KNOWLEDGE-BASED AND LAYOUT– DRIVEN ADAPTIVE INFORMATION PRESENTATIONS ON THE WORLD WIDE WEB

George Vouros
Dept. of Mathematics
University of the Aegean
Samos, Karlovassi
Greece

Abstract

The paper presents on-going research towards generic tools and methods for fulfilling the combined needs of information producers and consumers. It presents the principles, framework and key issues of our research, and focuses on developments concerning INFO-PRESENTER. This is an interactive system that provides knowledge-based and layout-driven information presentations, intending to satisfy the idiosyncrasies of information consumers, supporting a great amount of tailoring information to their needs, interests, preferences and background knowledge. The paper focuses mostly on themes concerning knowledge representation and layout specifications. The representation framework provides a general model for the specification of information requirements in terms of media-independent information item categories and types of information views for realising information. Layout specifications provide generic rules for tailoring information delivery, in conjunction with the information specifications. To facilitate user-tailored information production, information and layout specifications should be structured and encoded so as to facilitate their cost-effective creation and maintenance, in relation to their effective utilization for user-tailored information presentations.

1. Introduction

Critical issues concerning the use of information on the World Wide Web are the efficiency and efficacy of its creation, maintenance and exploitation. Major categories of information users are information producers and information consumers.

Information producers aim to provide information that achieves their communicative goals, addresses the needs, interests and satisfy the preferences of their intended audience. Information consumers need to tailor information to their background knowledge, preferences and abilities, and satisfy their information needs in various contexts of information use.

This paper presents on-going research towards generic tools and methods for fulfilling the above-mentioned needs of information users. It presents the principles, framework and key issues of our research, and focuses on developments concerning INFO-PRESENTER. This is an interactive system that provides knowledge-based and layout-driven information presentations. The system aims to satisfy the idiosyncrasies of information consumers and supports a great amount of tailoring information to their needs, interests, preferences and background knowledge. The paper presents system's overall architecture, and focuses on the knowledge representation framework that the system exploits, as well as on the way layouts, which drive information presentations, are specified. The representation framework provides a general model for specifying information. Information comprises domain concepts, media-independent information items related to domain aspects, and information views for realizing information items using specific media formats, subject to the contextual constraints of information use. Layout specifications provide generic rules for tailoring information delivery, in conjunction with the information specifications.

The paper is structured as follows: Section 2 presents related work towards our research goals, presents the motivations and key issues of our research. Section 3 presents the system architecture and section 4 describes the current status of system implementation and future developments. Section 5 provides concluding remarks.

2. Previous work - Motivation – Key issues

Adaptive hypermedia systems aim to tailor the content, presentation and hypermedia structure of information to the needs, interests, preferences, abilities and background knowledge of their users.

- *User needs* include information seeking goals and the real-world tasks that comprise the context in which information is consumed. For example, in case the user is operating with a device and does not know how to perform a particular task with it, then he forms the desire "to acquire knowledge about performing this task". This desire represents his need. Moreover, physical abilities and background knowledge of users may help to determine their information needs. For instance, the information needs of an expert in a domain are different from the needs of a novice. Needs determine the information interests of users.
- *Information interests* comprise subject related knowledge of the information items that users need to consume. For instance, in case the need of the user is "getting information about setting the volume of tone ringing volume' in a telephone device, then his interests are, among others, about "tone ringing" and "volume". These may specialize a generic interest, or be part of an inclusive one, recognized earlier through interaction.
- *Preferences* are about certain information modalities for communicating information, such as text over graphics and images, audio over text etc.
- *Abilities* concern physical abilities of the user, as well as network bandwidth, hardware and software performance characteristics.
- *Background knowledge* of users denotes their experience in the subject domain.

In the last few years, a lot of effort has been devoted to the development of adaptive hypermedia systems, with major emphasis to adaptive presentation of information content and adaptive navigation support. More specific types of adaptive hypermedia systems, such as adaptive educational systems, address also issues concerning adaptive sequencing of information, problem solving support and intelligent solution analysis [Spe99, Bra98, Bru98, Esp96].

