Introduction

The dissertation consists of four chapters which are closely related to each other. In the *first chapter* of the dissertation a general and abstract model of information systems is introduced and discussed in detail. The Multi-Layer Architecture of Information Systems (MLAIS) model, invented by the author, describes information systems as complex structures built on four main layers and two additional layers. The layers are connected to each other by interfaces that carry out communications procedures to exchange information ("messages") between the layers. Each of the following three chapters of the dissertation discusses an important aspect of one of the layers of the MLAIS model (i.e. the T, LC, and H layers, respectively), which therefore serves as a *general framework* of the issues discussed in the dissertation. In addition, the chapters add some new approaches to the corresponding layers of the MLAIS model:

- the *second chapter* of the dissertation examines the inner structure and coherence of natural language texts using co-reference analysis (the complex notation and terminology of which have been developed by János S. Petőfi [PETŐ97], [PETŐ98]). The second chapter applies, and completes the notation of co-reference analysis with some new elements in order that it can serve as a *metalanguage* in further, and mainly computer-based, text linguistic or textological studies;

- the *third chapter* of the dissertation explores a promising way of describing natural language texts in an artificial language (i.e. in PROLOG) placing great emphasis on the coding and interpretation of (conceptual) metaphors and other figures of speech;

- the *fourth chapter* of the dissertation demonstrates the universality and applicability of the above considerations in the semantic interpretation of poetic texts using the “iceberg” representation of the MLAIS model as a cognitive framework. The “iceberg” model and its cognitive aspects has been developed and applied in the interpretation of literary texts together with Judit Porkoláb (see the publications [15], [17], [30], [32], [34], [35], [45], [51], [55], [67], [69], [71] in the ‘Publications and presentations of the author’ section).

As regards methodological issues, each chapter follows a constructive way to elaborate its subject that is, the methods, considerations and conclusions applied are always demonstrated through *examples from selected literary works*. Note that each chapter (including the first chapter as well) contains original, and new, results based on the following presentations and publications:

1. Károly I. Boda: Complex Data Structures and their Role in the Organisation of Information Systems. - Presentation in "Conference of PhD Students in Computer Science" (Institute of Informatics of József Attila University, Szeged, 18 July 1998.) **(Chapter 1)**

2. Boda I. Károly - B. Porkoláb Judit: Koreferenciális kifejezések és koreferenciarelációk. Példaszöveg: Szent János Apostol Jelenéseinek könyve. 21:9-23. Az új Jeruzsálem. (Részlet) = Officina Textologica 1998 évf. 2 szám, 32-56. l. **(Chapter 2)**

3. Boda I. Károly - Porkoláb Judit: A koreferencia kérdései a számítógépes szövegfeldolgozás szempontjából. = Officina Textologica 4 szám. Koreferáló elemek – koreferenciarelációk. Magyar nyelvű szövegek elemzése. Diszkusszió. – (szerk. Dobi Edit, Petőfi S. János) – Kossuth Egyetemi Kiadó, Debrecen, 2000. **(Chapter 2)**

4. Károly I. Boda – Judit Porkoláb: The Role of Conceptual Metaphors in the Hypertext Structure of Poetic Texts. = Annales Universitatis Scientiarum Budapestinensis de

Rolando Eötvös Nominatae. Sectio Linguistica. Tomus XXIV. (Redigit I. Szathmári.) - Univ. Budapestinensis de Eötvös Nom. Facult. Philosophiae, Budapest. (in publication) **(Chapter 3)**

5. Boda I. Károly - Porkoláb Judit: A nyelvi tudat fejlesztésének néhány eszköze. - Előadás a II. Pszicholingvisztikai Nyári Egyetemen (Balatonalmádi, 1999. június 8.) **(Chapter 4)**

6. Károly I. Boda – Judit Porkoláb: The hypertext approach to the question of the interpretation of poems (Miklós Radnóti: Neither Memory Nor Magic). = Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös Nominatae. Sectio Linguistica. Tomus XXIV. (Redigit I. Szathmári.) - Univ. Budapestinensis de Eötvös Nom. Facult. Philosophiae, Budapest. (in publication) **(Chapter 4)**

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Overview of Chapter 1

Complex Data Structures and their Role in the Organisation of Information Systems

It is widely known that the accumulated knowledge of mankind rapidly grows, at a rate that often seems to be very hard to handle. Those who use the Internet, and especially the World Wide Web with its hypermedia capabilities, have to cope day by day with more or less difficulties in finding the relevant, or at least the adequate information they need. As a consequence, the various ways of *organising the accumulated knowledge* stored in different computers and networks are, with no doubt, of great importance. The ultimate aim of these efforts is to increase the effectiveness and efficiency of *information retrieval*: its relevance, completeness (or recall), etc.

