Haldur Õim and Madis Saluveer
Frames in linguistic descriptions

Introduction

There have not been many concepts in the recent history of the sciences dealing with language which broke the barriers between these sciences as easily as the concept of frame. After M. Minsky introduced the concept [Minsky 1975], it quickly became a familiar and popular topic in psychology, anthropology, linguistics, and, of course, artificial intelligence.

When we look a little closer, however, we discover that there in fact is no such thing as *the* concept of frame. Instead, there is a family of concepts and conceptions that share some basic characteristic but differ considerably in other aspects. And second, in no one of these various sciences – except, maybe, in artificial intelligence – do we find 'frame' as a technical term, i.e. as a term integrated into the system of conceptual and formal means of the science. Even in artificial intelligence, however, formalizations such as KRL [Bobrow and Winograd 1977] or FRL [Goldstein and Roberts 1977] catch only a subset of relevant ideas and properties usually associated with frames in more informal discussions. But especially remarkable is the situation in linguistics. On the one hand, there are several papers that discuss the general idea of frame (in its several variants, such as scripts, conceptual schemes, etc.) and argue very convincingly for the necessity of introducing the frame concept into linguistic semantics and pragmatics [e.g. Fillmore 1975, 1977; Lakoff 1977; Petöfi 1976; van Dijk 1977; Metzing 1980]. On the other hand, there is no serious attempt to *use* frames in larger studies of empirical language material or to otherwise specify systematically the relevant consequences and conditions of using frames in linguistic descriptions. So it is not even surprising that when it comes to formal, technical aspects of frames we run into claims that frames are merely a specific mode for presenting expressions of predicate logic or even that they are nothing but «a cumbersome convention for listing facts» [Dresher and Hornstein 1976].

In the present paper we will discuss, first, the question of the background ideology in the context of which the concept of frame was introduced into linguistics (and the symbol of which it was felt to be). As the second and main topic we want to bring forth the question of what should be done in order to make the general idea of frame a usable tecnical tool of semantic descriptions in linguistics. More specifically: (a) what *internal* characteristics of frames must

be elaborated; and (b) what kinds of *other* concepts and/or principles should be developed and elaborated simultaneously with frames in order to create a general conceptual apparatus in the context of which frames could be used effectively.

Frames and linguistic theory

As we see it, there can be identified at least two general lines of thought, two 'ideological trends' in the recent history of theoretical linguistics with which the introduction of the frame concept is associated: one is the trend to study language in the larger context of other human cognitive and social activities. The other is the trend to study larger linguistic structures beyond the classical words, phrases and sentences, i.e. to study texts [Õim1981a]. The focusing of interest upon the questions of the relationship between language and other areas of human cognition may be regarded as a profound shift in the interests of theoretical linguistics, and from this shift are emerging the tentative outlines of a new paradigm [Õim 1981b]. The main theoretical task of linguistics is seen not in describing language as a closed system of signs but in discovering and explaining the principles that govern, and the regularities that apply in, the *process* of communication. In other words, as Kibrik [1983] remarks, «everything concerning the existence and functioning of language pertains to the competence of linguistics».

Proceeding from these ideas we can identify two new types of data appropriate for consideration in linguistics. To the first type belong facts about the cognitive processes, knowledge and memory of the language users. It is evident that text understanding requires much more than merely knowing the meaning of words and morphological and syntactic structures – it also requires an extensive knowledge of the real world phenomena described in the text, and knowing how to use this knowledge in interpreting the meaning of the incoming text. This knowledge may be said to constitute the *cognitive competence* of the language user. The second type of data consists of the knowledge of various regularities of a social, conventional character that govern human linguistic communication; the knowledge of how to construct (and/or interpret) different kinds of texts in various contexts. From the point of view of language, this knowledge concerns not the contents of words but the rules and models for building (and interpreting) *texts*. This knowledge may be termed as the *interactive competence* of the language user.

Together with human *linguistic competence*, i.e. the knowledge of language proper (knowledge of the meanings of words and rules of grammar) these two competences are used simultaneously in any proper act of communications, thus forming human *communicative competence*. The theoretical approach to language which aims at describing communicative competence in the given sense is no more conceived as a theory of language as a «structured object», a system of signs, but instead as a theory of *language understanding*, this latter being understood as a specific kind of human cognitive activity. The concept

of frame has been introduced into linguistics in a certain context: frames were primarily seen as representational tools by means of which the purely linguistic knowledge could be connected with relevant non-linguistic common-sense knowledge. On the more concrete level, the use of frames in linguistics is primarily associated with the semantic description of words, of lexicon. So the bulk of theoretical discussions and concrete examples concerning the use of frames in linguistics is – explicitly or implicitly – about frames as conceptual tools of lexical semantics, frames as means of including into the semantic descriptions of words also relevant types of common-sense knowledge about the objects or situations referred to by the corresponding word [Fillmore 1977; Thompson 1976; Metzing 1981].