Adaptive hypermedia systems utilize a conceptual, or content, model of the domain and use concepts to either tag segments of canned information, or to generate natural language descriptions of the information content, and sometimes, to generate graphical descriptions of domain knowledge or of the way information is structured. Although it seems that a unifying framework for information specification can exist, most of these systems do not propose the utilization of such a representation framework.

M.Zhou and S.Feiner [Zhou98] proposed an extensible, comprehensive and general representation framework with the aim to represent all basic visual forms (visual media formats) needed for automated graphics generation. One or more primitive visual forms, referred as object's senses (visual words), represent a domain aspect. A sense includes the necessary characteristics for specifying the role an information item may play in a presentation, as well as its form. The framework does not distinguish between medium-independent information items and medium-dependent forms for realising these items. For the presentation of an object, a sense selection mechanism selects a visual word by taking into account presentation goals and contextual constraints. However, there are cases that a presentation needs two or more pieces of information of the same domain aspect, each piece presented in multiple media and forms.

C.Welty [Wel96] proposed an ontology, which is broken into three parts: Domain aspects, medium-independent information items and information views that express information items. However, this framework does not deal with representing the

necessary knowledge for choosing information items and views in the appropriate contexts.

Generally, selection of information during a presentation involves selecting the information content (i.e. media-independent items of information for achieving presentation and communicative goals), and designing the presentation by selecting the appropriate media and formats (i.e. media and form dependent views of information items) for information realization. These tasks involve reasoning about the domain, the presentation goals, the presentation context, and user characteristics. Selection of information items may be driven by the availability of views and vice-versa. Making the distinction between information items and medium-dependent views of information, makes the representation more comprehensive and supports the identification of generic information categories and types of information views. Information categories help in categorizing fragments of information according to their role in achieving presentation intentions, and types of views provide the generic forms of realizing information subject to contextual (pragmatic) constraints.

Furthermore, most of adaptive hypermedia systems do not deal with the costs of creating knowledge bases and do not emphasize on methods and tools for their efficient development. As pointed in [Par96], "… systems assume that an underlying knowledge base containing the necessary information is available or can be easily obtained". Moreover, as it is documented in [Rei94], a major obstacle towards automatic generation of technical documentation is the increased cost for knowledge base development and maintenance. This, together with the needs of reducing the costs of quality assurance, and of achieving a great amount of adaptability of information, point to the necessity of keeping information producers into the loop.

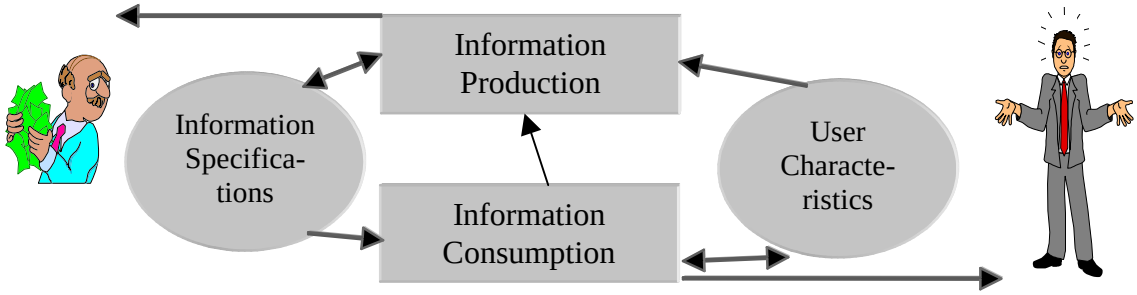


***Figure 1**: Keeping information producers and information consumers in the loop.*

Information producers need tools for defining the conceptual structure of a domain, for specifying information items about domain aspects, and for providing alternative ways of realizing information in particular contexts/settings. Furthermore, information producers must relate information to the characteristics of their intended audience. These characteristics include the needs, interests, preferences, abilities and background knowledge of potential information consumers.

Concerning information consumption, adaptivity of information must be based on specifications about the proper use of information, be driven by the on-going dialogue between user and system, by user characteristics acquired during interaction, as well as by specifications about presentations overall structure and layout.

Figure 1 describes the information production-consumption loop in which characteristics of information consumers drive information production as well.

The aim of the research reported in this paper is in empowering information producers and information consumers by providing them with the appropriate tools.