Setting out from the experiences and basic principles of some well-tried information systems, in the first chapter a general and abstract model of information systems is introduced and discussed in detail. In the development of the MLAIS model, some information systems as well as other means and methods of organising knowledge in traditional or modern way (i.e. by the use of computers) have been taken into consideration. Those information systems and their equals (e.g. traditional, "linear" texts (e.g. books) and selected methods for analysing and processing them, bibliographies, encyclopaedias, monolingual and bilingual dictionaries, thesauruses, lexicons, classifications schemes, library systems, keyword indexing systems, relational and object-oriented database models, expert systems, hypertext and hypermedia systems such as the WWW, multimedia CD-ROMs, etc), their organisation levels or layer structure, as well as the basic functions and relationships of the layers explored, can serve as examples that illustrate certain points of the MLAIS model. In order to describe hypertext-based information systems, ‘there have been several attempts to create a unified data model but, up to now, without resounding success’. ([SÜTH99], p. 28) As can be seen later, the MLAIS model implements the terminology and various parts of other models (e.g. Dexter Hypertext Reference Model ([HAL94]), object-oriented database (OODB) model ([ULLM88], [ULLM98], [BUS93]), etc – for a good overview of the different models see [SÜTH99], [BAL94], [ALB90]). Where it is possible, we refer to points of contact with different models.

Before we discuss the data structure and basic functions of the layers, we should make some restrictions. Our main concern is to explore the data structure of the layers or, generally, the organisation levels of information systems; so we will not deal with operational issues of information systems (e.g. functionality, user friendliness, data safety and security, physical structure and implementation, etc). Also, the questions relating to interfaces between layers as well as their communications functions are only slightly discussed, mainly to the extent that they are relating to our main concern.

Architecture of the MLAIS model

The four main layers of the MLAIS model are as follows:

- textual layer (designated as T layer)
- index layer (designated as I layer)
- logical / conceptual layer (designated as LC layer)
- hypertextual layer (designated as H layer)

Moreover, two additional layers belong to the MLAIS model:

- supplementary layer (designated as S layer)
- component layer (designated as C layer).

We should not forget two additional components which are of vital importance: the *users* themselves who use the information system (normally via the H layer), and the *entities of the real world* (the representations or images of which are normally stored in the T layer as parts or components of a complex hypertext system).

The function of the main layers can be outlined as follows:

- the index layer identifies the attributes, or characteristics of the abstract objects of the LC layer and the components of the T layer;
- the logical / conceptual layer identifies the abstract objects, and their high-level structures, which are abstract representations of the components of the T layer;
- the textual layer contains components, or segments, that are abstract representations of the entities described by the information system, and concrete representations of the abstract objects and their structures;
- the hypertextual layer implements various links between segments of the textual layer, *organising its content on high level*. Beside this, the hypertextual layer presents links or sequence of links (coming from the result of a search query, keyword index, list of subject categories, etc) which enable us to access the segments of the textual layer indirectly, i.e. via the index layer or logical / conceptual layer which generate the links to be presented.

Textual Layer (T layer) and Component Layer (C layer)

The primary information supplied by an information system are stored basically in the textual layer or T layer in the MLAIS model. In the MLAIS model the T layer is composed of components interconnected by relational or hypertext links. The components, which make up the so-called *macrostructure* of the T layer, can be

- atomic or base components, or atoms which are considered "primitive" or "black boxes" in the T layer i.e. their structure is not studied on this level (e.g. a linear text such as an electronic mail, an image, etc),

- (hypertext or static) links which contain references to other components (e.g. a chapter name in a 'Table of Contents', a keyword in an 'Index', etc), and
- composite components, composites or segments that consist of other components (e.g. an HTML document such as a Web-page, a chapter of a book that contains text, illustrations, tables, etc).

The terminology *node* can be used for atoms or composites. The *hypertext architecture* can be considered roughly (i.e. apart from functional issues such as navigation which will be discussed later, in the section dealing with the H layer) as a network of nodes and links. There can be several approaches to study the macrostructure of the T layer. Note that the great majority of the composites have a kind of textual format and are written in one of the natural languages. Although multimedia is, with no doubt, essential with respect to the efficient communication between the information system and the user, but the typical multimedia formats belong nowadays chiefly to atoms, and not composites. So the basic question concerning the inner organisation of the T layer is the way *how natural language texts are organised*. Some basic issues of the organisation of natural language texts are discussed in detail in **Chapter 2**. It is interesting, however, that the interaction between natural language texts and hypertext is mutual. Based on various hypertext link structure models, hypertext can also be used in creative writing. ([TRAE])

Now let us deal briefly with some other issues, mainly about the *microstructure* and *functions* of the T layer. The segments or composites of the T layer can contain atoms, links and (other) composites to form a complex structure which play a major role in particular applications. As has been established before, the inner structure of atoms as well as the way segments are composed of other components is of no concern to the T layer. In particular applications, however, these issues can be very important. So we should introduce another layer, the *component layer* or C layer by which the inner structure of components, that is, the microstructure of the T layer, can be interpreted. The C layer is more or less equivalent to the 'within-component' layer of the Dexter model ([HAL94]).