In this context, the representations of the meanings of words are usually believed to form also a natural basis for representing the meanings of sentences and texts. Because of this, also the more general treatments of 'frame based semantics' are often reduced to discussing the question of how *word* meanings should be represented in order to cope with the new and broader tasks of semantics [Raskin 1981; Metzing 1981]. Although in this connection, some quite well elaborated new models of the lexical component of linguistic description were proposed (e.g., Raskin's script-based lexicon), it seems to be forgotten in the context of this approach that the meanings of words are not the *only* structures in language with which certain kinds of common-sense knowledge are associated that affect the process of language understanding and, accordingly, should be taken into account in a general linguistic description. On the other hand, this fact is well accepted in another type of investigation where frame-like structures are also systematically used for describing language material, viz., in theories of text understanding. Here it is accepted as a truth that the knowledge associated with meanings of separate words constitutes but a small part of the whole stock of knowledge needed for understanding natural language discourse. There are various other kinds of knowledge which cannot be attached to concrete words but, nevertheless, play an important role in building or interpreting coherent texts and so should find their way into the general linguistic description.

These other kinds of knowledge are so far studied mostly in connection with building text understanding systems in artificial intelligence. Several types of such knowledge structures have been offered: goals and plans [Schank and Abelson 1977; Wilensky 1978]; points [Wilensky 1980]; affect or plot units [Lehnert 1980]. These are designed as representing high-level common-sense knowledge structures that, in the process of interpreting a text, interact with concrete data presented by the text and organize the results of the interpretation into corresponding higher-level units and structures. But when we look at these theoretical constructs from the linguistic viewpoint, the first thing we must note is that all the mentioned structures are designed to characterize in fact one kind of text only, viz., stories about (human) goal-directed activities. So they reflect, first of all, certain characteristic features of the *reality* described in these texts. It is not at all clear to what extent the same organizational (knowledge) structures are relevant in interpreting other kinds of texts.

And still more open is the question of what types of such knowledge are used by humans in the task of discourse understanding *in general*. In other words, there is no clear picture of the *general system of conceptual means* that would be needed in the 'linguistic theory of language understanding'; the system in which frames present only one concrete kind of representational tools and lexicon forms only one part of the general description.

We think that this is one of the explanations of the fact that frames have not gained any popularity in larger descriptions of empirical language material, not even in the case of describing the semantic structures in lexicon. The reason is that because it is not clear with what other kinds of conceptual structures frames should interact in a general description of language, it cannot be decided exactly what should be included in a frame (of a word, for instance), and in what form. As is apparent, nobody is tempted to formulate the results of some large empirical study in a certain complicated form before he can be sure – at least to a certain extent – that the results of his work thus formulated make sense in a larger theoretical and empirical context. But there are still other reasons for the current situation; and one of the most important ones is undoubtedly the lack of clarity on the question of the *internal structure* of frames themselves. What we mean by this is not that there is no clear view of what the internal organization of a frame should look like (as we have just pointed out, an unambiguous solution to this problem is not possible before the corresponding general context is clarified). What we mean is that even *when* a certain internal structure is attributed to a (type of) frame it is usually left fully unspecified what this structure amounts to in the formal sense: in other words, how this structure should be manipulated in various contexts; what formal *rules* this manipulation should follow, e.g. in deriving inferences from a frame instantiation in a concrete context.

Until a particular frame structure is not supplemented with a corresponding system of rules which determine the implications of using this structure in concrete cases, the frame structure cannot be meaningfully applied to describing large amounts of language data, since there is no possibility to check the adequacy of such a description.

In the following we want to give concrete illustrations of two kinds of elaborations that the linguistic frame conception is most in need of, according to the discussion presented above. First, we present an example of rules that should simultaneously be specified, when a certain frame format is accepted, rules that should always form an inseparable part of the accepted frame format. Second, we will briefly consider, again on the basis of a concrete example, the question of what other kinds of formal knowledge structures are needed beyond the structures typically represented by frames in the linguistic treatments of text understanding.