Key issues in this research are:

- The use of a general, extensible and comprehensive framework for the representation of knowledge concerning the use of multimedia information in the context of the presentation design task. The framework must be general by providing the building blocks for specifying generic information categories and types of information views. Furthermore, it must be extensible by facilitating the specification of new information categories and information types, and by facilitating the specification and proper categorization of information items and information views, according to their role in achieving presentation intentions and their use in various information-related human activities. The objective is to facilitate efficient knowledge base development and maintenance, in conjunction with effective and efficient utilisation of knowledge for information presentation. As already pointed in [Vou99a, Rei95], to reduce the cost of creating knowledge bases, and in order to facilitate their development by information producers, we sacrifice the benefits of using low-level generation techniques. Therefore, the proposed representation framework is hybrid, mixing proper knowledge structures with canned fragments of media objects. The representation framework guides information production and captures the necessary knowledge for supporting a great amount of designing user-tailored information presentations.

- The design and development of a tool that will assist and facilitate specification of information using the above mentioned representation framework. Users must specify information items that they intent to present, relate these items to the domain aspects, specify the communicative functions of these items, specify alternative forms of realizing information and associate information with user-oriented data. This tool must also assist users to the production of presentations' layout specifications.

- The design and development of a tool that will tailor and present information to consumers' requirements and characteristics. The tool must consult presentation layout specifications and exploit knowledge concerning the proper use and combination of information items. The tool must exploit the specifications of information producers.

- The use of a user-modelling framework for representing, inferring and maintaining knowledge about users by elaborating on their stated characteristics (e.g. background knowledge, abilities, software-hardware platforms, network connection), on their interaction with the system (e.g. follow-up questions, preferences in media, interests related to domain aspects etc), and on the on-going dialogue with the system (e.g. plans, goals, intentions, knowledge acquired, generic information interests about the domain).

The paper presents INFO-PRESENTER, which is an interactive prototype system that provides user-tailored information presentations. To tailor information to users, INFO-PRESENTER exploits information specifications encoded in the above mentioned representation framework, layout specifications encoded in extended HTML, the stated user characteristics, and the dialogue context with the user.

3. INFO-PRESENTER Architecture

The overall system architecture of INFO-PRESENTER, in terms of the Standard Reference Model for Intelligent Multimedia Presentation Systems [SRM98], is given in Figure 2.

Key issues related to system implementation are

(a) The framework for representing knowledge about the domain and the media objects utilized during presentation, and

(b) The layout specifications that drive information presentation.

Knowledge Base.

The knowledge base is built using the representation framework proposed in [Vou99a]. It represents domain knowledge in combination with knowledge concerning the use of multimedia information in the context of achieving communicative goals. As already pointed out, emphasis has been given to the efficiency of developing and maintaining knowledge bases, as well as to the efficient use of knowledge for constructing multimedia presentations.