There is a huge variety of different physical and logical realisation of components. For example, any component can be described or identified by its

- media (e.g. text, image, sound, video, etc);
- organisation (logical structure) (e.g. list, table, tree (hierarchy), etc or any combination of these, predefined as hypertext or hypermedia, (Word) document, (Excel) spreadsheet, etc);
- (physical) format (e.g. TXT, HTM(L), GIF, WAV, AVI, DOC, XLS, PS, PDF, CGI, etc).

Because of the great number of different kinds of components, the C layer should be divided into *different sub-layers* each of which is familiar with the specification of a particular component realisation which in turn is based on a sensible and/or existing variation of the aspects mentioned above (that is, the various realisations may differ in media, organisation and format).

Logical / Conceptual Layer (LC layer)

The logical / conceptual layer or LC layer consists of abstract objects that identify or describe components of the T layer. Considering the T layer as "cyberspace", the LC layer might be referred to as a "mirror" that reflects the data stored in the T layer by mapping the objects of the LC layer into the T layer. In other words, the objects of the LC layer can be considered as abstractions or "images" of the components of the T layer, while the components of the T layer can be considered as concrete representations of the objects of the LC layer.

The LC layer performs a *database function* in the MLAIS model. In order to describe most of the different applications, the object-oriented database model (OODBM) appears to be the most appropriate data model for the LC layer. ‘Hypermedia in general, but more so the WEB, are founded on the object oriented paradigm.’ ([GUAY95]) The object-oriented paradigm has definite advantages over other paradigms. For example, considering a library application that uses the tables 'READER', 'OPAC', and 'TRANSACTIONS', the table 'CIRCULATION' can be obtained on the relational database paradigm by joining the tables with each other (or using the appropriate 'select' or 'create view' statement in SQL). Besides, the problem of multiple authors are frequently solved using another paradigm, e.g. in keyword indexing systems by using a repeatable field for authors. In OODBM either the joining of different tables or the use of repeatable fields can be easily accomplished (see e.g. in [ABIT96]). For example, assuming that, in a new object class containing several object classes, the fields occurring in more than one object classes with the same name will occur only once, we can create the following classes (as regards the notation we used see [BUS93]):

There are some ways to create the object 'CIRCULATION', e.g. simply by using object types:

We might use another notation henceforth referred to as *P-notation* in describing the data structure outlined above. Assuming that we have a database of facts, the following PROLOG-like (or DATALOG-like) rules are equivalent with the object classes described above:

Now, with these rules we can create the rule for *circulation*:

Note that in the rule for *circulation* the variables *X* and *Z* occur in more than one predicate and so link them together.

Let us study now briefly the problem of semantic interpretation. We can describe the situation which is expressed by the concept *circulation* with the following *pattern in natural language*:

sy (a user) borrows sth (a book) in (MM-DD-YYYY) (e.g. in June 16, 2000) **(3)**

Let us try to describe this pattern in P-notation:

Let us call this notation *P*-notation*. Although we should have made some modifications, but the result is semantically equivalent with what appears in definitions (1) and (2). The main difference is that definition (4) reflects the grammatical structure of pattern (3) which describes the situation in *natural language*. Therefore the *semantic interpretation* of definition (4) (i.e. the rule for *circulation* written in P*-notation) is as clear as any description when using natural language in describing a situation. This suggests that natural language texts and object-oriented databases are semantically very close to each other. It is not surprising that the complex data structure of an OODB can be equivalently described in natural language (as we normally think and communicate in this way). But we will demonstrate in **Chapter 3** that a natural language text, including such complex language elements as *metaphors*, can be fully described in P*-notation.

The main function of the LC layer in the MLAIS model is, together with the I layer discussed below, to provide *interactive access* to the components of the T layer. Beside this, the LC layer can support the retrieval of the components by itself (i.e. without queries), accomplishing the idea of 'classification' by creating, *according to some predefined aspects*, classes from certain groups of components, higher classes from these classes and other groups of components, etc. The hierarchy obtained as a result of this is called a 'classification scheme'. We will demonstrate in Chapter 1 that *classification schemes can be represented by class hierarchies in OODBM.*

Index Layer (I layer)

The index layer or I layer identifies the attributes, or characteristics of the abstract objects of the LC layer and the components of the T layer, in order to retrieve the objects or components stored in the information system according to those attributes. The I layer is often represented by computer-generated concordances (see e.g. [PAPP75]) or keyword lists which can either be used in preparing the objects of the LC layer (e.g. when represented in dictionary form, see [PAPP68]), or in the retrieval of the objects or components of the corresponding T or LC layers. The objects or components can be retrieved either interactively by *search queries* which identify a *set of objects* called search results, or by means of *navigation* through selected lists of attributes (such as keyword or concordance lists) which contain *links* to various objects or components.