Rules in frames, or the internal logic of frames

In the present section we will consider a form of representation for words

(and phrases) denoting actions and processes. Let us accept the following (quite typical) internal format of these representations. There are three functionally different parts in the representation of an action or process: (1) SETTING, where necessary and/or typical (pre-) conditions of the action or process are presented; (2) EVENT, where the proper (physical or mental) act or change-of-state is presented through which the corresponding action or process is realized; and (3) CONSEQ, where the necessary and/or typical effects and consequences of the action or process are represented. Each of these subparts may contain several conjunctive or disjunctive propositions. The exact form of these propositions is not important here, but the relevant details will be explained in the course of the discussion. For instance, in the case of the word *lend* (AGENT = A; RECIPIENT = B; OBJECT = C; TIME = t_i) its SETTING, EVENT and CONSEQ parts should contain at least the following propositions

(1) SETTING
   (a) A has (owns/controls) C before the time t_i:
   (b) B communicates to A his wish to have C for a certain time interval t_i-t_j;
   (c) B promises to return C to A after t_j;
   EVENT
   (d) A gives C to B at t_i;
   CONSEQ
   (e) B has C after t_i;
   (f) B is obliged to return B to A after t_j;
   (g) DEFAULT: B returns C to A after t_j.

We have established these propositions on the ground of our intuitive analysis of various actions (and of various contexts where these actions can occur) which can be referred to by *lend*. And we expect this representation – as a 'frame of lending' – to guarantee, among other things, that when *to lend* is used in a text (e.g. in the sentence *John lent Harry his old car for two days*), all the relevant propositions could be *inferred* from this representation exactly in the way the human understander infers them. This drawing of inferences is one kind of 'manipulating' a frame in the process of constructing representations of texts where the given word occurs. But of course, no such manipulation is possible without corresponding *rules*. In the first place, the mere symbols SETTING, EVENT and CONSEQ in the above structure don't mean anything to a formal 'interpreting device' unless there are rules which determine how the propositions listed under these headings should be treated.

Intuitively, there are crucial differences in the roles that the facts listed in SETTING, EVENT and CONSEQ parts fulfil in the general situation of lending. These differences become evident, for instance, when the corresponding word is negated:

(2) John *didn't lend* his car to Harry;

or when it is used in the context of certain other words:

(3) John *agreed to lend* Harry his old car for two days.

For instance, in the case of (2) (taken in its unmarked interpretation where

negation is attached to *lend*) we infer, first of all, that the act of giving presented in the EVENT part of the frame (1) did not take place, and second, that the propositions listed in CONSEQ part cannot be true either. In other words, from the negation of *lend* the negations of (d) – (g) can be inferred. On the other hand, on the ground of (2) we are unable to make any definite inferences concerning the facts presented by (a) – (c). It is plausible that they are true; and in fact, in neutral contexts people tend to interpret the sentence (2) in the sense that (a) – (c) can be inferred as true. But, nevertheless, it is quite *possible* also to use the negated form of *to lend* in situations where (a) – (c) (or some of them) are *not* true.

So we have here examples of at least three different relations between *lend* and the propositions contained in its frame. First there is the well known (linguistic, or «common-sense») *implication* relation between *lend* and the propositions (d) – (g): 'A implies B' means that from A we can infer B and from NOT(A) we can infer NOT(B). Let us express this relation by $A \xrightarrow{i} B$. Second, there is the relations of *presupposition*: 'A presupposes B' means that from A we infer B and from NOT(A) we infer B as well. As we have seen, this relation can be said to hold between *lend* and the propositions (a) – (c) in certain (neutral, usual) contexts; let us express the relation of presupposition by $A \xrightarrow{pr} B$. And third, there is the relation that may be termed *allegation*: from A we infer B but in the case of NOT(A) the logical status of B cannot be unambiguously determined. This relation is understood to hold between *lend* and the propositions (a) – (c) in contexts where the more informative relation of presupposition cannot be recognized; let us express it as $A \xrightarrow{a} B$. More explicitly the inference schemes based on these three relations may be formulated as follows (øA means that the logical status of A is not determined):

(4) *implication* ($A \xrightarrow{i} B$):

(a) $$\frac{A \xrightarrow{i} B; A;}{B}$$

(b) $$\frac{A \xrightarrow{i} B; NOT (A);}{NOT (B)}$$

(c) $$\frac{A \xrightarrow{i} B; NOT (B);}{NOT (A)}$$

(d) $$\frac{A \xrightarrow{i} B; B;}{øA}$$

presupposition ($A \xrightarrow{pr} B$):