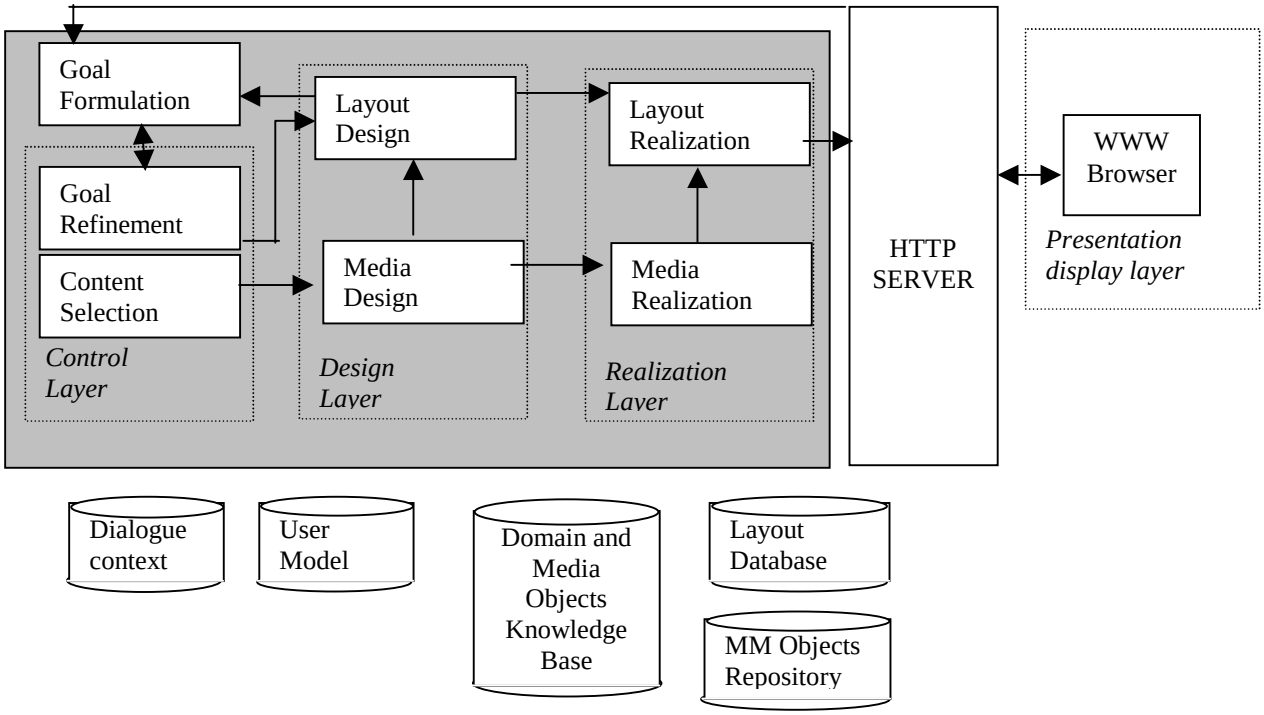


Figure 2: *INFO-PRESENTER architecture*

The representation framework

- Is extensible, generic, and makes specific ontological commitments for guiding information specification and structuring. The representation is comprehensive to represent and handle information items of domain aspects, as well as to handle multiple and heterogeneous views of these items. The representation provides the means for expressing the necessary constraints for selecting information items of domain aspects and views of these items during design of information presentations.

- Is hybrid and intermix formal knowledge structures with canned information fragments. The level in which primitive information fragments are specified and therefore, the balance between proper knowledge base structures and canned media objects is an issue to which the framework makes no commitment.

- Supports subject-based classification of the represented information. Representation of subjects and subject based classification is important for indexing information, for keeping track of user interests and, for making information accessible in the appropriate contexts (e.g. for answering follow-up questions).

The framework has been implemented using the BACK Description Logic [BACK]. Description Logics have been chosen due to their formality, and due to the reasoning facilities provided.

The representation framework is depicted in Figure 3. Each oval in this diagram represents a concept hierarchy. Based on this framework, Figure 4 depicts specification of information concerning a part of a telephone device: SET KEY.