The information retrieval is usually based on the attributes and attribute values of objects. In the simplest case, values are of elementary type that is, the domain of attribute values can be mapped into the power-set of objects directly (e.g. by indexes). In case of values that are of complex type however, we should at first determine those fragments or extracts from each attribute value that characterise relevantly the objects containing the attribute value in question (i.e. fragments or extracts that have semantic content). Then the domain of extracted values called *keywords* or terms can be mapped into the power-set of objects (e.g. by inverted files). The elementary attribute values and keywords are called object characteristics. In case of components containing text written in natural language we can consider certain parts of the text (e.g. text sentences, paragraph, etc) as attributes having values of complex type.

As for an appropriate data structure of the I layer, frames appear to be one of the most flexible choices. Almost every aspect of a *descriptor-based* search language can be described with the use of frames. (In our case we need two types of frames, namely *generic* and *reference frames*.) The use of frames, often applied in expert systems as well as in early linguistic investigations ([KIEF00a]), emphasises that the I layer can be considered as *the knowledge representation of the LC layer* (and through that of the T layer as well). We should remark here, however, that in some cases (e.g. in relational database systems) the function of the I layer is restricted to the support of the information retrieval function of the LC layer. By contrast, the effective implementation of the I layer is extremely important when searching full-text databases, e.g. in keyword indexing systems. ‘Indexing and other common database techniques are complicated in full-text, since every word is, by default, equal in importance to every other. The structure of the data cannot be as easily used to optimize indexing. Semantic processing is often necessary to produce useful navigation aids and search techniques.’ ([ELAB95])

Hypertextual Layer (H layer) and Supplementary Layer (S layer)

The hypertextual layer or H layer provides an integrated "user interface" for the information system (and its users). The H layer enables the users to access the primary information stored in the T (or LC) layers in the information system according to different approaches. Some publications use the terminology *hypertext management system (HTMS)* which is very close to the concept of the H layer ([SÜTH99]). Moreover, the H layer corresponds more or less to the *'run-time layer'* of the Dexter model [HAL94].

The H layer has three basic functions which allow users to have access to the information stored in the information system. They are as follows:

- The H layer provides two basic *control methods* through which the users can express their special needs or requests for information;
- The H layer (together with the S layer, see later) has special *presentation capabilities* through which the information content of the segments or objects having different organisation and format can be satisfactorily presented (i.e. displayed, printed, etc);
- The H layer allows users to *navigate* between the various links of the information system. It is a step-by-step interactive process wherein the users can gradually refine the results the information system provides.

Let us examine first the *navigation function* of the H layer. The navigation capabilities of the information system are of vital importance because they make the information content stored and organised in the system work. In other words, while navigating between the various links of the information system the individual knowledge of the user and the stored and organised knowledge of the information system *becomes one unit or entity* and immensely extends the information accessing and processing capabilities of the user. Note that communication between the user and the information system is (usually) not for its own sake. The user should have a starting point, in most cases a text to be interpreted or processed, which will serve as the *initial paradigm of the communication process* through which the information content of the text becomes understood, completed, and linked to the knowledge activated by the paradigm (that is, with the knowledge covered by the appropriate cognitive schema of the user and with the appropriate portion of the “third world” represented by the information system). The cognitive paradigm described here is illustrated in Fig 1.

It is clear that the organisation of the T layer in macro level influences greatly the effectiveness of navigation. It has proved to be very fruitful in our examinations to compare metaphorically the organisation structure of the T layer to an “iceberg” which we will henceforth consider as a *cognitive framework* for the various applications of the MLAIS model. The different levels of the iceberg correspond to the different kinds of knowledge. The levels of the iceberg are cross-linked with each other, the overall corpus of various texts and these links form together a *complex hypertext structure* which is the core of our further considerations. These issues will be discussed in detail in **Chapter 4**.