(a) $$\frac{A \xrightarrow{pr} B; A;}{B}$$

(b) $$\frac{A \xrightarrow{pr} B; NOT (A);}{B}$$

(c) $$\frac{A \xrightarrow{pr} B; NOT (B);}{NOT (A)}$$

(d) $$\frac{A \xrightarrow{pr} B; B;}{øA}$$

allegation $(A \xrightarrow{\;a\;} B)$:

(a) $\dfrac{A \xrightarrow{\;a\;} B;\; A;}{B}$ (b) $\dfrac{A \xrightarrow{\;a\;} B;\; \text{NOT } (A);}{\text{Ø}B}$

(c) $\dfrac{A \xrightarrow{\;a\;} B;\; \text{NOT } (B);}{\text{NOT } (A)}$ (d) $\dfrac{A \xrightarrow{\;a\;} B;\; B.}{\text{Ø}A}$

All these relations are relatively well known in linguistic semantics, of course. But the point here is that when we want to use these relations in drawing inferences from frame structures we have to formulate special rules that establish how the inference rules formulated in terms of these relations can be applied to structural components of a frame, so that when, for instance, a frame structure (such as (1)) is placed into the position of A, it would be possible to determine formally what propositions contained in it could be inferred from it, and in what way.

On the ground of the above discussion we may formulate the following (illustrative) rules. Let FRAME$_i$ denote a frame structure of the kind of (1), and SETTING(F_i), EVENT(F_i) and CONSEQ(F_i) denote any proposition contained in the SETTING, EVENT and CONSEQ components of the frame FRAME$_i$, correspondingly.
Then:

(5) (a) $\text{FRAME}_i \xrightarrow{\;i\;} \text{EVENT}(F_i);$
      (b) $\text{FRAME}_i \xrightarrow{\;i\;} \text{CONSEQ}(F_i);$
      (c) $\text{FRAME}_i \xrightarrow{\;a\;} \text{SETTING}(F_i);$
      (d) $\text{FRAME}_i \xrightarrow{\;pr\;} \text{SETTING}(F_i);$

The rule (5a) states, for instance, that when we have a frame FRAME$_i$, we are entitled to infer from it, *in the sense of an implication*, any proposition which is contained in its EVENT subpart.

To differentiate between the application possibilities of the rules (c) and (d) we have to specify those relevant characteristics of the *context* of FRAME$_i$ which influence the human reasoner (text understander) to choose and apply one of these rules.

Let us observe, further, that the propositions in the EVENT, SETTING and CONSEQ parts of a frame in fact constitute instantiations of certain other frames. So we may have hierarchies of frames embedded into one another along the dimension of SETTING-EVENT-CONSEQ components. That means, for instance, that we may have in the SETTING component of a frame a certain other frame which itself has SETTING, EVENT and CONSEQ components (i.e. contains propositions grouped into these rubrics). How do these embedded propositions relate to the inferences of the dominating frame?

The rules (5a) – (5d) determine this relation quite naturally, since they can be used recursively.

For instance, the SETTING-component of the frame of *answer* (by A to B that P) should contain, apparently, a frame of *question* (from B to A concerning P);

and one of the apparent consequences of this asking the question is the fact that A *knows* that B *does not know* P:

(6) *answer*

(AGENT = A; RECIPIENT = B; CONTENT = P; TIME = t_i)

Setting:

   (a) *question* (AGENT = B; RECIPIENT = A; CONTENT = (concerns P); TIME = $t_j < t_i$)

Setting:

.
.
.

Event:

.
.
.

Conseq:

   (b) A knows that B does not know P.

One may ask now, how does the proposition «A knows that B does not know P», which is embedded into the CONSEQ-part of a frame contained in the SETTING-part of *to answer*, relate to inferences of *to answer*? Formally this can be determined by means of the rules (5). First, using (5b), we may infer the given proposition from the frame of *to question* (as its implication). As the result of this operation, the proposition (b) appears among other propositions contained in the SETTING-component of *to answer*. And now, according to the rule (5d), for instance, it should be possible to infer the given proposition from *to answer* as a presupposition. That is, from «A answered B» as well as from «A did not answer B» it should follow that «A knew that B does not know P» which appears to be quite correct.