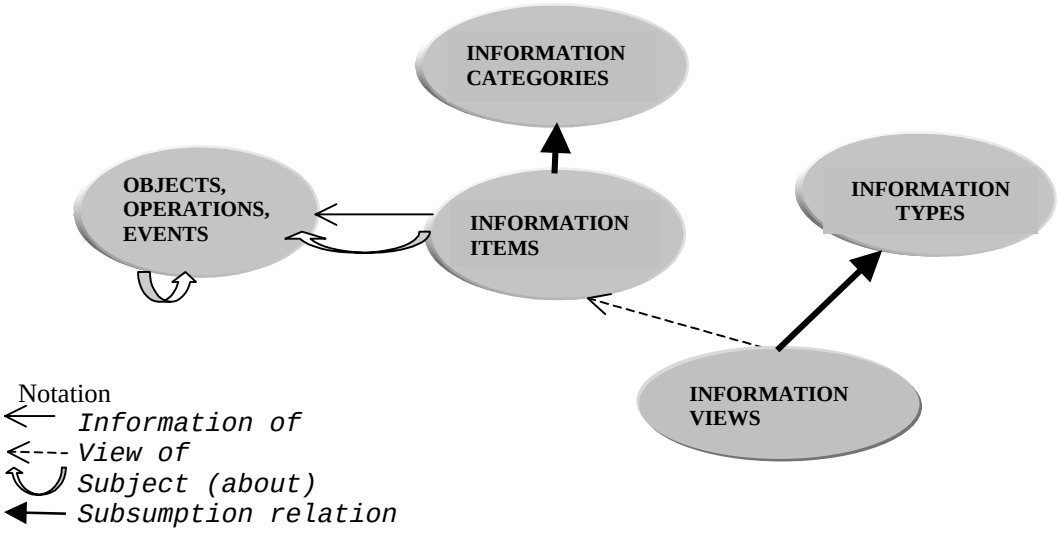


Figure 3: *General Structure of the Knowledge Base.*

Concepts, i.e. classes of objects and events, as well as concrete objects and events of the subject domain have a number of information items associated with them. For instance, the SET KEY in Figure 4 is associated with 4 information items: SET KEY LTERM, SET KEY GTERM, SET KEY POS, and SET KEY F2. Information items represent medium-independent pieces of information about domain aspects. They are categorised to information categories according to their role and scope in achieving communicative goals. For instance, as shown in Figure 4, SET KEY LTERM is a Linguistic Term (LTERM) with role:identifies and scope: naming. The SET KEY POS item is a POSITION INDICATOR with role:indicates and scope:position. Information categories, such as LTERM and POSITION INDICATOR, correspond to rhetorical acts [Mayb93][Andre93]. The intentions of presenting items that belong in these categories are identical to the intentions of the corresponding acts. Information categories suitable for technical documentation have been identified in [Vou99a]. These correspond to Rhetorical Structure Theory relations [Mann89][Andre93] and can be further extended with categories that are suitable for covering other documentation purposes. For instance, [Esp96] and [Car99] identified information categories for the documentation of object oriented software development methods and for medical guidelines, respectively.

An information item is associated with a number of alternative information views. Views realise information using a specific medium and format, and are classified under information types that represent generic forms of information. Information types, and consequently information views, combine the sense of realising an information item (label, list, plot, symbol, portrait, information) with the actual medium of information presentation (text, graphics, image, information, video, audio). Returning to our example, the SET KEY POS item has two views: SET KEY POS TIND and SET KEY POS IMIND. SET KEY POS TIND is a text fragment that provides information about SET KEY POS. It is an instance of the INFO TEXT TYPE, information type. The SET KEY POS IMIND is an instance of the PORTRAIT IMAGE TYPE and represents an image that is a “portrait” of the SET KEY POS item. Views may also include characteristics that express regularities in data sets and are necessary for selecting a medium/modality for realising information. These are:

dimension, transience, ordering, scalability and continuity [Arens93]. Furthermore, information views are associated with user-oriented information that constrains their selection during presentation. User-oriented information, as it is indicated in Figure 4, may contain information about language (for the lexicalisation of terms and textual views of items), user type indications, as well as hardware and software platform requirements for the corresponding views to be effective in an efficient presentation. User type indications may include user categories, user abilities, specific needs and interests. Users may be categorized based on their background knowledge (expert vs. novice) and on their generic needs (user vs. technician) on the subject domain.