Overview of Chapter 2

Co-reference analysis and the structure of natural language texts

In this chapter we will analyse a selected text from the Bible using the methods and notation of *co-reference analysis*. The complex notation and terminology of co-reference analysis have been developed by János S. Petőfi ([PETŐ97], [PETŐ98]). In this chapter we will complete (and slightly modify) this notation in order that it can serve as a *metalanguage* in further, and mainly computer-based, text linguistic or textological investigations. The new elements added to the original form of co-reference analysis are as follows:

- using communication units instead of text sentences as the basic elements for the analysis
- the relationship between text sentences and communication units is completely formalised
- the coding of communication units is completely formalised
- the introduction of relation indices
- using verb patterns in the coding of the communication units
- the introduction of new operators and symbols such as B, N, G, C, !, !!, /, +, decl, imp, t0, t1, ...
- adding “dimensions” (such as time, mood, etc) to the coding of the relation indices
- using traditional operators (such as =) in new, broadened sense
- using prepositional or adverbial phrases in the coding of the communication units (e.g. to, in order that, etc)
- the formal introduction and coding of comments as part of the metalanguage developed
- the introduction of basic co-reference indices and definitive attributes
- the introduction of group indices
- the introduction of the net of co-reference indices (as well as its table representation)
- the introduction of the graph representations of the associative structure of text

Our aim is to demonstrate the effectiveness of co-reference analysis in describing natural language texts in a way which may be independent of any natural language. This makes possible, among others, that the prepared text could be the input for a text processing computer program. We will lay great stress on specific methodological issues, e.g. how natural language texts can be transformed or coded adequately i.e., without loss of information; how we can describe and *complete* the syntactic and semantic structure of the text analysed without modifying its content; how we can present the results of co-reference analysis in a friendly, clearly way; etc. After we performed the co-reference analysis of the selected text, we will discuss the interpretation possibilities of the results.

Overview of Chapter 3

The Role of Conceptual Metaphors in the Hypertext Structure of Poetic Texts

‘One of the most important subjective factors of any language is *metaphor* which is the part of language creativity.' ([KIEF00b]) In Chapter 3 we will examine the role of *conceptual metaphors* ([LAK92], [KÖV98]) in the hypertext structure of poetic texts. We will describe and apply a simplified language model using the so-called P*-notation (see **Chapter 1**) which will serve as a *constructive linguistic tool* in our further examinations. In other words, our experiences coming from the application of the P*-notation in practice will help us expressing some ideas, as well as checking our considerations,

- about the role of conceptual metaphors in poetic texts, and
- about the explicit form of metaphorical (and other) relationships within the hypertext structure we use as a cognitive paradigm in the interpretation of poetic texts.

The coding of natural language texts in P*-notation is partially based on the notation of co-reference analysis described in **Chapter 2**.

We tried to lay great stress upon the simplicity and easy-to-use feature of the model. Thus it is not at all intended to be a "perfect language" ([ECO98]); rather, it *is* intended to be a useful linguistic tool which makes it possible for us to examine directly, *constructively* some linguistic phenomena including metaphors, other figures of speech, etc. Nevertheless, it is essential for the model to have enough complexity to meet some *minimal* criteria:

minimal syntactic criteria for the model:

- the model should properly describe the inner structure of syntagmas (phrases, clauses, sentences, etc), and
- the model should convey the original syntactic structure of sentences or *communication units* and the co-referential structure of texts.

minimal semantic criteria for the model:

- any question that can be formulated in a natural language should be expressed (that is, *coded*) in the model of that language, and
- the model should give meaningful (coded) answers to meaningful (coded) questions on the basis of, and faithfully to, the original text described in the model.

Here we would like to emphasise again that our approach is basically constructive which is also expressed in the way we expound our ideas *by the interpretation process of a selected poem*. Consequently, we do not intend to build a theoretic construction that can solve every problem (from the simpliest to the most sophisticated one), but do intend to *describe and apply* a simple language model which can be used as a useful tool in our further examinations. Thus the appropriateness of the model can be measured by its usefulness or usability, some examples to which will be shown in the following parts of this chapter. The usability of the model in practice can be well ensured by using computer assistance. For that purpose, we will apply the syntactic rules of the Turbo Prolog 2.0 language.

Because the model has not been intended to be exhaustive, it is possible that some linguistic phenomena cannot be represented adequately in it. But we looked for *a logically well-founded model* that meets the minimal syntactic and semantic criteria prescribed above. Thus those things that can actually be represented in the model can be considered as a firm basis of our further considerations which can therefore be expected to correspond to the facts.

The description of the model can be found in the following sections of the chapter as part of the interpretation process of the poem Poppy by Miklós Radnóti.

Overview of Chapter 4

The Hypertext Approach to the Question of the Interpretation of Poems

The concept *'understanding'* is used, as in everyday language, in more than one sense in the psychology of discourse. In the narrower sense, it can be interpreted as a process in which, from the input signals coming from spoken or written sources, we recognise the basic statements lying behind the acts of discourse ([BÜKY84]). Although the understanding of poetic texts is a more complex process, it should be similar, in one way or another, to the recognition process of everyday statements. In this chapter, we try to establish some basic elements of the understanding process of those people who want to understand the way the poet thinks, or, in an advanced stage, who can enter into the spirit of the poem, i.e. the emotions, ideas, attitudes, or behaviour patterns expressed by the text of the poem.