So the rules (5a) – (5d), as they are formulated above, can be used to 'raise' from the 'depths' of a frame certain relevant embedded propositions and to establish their status as inferences of the frame. It should be pointed out that the rules (5a) – (5d) operate only upon propositions embedded along the dimension of SETTING-EVENT-CONSEQ components. These rules cannot be applied to 'raise' propositions that are embedded in a frame in some other way, e.g. through some syntactic slot such as OBJECT or CONTENT. For instance, in order to establish what exactly can be inferred from the proposition «A knows that B regrets that he did not manage to kill C» concerning the question of whether B did kill C or not, other kinds of rules are needed, viz., rules that establish how the propositions contained in the OBJECT (or CONTENT) slot of a specific predicate frame should be manipulated. So the rules considered above constitute just one concrete example of rules with which one should supplement a frame structure which one wants to put to use. Our point was simply that *when* we introduce a type of frames where such structural components as SETTING, EVENT and CONSEQ are distinguished, we also have to formulate rules that establish how the concrete data presented in these components can be manipulated, e.g. in the case of drawing inferences from the frames.

Such rules have to be formulated for any structural feature of a frame. Only the presence of such rules makes it meaningful to try to apply frames with a certain structure in the description of large amounts of language material, since only these rules guarantee the controllability/checkability of the results of such a description.

Frames and other conceptualizations in linguistic descriptions

Very often, when some specific new conceptualization mode is introduced into the arsenal of linguistic descriptions, it is stressed that the new conceptualization can be treated as a special case of frames. Nevertheless, there is little use in such an observation until we have a clear-cut theory of what it exactly means to be a (special case of a) frame. Instead, it would be more important to get a more elaborated general picture of different conceptual means that are needed to describe all the new kinds of data that should be treated in the linguistic theory of language understanding. This would provide us also with additional cues for deciding what characteristics should be attributed specifically to frames (e.g. to frames of words in lexicon, to frames of events and episodes described in a text, and so on).

It is, of course, impossible to determine beforehand in some deductive or speculative way what these other conceptual means of description beyond frames should be. This is a problem for empirical investigations, and as it was pointed out above, several interesting types of such conceptual units and structures have been offered already by various investigators. But departing from frames, it still is possible to point out also certain other types of conceptualizations that are needed if frames are used to describe the process of text understanding. In particular, there should be certain means for describing the *interaction* of frames which occur in a text; in other words, for describing the ways in which *context* (that in the case of a text presented in the form of frames) can influence the construction of an instantiation of a frame as the interpretation of a certain subpart of a text.

The relations between events described in texts are usually formulated in terms of temporal, causal or intentional relations between the corresponding events. But of course, these categories do not exhaust all the empirically possible relations that can occur in a text. Sometimes the relations between events presented in different parts of a text can take very specific contents (and forms). And, what is particularly important in the present context, *the description* of these relations cannot be confined to introducing certain abstract frame-units (such as CAUSE), so that the frames of events presented in the text could be merely placed in the corresponding slots of such a frame. The establishment of relations between frames in a text and the construction of corresponding higher-level units, as a rule, leads to definite *modifications* of the internal structure of the participating frames. Accordingly, there should be formulated *rules* that control these modifications.

Let us give a quite concrete example of what we mean. In texts that de-

scribe human social (communicative) interaction we find such events (acts) as requesting, demanding, threatening, ordering, on the one hand; and such events (acts) as agreeing or refusing (to do something), on the other. The structure of these acts can be represented by corresponding frames. For instance, they can be represented by frames of the general type considered in the previous section, i.e. as containing SETTING, EVENT and CONSEQ subparts, in the first place.

To present the frame of *refusal*, for instance, means to specify the setting in which a refusal can occur, the immediate (physical) acts by which it can be carried out, and the states or actions which may constitute its consequences.

But refusal as a communicative act always occurs as a reaction to some other communicative act of the first type listed above (*a request, a demand, an order, etc.*). When we construct a frame of a refusal event in a text, we always have to establish the connection of this frame to the frame of the corresponding initiating event explicitly or implicitly present in the previous text. But now, the point is that the concrete contents of a *refusal* frame instantiation depend to a great extent on the type of this initiating event – e.g. whether it was a request or a demand or a threat. This dependence does not concern the contents of the SETTING component of the *refusal* frame only; also the consequences of a refusal – the contents of the CONSEQ component – are quite different depending on whether the refusal constitutes a reaction to a request, a demand, a threat, or an order. These differences concern, e.g., the relationships that the refusal establishes between two interacting subjects; and, in particular, the possible (predictable) 'counteractions' of the agent of the initiating act. Intuitively, it is quite clear to us, for instance, that by refusing to obey an order or a threat the subject of refusal puts himself into quite a different situation than by refusing to fulfil a request. What all this means in the formal, technical sense is that when we are constructing a concrete instantiation of the *refusal* frame in the interpretation of a text we have, as it were, to go back to the corresponding initiating event and on the ground of its type, to decide what propositions should be included into the CONSEQ component of the refusal frame. So there should exist *rules* that regulate such interactions between frames in a text; rules that guide the construction of certain frames under the surveillance of certain other frames that have been constructed from the previous text.