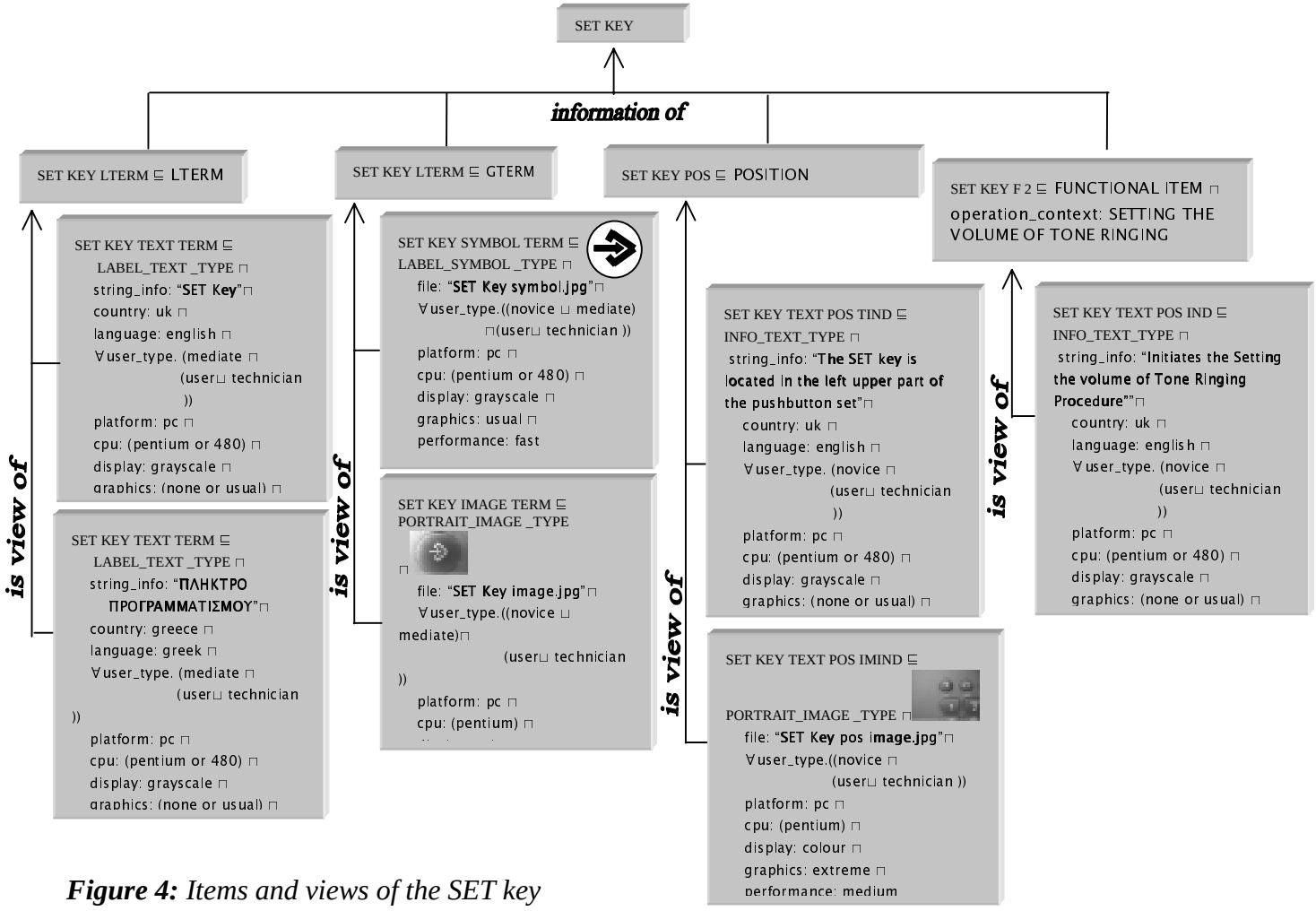


Figure 4: *Items and views of the SET key*

Domain concepts and objects, as well as information items, are classified by subject, i.e., by the aspects that they deal with. For instance, the SET KEY is classified in the following subject categories, among others: SET KEY (itself), SETTING THE VOLUME OF TONE RINGING (via the operation_context of the functional item SET KEY F2), TONE RINGING and VOLUME (which is the subject of the SETTING THE VOLUME OF TONE RINGING). Interest in these domain aspects may designate interest in information about the SET KEY.

During presentation, a system must choose information items according to their scope and role in achieving communicative and presentation goals, and based on user characteristics and further contextual constraints, it must choose views of these items. Selection of an information item depends on the availability of views for realising this

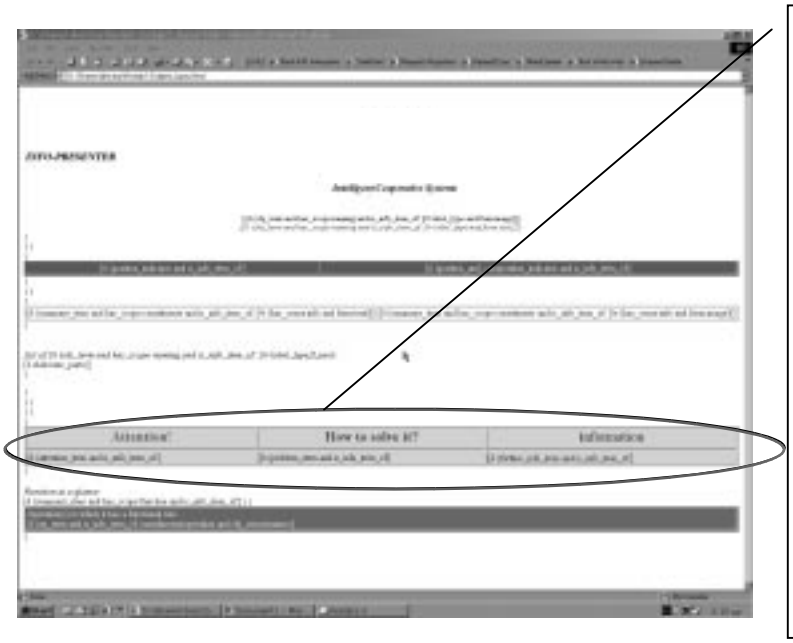
item in a presentation context, and utilization of views depends on whether the corresponding items achieve the presentation intentions. Distinguishing between items and views, the framework offers more flexibility and enables coordination of the information content selection and media design mechanisms.