During their elementary, secondary, or higher education literary studies in Hungary, pupils and students get to know a lot of poems and several excellent, and mainly heuristical, methods for interpreting them. However, it seems to be a very promising way with respect to the better understanding of literary texts, to add *psycholinguistic methods* and ideas to the usual interpretation methods pupils and students use day by day during their literary studies. We are convinced, that the effectiveness of such methods can greatly contribute, among other things, to the development of the overall knowledge and skills pupils and students have in language use, from the recognition of words and concepts to the complete understanding of them.

There are several models for the *representation of knowledge* or memory described in the specialist literature of psycholinguistics (see e.g. [DENH88], [GÓSY99]). In the following, we attempt to select some basic elements of those models, as well as adding some new elements to them, without strictly sticking to one of the models having been described so far. As our aim is to study the understanding process of poetic texts as well as our approach is constructive instead of being purely theoretical, the applicability of the interpretation procedure we describe later, with its effectiveness and efficiency in practice, can justify the consistence of the selection of elements.

The *cognitive framework* of our further considerations is as follows. The interpretation of texts - in this case, poetic texts - requires, first of all, the precise knowledge of the meaning of words. Here, together with the accepted definition of the words that is valid in the given context, we should take into consideration certain knowledge about the world (see [PETŐ97]) which is necessary to understand fully the message of the text of the poem (note that the context itself is also part of such knowledge at “the tip of an iceberg” or below, as can be seen later). This knowledge can well be represented as a *hypertext structure* rather than a hierarchical one. The structure can be considered metaphorically as an "iceberg" where the text of the poem is only at the tip of the iceberg which contains several additional levels. Note that these levels are almost as important with respect to the meaning of the text as the text itself.

The levels of the "iceberg" might be as follows:

- the selected poem or text to be interpreted
- other poems or texts from the poet of the text analysed;
- poems or texts from other poets who had or could have had certain effects on the poem;
- the background context of the text of the poem, e.g. its historical background, events that were of vital importance for the poet, similar events or experiences (i.e. the appropriate *schemas* of the receiver of the poetic message) that might influence, in one way or other, the understanding or interpretation process of the poem, etc.

The levels of the iceberg are cross-linked with each other, the overall corpus and these links forming together a hypertext structure which is the core of our further considerations.

Note that the 'dictionary' or 'lexical' knowledge (about the different types of knowledge see [ANDO98]), and the knowledge about the "world" (of the poem, of other literary texts, of the poet etc. - that is, the knowledge about the corresponding portions of the real and *third world*, see [POPP98]) represented above as an "iceberg" are equally important with respect to the whole interpretation process. Therefore, they can be represented as two separate, but cross-linked, layers of a complex, multi-layer hypertext structure (see Fig 2). Note that they correspond to the LC and T layers of the MLAIS model, respectively.

<table>
<tr><td colspan="2" align="center">individual knowledge</td></tr>
<tr><td colspan="2" align="center">generic knowledge</td></tr>
<tr><td>dictionary knowledge
encyclopaedic knowledge</td><td align="right">primary text (to be interpreted)
background knowledge
(such as poems/texts from the same poet
poems/texts from other poets
events in the poet's life
historical background of the poem, etc)</td></tr>
</table>

Figure 2: certain types of knowledge as layers of a complex hypertext framework

As can be clearly seen in the construction of the "iceberg" structure, the layers of the multi-layer hypertext structure have their own, inner or "fine" structure which fits the multi-level hypertext representation excellently. For example, dictionary knowledge can be *represented* as a certain network of the meaning of words, a so-called semantic network of concepts (see e.g. [BOR95], [ECK95], [GÓSY99], [PRÓ99]). Note that this *representation* corresponds to the I layer of the MAIS model. The semantic network of concepts is organised on the basis of certain (binary) relationships between the concepts including paradigmatic and syntagmatic relations coming from substitution, addition, comparison and distinction of concepts, etc. Most of such relations are implicitly or explicitly indicated in the dictionary items of the corresponding words. In addition to the words and their relationships that can be found in dictionaries, other concepts and relations may as well be necessary e.g. from specialist books, essays, articles, encyclopaedias, etc. Thus if we take this "encyclopaedic" knowledge into consideration, it will form a new level beside (or under) the "dictionary" level of the corresponding layer. Because the relationships of concepts can easily be represented as hypertext links between the nodes of the semantic network, a hypertext paradigm can be applied to the layer containing those nodes as well as to the whole cognitive framework, too.