Although the concrete empirical contents of the relationships between communicative acts considered here is to a great extent specific to them, the considered general type of interaction between representations of events in a text is undoubtedly quite general to natural language discourse. The rules that regulate such interactions constitute one example of the conceptualizations that are needed *beyond* frames as a part of the general systems of the means of linguistic description.

We will not try here to specify more explicitly the questions of how and in terms of what categories these rules should be formulated, as it would involve too many technical questions. But the general format of such rules should be sufficiently apparent from the above example: «*if* a frame F_i occurs in the rela-

tionship R_i to a certain other frame F_j, *then* in the structure of F_i certain modifications M_i should be carried out». And the task of empirical studies should be to specify what kinds of relationships between events or situations in a text form the basis of what modifications. The above relationship between the contents of initiating and reactive acts present but one example. On the other hand, the results of these empirical studies will show us what types of *internal* organization in frames are needed in order to formulate certain rules.

REFERENCES

Bobrow, D. and Winograd, T. [1977], *An Overview of KRL, a Knowledge Representation Language*, in «Cognitive Science», vol. 1, No. 1, pp. 3-46.

Dijk, T. A. van [1977], *Text and Context: an Exploration into the Semantics and Pragmatics of Discourse*, London, Longman.

Dresher, B. E. and Hornstein, N. [1976], *On some Supposed Contributions of Artificial Intelligence to the Study of Language*, in «Cognition», vol. 4, pp. 321-398.

Fillmore, C. J. [1975], *An Alternative to Checklist Theories of Meaning*, in *Proceedings of the First Annual Meeting of the Berkeley Linguistic Society*, Berkeley, pp. 123-131.

— [1977], *Scenes-and-Frames Semantics*, in Zampolli. (ed.), *Linguistic Structures Processing*, Amsterdam, pp. 55-81.

Goldstein, I. P. and Roberts, R. B. [1977], *The FRL Manual*, in MIT AI Memo 409.

Kibrik, A. [1983], *Linguistic Postulates. – Papers on Artificial Intelligence*, vol. 4, Tartu, pp. 24-40.

Lakoff, G. [1977], *Linguistic Gestalts*, in *Proceedings of the 13th Annual Meeting of the Chicago Linguistic Society*, Chicago, pp. 236-287.

Lehnert, W. [1980], *Affect Units and Narrative Summarization*, Yale University Research Report No. 179.

Metzing, D. (ed.) [1980], *Frame Conceptions and Text Understanding*, Berlin.

— [1981], *Frame Representations and Lexical Semantics*, in Eikmeyer, H. J. and Rieser, H. (eds.), *Words, Worlds and Contexts: New Approaches in Word Semantics*, Berlin, pp. 320-342.

Minsky, M. [1975], *A Framework for Representing Knowledge*, in Winston, P. H. (ed.), *The Psychology of Computer Vision*, New York, pp. 211-277.

Õim, H. [1981a], *Language, Meaning and Human Knowledge*, in «Nordic Journal of Linguistics», vol. 4, pp. 67-90.

— [1981b], *About the New and Old Paradigms in Linguistics*, in «Keel ja Kirjandus», No. 7-8 (in Estonian).

Petöfi, J. S. [1976], *Lexicology, Encyclopaedic Knowledge, Theory of Text*, in «Cahiers de Lexicologie», vol. 29.

Raskin, V. [1981], *Script-Based Lexicon*, in «Quaderni di Semantica», II, 1, pp. 25-34.

Schank, R. C. and Abelson, R. P. [1977], *Scripts, Plans, Goals and Understanding*, Hillsdale.

Thompson, H. [1976], *A Frame Semantics Approach to Kinship*, Mimeo, Linguistic Department, University of California, Berkeley.

Wilensky, R. [1978], *Understanding Goal-based Stories*, Yale University Research Report No. 140.

— [1980], POINTS: *A Theory of Story Content*, Memorandum No. UCB/ERL M80/17, University of California, Berkeley.