Concluding, the proposed framework (a) provides the basis for tailoring information presentations, (b) facilitates the specification of generic information categories and types of views for achieving presentation intentions and realizing information in various presentation contexts, respectively, and (c) provides the building blocks for information producers to specify both, the information items related to domain aspects and alternative views for realizing these items in various contexts of information use.

In INFO-PRESENTER, the presentation task is driven by layout specifications.

Layout Database

Layouts are encoded as extended HTML pages with optional sections of information.



```
{<table BORDER COLS=3 WIDTH="100%" BGCOLOR="#F0E233" >
<tr>
{
<td><center>
<b><fontcolor="#FF0000"><fontsize=+3>Attention!</font></font></b><
/center>
<hr WIDTH="100%"><font color="#000000"><font size=+1>
        [/i (attention_item and is_info_item_of:]
</font></font></td>
}
{
<td><center>
<b><font color="#990000"><font size=+3>How to solve
it?</font></font></b>
<hr WIDTH="100%"></center>
<font color="#000000"><font size=+1>
        [/i (problem_item and is_info_item_of:]
</font></font></td>
}
{
<td><center>
<fontsize=+3><b><fontcolor="#990000">i</font></b>
<fontcolor="#660000">nformation</font></font>
<hr WIDTH="100%"></center>
<font color="#000000"><font size=+1>
        [/i (further_info_item and is_info_item_of:]
</font></font></td>
}
```

Figure 5*: Layout Specification for Objects' Presentation*

An example of such an HTML page is depicted in Figure 5. Optional sections are included in brackets ({}) and information item sections are included within square brackets starting with "/i". Information sections may also include view sections that drive the system to select views of a specific information type. Information view sections are included within square brackets starting with "/v". A formal BNF specification of optional information sections is as follows:

```
<information_section>::<information item>|<information view>|<optional item>
<information_sections>::<information_section>|<information_section><information_sections>
<information item> :: [/i <term><information view>]
<information view> :: [/v <term>]
<optional item> :: {<string><information_sections><string>}
```

A `term` may be a description of an information item category, of an information view type, of a class of information items, of a class of information views, as well as the description of a specific item or view. For instance, the following term represents a textual view of an information item that summarizes the constituents of the object that is in the focus of attention.

```
[/i (summary_item and has_scope:constituents and is_info_item_of: focus_of_attention
```

```
   [/v (has_sense:info and form:text)]
]
```

Furthermore, `terms` may be macros that elaborate on specific items and views. An example of such a macro is the `elaborate_parts` shown in Figure 5, that returns a list of views of the constituents of an object, or of the steps of an operation. Macros help specifying complex interactions of information items and views, combined with special presentation requirements.

Optional sections allow adaptation of presentation and, more than information item/view sections, support the specification of alternative presentations. For example, let us consider the following optional part:

```
{<B>Information about A:</B>
   {<BR>Please read:<I>[/i A [/v form:text]]</I><BR>}
   {Hear that! - [/i A [/v form:audio]]}
<B>Bye!</B>},
```

where, A is a term.

In case A has a textual view that satisfies user characteristics, and does not have an auditory one, then the presentation will be as follows:

Information about A:
Please read: *<A's textual description>*
Bye!