Although forming a corpus as a hypertext structure as well as having enough dictionary (and encyclopaedic) knowledge is fundamental to understand the meaning of the elements of the text of the poem, there are obviously other levels in the organization of knowledge which are also responsible for the effectiveness of the whole, rather complex, cognitive process of understanding the poem.

One example of those levels is as follows. Based on the complex hypertext structure outlined above, the concepts of the text of the poem can be (simultaneously) grouped *or classified* into several schemas where each schema forms, after all, a consistent system of concepts and relationships. In other words, ‘concepts may be *organized* into schemas ... which are mental frameworks for representing knowledge, encompassing an array of interrelated concepts in a meaningful organization.’ ([STER96], pp. 198-199) These schemas, especially in case of reading or hearing the text for the first time, are supposed to be organised around certain keywords (see [GUID53]), and can be clearly separated on the basis of certain dimensions (e.g. time, space, etc.). Note that the construction of schemas is a kind of abstraction (or generalisation) and therefore the schemas belong to a particularly high level of a vertically organised "generic" knowledge which corresponds to the LC layer of the complex hypertext framework. In addition, generic knowledge is an inherent part of the hypertext structure *which is expressed through the activity of the users* who

- formulate a query,
- activate the corresponding links of the overall structure,
- access to the corresponding nodes of the structure , and
- *organise dynamically* the obtained information in their own mental knowledge base.

As can be seen, this activity is a representation of the H layer of the MAIS model. Note that its effectiveness depends on the users who try to get the best of the navigation features of the H layer of the system. This approach might as well explain some problems with respect to the use of hypertext, for example cognitive overload.

Note that the abstract schemas, their content and organisation, and especially the paradigm on the basis of which the concrete, or text-based representation of those schemas (referred to simply as 'schemas' above) can be interpreted, depend on and are greatly influenced by his or her own "individual" knowledge of the receiver of the message of the poem, concerning all types of knowledge mentioned so far. This fact itself can provide a huge number of different interpretations, and therefore it is responsible for the 'openness' of poetic texts which is probably one of the most important features of the interpretation process (see [ECO98]).

In what follows, we try to demonstrate the applicability and efficiency of the MAIS model as a cognitive framework in the interpretation process of poems.

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[36] Boda István Károly: A nyitott oktatási formák perspektívái a 90-es években. - Előadás a Magyarországi Felnőttoktatás Története konferencián (Debrecen, 1997. október 6-8.)

[37] Boda István Károly - Porkoláb Judit: Füst Milán: Feleségem története c. művének stílussajátságai. - Előadás a Stilisztika és Gyakorlat Konferencián (ELTE Budapest, 1997. október 15.)

[39] Boda István: Informatikus könyvtáros képzés a KLTE-n. - Előadás az Informatika és Oktatás Konferencián (Békéscsaba, 1997. november 21.)

[48] Boda István Károly - Porkoláb Judit: Nyelvi megformálások értelmezése számítógépes programmal (A Jelenések könyve néhány részlete alapján). - Előadás a VIII. Magyar Alkalmazott Nyelvészeti Konferencián (A nyelv mint szellemi és gazdasági tőke.) - Berzsenyi Dániel Tanárképző Főiskola, Szombathely, 1998. április 17.

[50] Kocsány Piroska - B. Porkoláb Judit - *Boda I. Károly*: Radnóti-szinesztéziák. - Előadás a XIII. Anyanyelv-oktatási Napokon (Nyelvi és kommunikációs kultúra az iskolában). - Eger, 1998. július 9.

[53] Petőfi Sándor János - *Boda István Károly* - Vass László: A CD alkalmazásának lehetőségei. - Előadás "A tanár és a tankönyvi szöveg" c. konferencián (Juhász Gyula Tanárképző Főiskola, Szeged, 1998. július 15.)

[54] Károly I. Boda: Complex Data Structures and their Role in the Organization of Information Systems. - Presentation in "Conference of PhD Students in Computer Science" (Institute of Informatics of the József Attila University, Szeged, 18 July 1998.)

[56] Boda I. Károly - Porkoláb Judit: Radnóti-versek kognitív értelmezése. - Előadás a IX. Magyar Alkalmazott Nyelvészeti Kongresszuson (Nyelvi kihívások a harmadik évezredben). - Veszprémi Egyetem, Veszprém, 1999. április 9.

[57] Boda I. Károly - Porkoláb Judit: A nyelvi tudat fejlesztésének néhány eszköze. - Előadás a II. Pszicholingvisztikai Nyári Egyetemen (Balatonalmádi, 1999. június 8.)

[60] Boda István Károly: Rendszerfejlesztés integrált megközelítésben. - Előadás "A Közgyűjtemények és a Tudomány" c. konferencián. (Országos Széchenyi Könyvtár Budapest, 1999. július 2.)

