P_i$  understood as the operator, which realizes a sequence of mappings of the form  $P_i(I \rightarrow S_i)$  (where  $S_i$  is an ES

of the  $i$ -th US), for which the LT is mapped into the ES of each  $i$ -th US of the text segment, and, finally, executes (at the level of logic-semantic relations) mapping of the set of elementary senses  $\{S_i\}$  into the kernel sense  $\Omega$  of the segment:  $I =_{def} R : \{S_1, S_2, \dots, S_m\} \rightarrow \Omega$ . These logic-sense relations are mediated by the mappings  $I \rightarrow S_i$ .

The linking thought (LT)  $\mathbf{I}$  ( $= I_{ij}$ ) of text  $\{E_i\}$ , which links *elementary senses* (ESs)  $E_i$  of their chain of its components (text chapters/ paragraphs, etc.), may be defined as an operator, which implements a sequence of mappings of the form  $\mathbf{R}_i(\mathbf{I} \rightarrow E_i)$ , in the process of which the LT is mapped into an ES of each  $i$ -th component of the text. So, finally, the operator executes (at the level of co-sense relations) mapping the set of elementary senses  $\{E_i\}$  into the kernel sense  $\mathbf{\Omega}$  of the text as a semantic whole, i.e.  $\mathbf{I} =_{\text{def}} \mathbf{R}: \{E_1, E_2, \dots, E_n\} \rightarrow \mathbf{\Omega}$ . These logic-semantic relations are mediated by the mappings  $\mathbf{I} \rightarrow E_i$ . Our model of text sense integration, which is mediated by LTs, is shown in Fig.4.

Obviously, the concept of *linking thought* differs from such concepts as: 1) *a sense-indicating sign* (in publication by A.N.Sokolov, G.V.Bondarenko (1976) et al. it is treated as a lexical unit); 2) *an author's retraction from the text's content* (I.Bellert 1971: P.75); 3) *parenthesis* (E.D.Sinenko 1989), i.e. a kind of *text segmentation signal*; 4) *a verbal logic-*

*semantic connective* (V.E.Berzon 1980: P.22–25). 5) LTs are not identical to the mediator, which Z.I.Khovanskaya (1980: P.102) and S.A.Megentesov (1981: P.9) qualified as *identical through sense constructions*.

So, we have demonstrated *how* and *of what components* the text kernel sense forms, *what relations* are formed between elementary senses of its segments. On account of definitions of LT  $I$  and LT  $\mathbf{I}$ , the kernel sense  $\mathbf{\Omega}$  of a segment is a function of the form  $\mathbf{\Omega} = I(S_1, S_2, \dots, S_m)$ , and the kernel sense  $\mathbf{\Omega}$  of a text is a function of the form  $\mathbf{\Omega} = \mathbf{I}(E_1, E_2, \dots, E_n)$ , which links the elementary senses.

## 6. Conclusion

As a result of our investigations, we have proposed a method for finding out the text sense, which is based on the conception of linking thoughts as text sense integration mediators considered above. On this basis we have grounded our principles of constructing intelligent systems intended for analysis of multi-aspect senses.

<sup>1</sup> The compositional, stylistic, functional and other kinds of text sense integrity are obviously secondary with respect to the *structural-semantic* and the *content-semantic integrity of texts*.

<sup>2</sup> Revealing *relations of spatial interdependence* cannot by itself aid to disclosing semantic relations between them: often the author purposefully distorts the natural following of text events, while using a retrospective explication of facts to the end of achieving a desired communicative/emotional effect. This is a usual approach when, for example, it is not possible to tell directly (sequentially or in chronological order) about somebody's death, and it is advisable to postpone such a message. In such a case, the chronological sequence is replaced with a *conditional logical sequence* presumed by the author. We have to confirm, as far as texts, which belong to dynamic functional styles (journalistic genre, drama), are concerned, in which the actions are sequentially following within a limited space, the *relations of spatial interdependence*, which determine the reciprocal position of text segments, are sometimes weakened and replaced with *relations of temporal interdependence* (N.P.Ivanova 1991: P.11).

<sup>3</sup> These represent the integrity in the aspect of logic development of events and presume not only the "antecedent-consequent" relations for separate events (V.Ya.Golkova (1974), M.V.Malinovich (1987; 1992), but also the cause-consequence relations for the text on the whole, which explicate the global sense relations between ESs of large text segments.

<sup>4</sup> Reminding of importance of such figures as the aids for «creation and representation of some inexplicitly given sense» can be found in publications of 1978–2004: V.A.Kukhareenko [8], I.V.Arnold (1974), Yu.M.Skrebnev (1994), N.F.Krukova (1999), N.F.Nefedova (2000), A.B.Bushuyeva (2004).

<sup>5</sup> (i.e. existence of two or several parallel sense flows in the description, e.g. two different fates or two unidirectional or differently directed processes described comparatively)

<sup>6</sup> The idea bound up with analysis of *the situation context* as a mediator of text communicative integrity was put forward by W.Quine (1950) and repeated by J.Firth (1958), O.I.Moskalskaya (1981) and G.I.Bogin (1986).

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## **Вербально выраженные мысли-скрепы как медиаторы смысловой интегративности текста**

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*Статья описывает исследование, связанное с применением формальных моделей и методов в изучении семантики языка и мысли. Представлены некоторые результаты исследования, связанные с принципами смысловой интеграции (связности) текста. Постулируется медиатор смысловой интегративности текста, открытый авторами и известный как “вербально выраженные мысли-скрепы”. Его функции в семантическом связывании текста демонстрируются.*

*Ключевые слова: формальные модели в семантике, смысловая интегративность текста, медиаторы смысловой интегративности, мысль-скреп.*

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