[62] Boda I. Károly - Porkoláb Judit: Metaforák a kognitív nyelvészetben. Informatikai szaknyelvi metaforák vizsgálata. - Előadás "A metafora grammatikája és stilisztikája" c. konferencián. (Miskolc, 1999. október 12.)

[63] Boda I. Károly: Könyvtár-informatika képzés a Kossuth Lajos Tudományegyetemen. - Előadás a "Könyvtárosképzés, továbbképzés" c. szakmai konferencián (Szeged, 1999. november 18.)

[72] Boda I. Károly - Porkoláb Judit: A hipertext és a költői mű. - Előadás a X. Magyar Alkalmazott Nyelvészeti Kongresszuson. A nyelv szerepe az információs társadalomban. - Kodolányi János Főiskola, Székesfehérvár, 2000. április 18-20.

[73] Boda István - Porkoláb Judit: Költői szövegek értelmezése pszicholingvisztikai módszerekkel. - Előadás a III. Pszicholingvisztikai Nyári Egyetemen (Balatonalmádi, 2000. május 31.)

[76] Porkoláb Judit - Boda István Károly: Hipertextuális vonatkozások virágokkal kapcsolatos metaforákban. - Előadás a Magyar Tudományos Akadémia Szabolcs-Szatmár-Bereg Megyei Tudományos Testülete 2000. évi tudományos ülésén. - Nyíregyháza, 2000. szeptember 30.

5. other presentations, lectures, contributions, etc

[6] Porkoláb Judit - *Boda I. Károly*: Versértelmezések számítógépes programmal. - Előadás a Debreceni Nyári Egyetemen (Debrecen, 1994. július 17-augusztus 13.)

[11] Boda I. Károly - Porkoláb Judit: Mitológiai képek Radnóti Miklós verseiben (Hagyományos és számítógépes szövegvizsgálat). - Előadás a Debreceni Nyári Egyetemen (Debrecen, 1995. július 16-augusztus 12.)

[12] Boda I. Károly - Porkoláb Judit: Füst Milán: IV. Henrik (szövegelemzés). - Előadás a Debreceni Nyári Egyetemen (Debrecen, 1995. július 16-augusztus 12.)

[14] B. Porkoláb Judit - *Boda I. Károly*: Hagyományos és modern módszerek a stilisztikában. = A Magyar Nyelvtudományi Társaság Magyar nyelvi Szakosztályának felolvasó ülése, Budapest, 1995. november 7.

[16] B. Porkoláb Judit - *Boda I. Károly*: Számítógépes közelítésmódok a stilisztikai elemzésben. = A Magyar Nyelvtudományi Társaság debreceni csoportjának ülése, Budapest, 1995. november 30.

[21] Boda I. Károly - Porkoláb Judit: Helyzet és Válasz Radnóti Miklós verseiben. - Előadás a Debreceni Nyári Egyetemen (Debrecen, 1996. július 22.)

[22] Boda I. Károly - Porkoláb Judit: Életmotívumok Ady Endre verseiben. - Előadás a Debreceni Nyári Egyetemen (Debrecen, 1996. július 24.)

[42] Részvétel és hozzászólás a helyi könyvtárosképzés átalakítását célzó szakmai megbeszélésen. - *Meghívottak: Boda István*, Kokas Károly, Koltay Tibor, Nagy László. (Jászberényi Tanítóképző Főiskola, 1997. november 25.)

[44] Boda I. Károly - Porkoláb Judit: A Jelenések könyvének számítógépes elemzése. - A Magyar Nyelvtudományi Társaság debreceni csoportjának felolvasó ülése. - Debrecen, 1998. október 16.

[46] Boda István: Nyitott oktatási formák. - Előadás a Bessenyei György Tanárképző Főiskolán. - Nyíregyháza, 1998. október 26.

[49] Boda I. Károly - Porkoláb Judit: "... és lát az Isten égő mennyeket". Pilinszky János (Nyelvi látomások). - Előadás a debreceni Nyári Egyetemen. - Debrecen, 1998. július 23.

[59] Boda István: A multimédia alkalmazása. - Előadás a Hatvani István szakkollégium keretében. - Debrecen, 1999. április 7.

[61] Boda I. Károly - Porkoláb Judit: Értékvilág Radnóti verseiben. - Előadás a debreceni Nyári Egyetemen. - Debrecen, 1999. július 20.

[75] Boda I. Károly - Porkoláb Judit: "Sem emlék, sem varázslat" (Hipertextuális elemek Radnóti Miklós költészetében). - Előadás a Debreceni Nyári Egyetemen (Debrecen, 2000. július 19.)