We must notice that in case there is no view that can substitute any information item/view section of an optional section, then the optional section does not appear. This is the case with the auditory part of the presentation in the previous presentation. However, when there is a view of at least one information section, then the whole optional part appears. This is for instance the case with the whole optional section of our example.

Continuing our example, in case that A has an auditory view but does not have a textual one, then the presentation will be

Information about A: Hear that! – **Bye!**

and information about A will be heart.

However, in case that no view of A fulfils the required characteristics, then none of the included optional parts will be presented. Consequently, the inclusive optional part will not be presented as well.

It should be noticed that information view sections might indicate the intended audience of an information item, by including a specification of users characteristics. In this way, information producers can further constrain the contexts in which specific information items are presented, or the contexts in which specific views are used. Therefore, combining user-oriented information specified in information views, with information about the intended information consumers specified in information view sections of layout specifications, it is conjectured that information producers can control the amount and form of information in various contexts, and information consumers are given a great flexibility in satisfying their idiosyncrasies.

Layout specifications may be considered to realize presentation plans or schemes. Information sections correspond to sub-plans and information item and view sections to rhetorical and realization acts, respectively. Since information items correspond to rhetorical acts, the intention of an item is identical to the intention of its corresponding act. In this way, we can recover the intentional structure of a layout specification. But, this is a subject of further study and research.

Layout specifications are related with conditions. When these conditions hold, then the system selects the layout to guide subsequent information presentation. Therefore, the generic structure of a layout specification is:

L=<C,H>

Where, C is a set of conditions that must be satisfied in order the layout to be selected for presentation, and H the extended HTML part that drive information presentation.

Currently, INFO-PRESENTER exploits layouts for objects' and for operations' presentation. However, given that each of these layouts have 12 optional parts, the total number of possible presentation alternatives for each layout, are

$$\sum_{i=1}^{i=12} C(12,i) = 4095$$

This number must be multiplied by the number of alterative views of each information item.

This type of layout specifications is in close spirit with specification approaches in AVANTI [Fin99], AHA [Bra98], "formation" [FORM] and are within the scope of the ICONOCLAST [ICON] project. However, in contrast to most of these approaches, the information producer does not have to specify exhaustive conditions in optional parts and all the conditions of all possible alternatives, in each part of the presentation. On the contrary, the user may choose the appropriate level of abstraction to make the specification. This may range from very abstract information categories (leaving the type of information unspecified), to specific views of specific items with detailed user-oriented data. Furthermore, to construct layout specifications, producers must consult the represented knowledge, the characteristics of potential users specified in the user model, and must be driven by the ontological commitments (information categories, information types and their relations) of the formal representation framework described above.

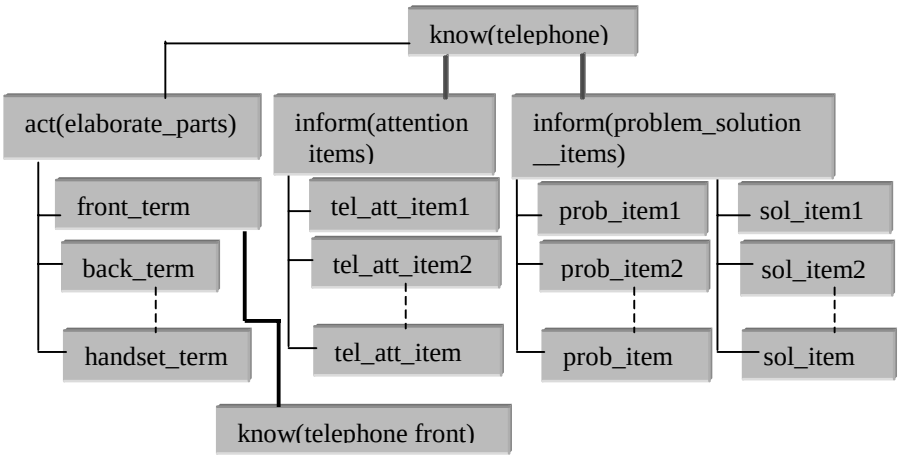


Figure 6: *The structure of the Discourse Context.*

Discourse Context.

The Discourse Context provides a blackboard facility in which the actions of the system and the user are recorded. As shown in Figure 6, the dialogue context has the form of a recipe graph [Loch96]. The system inserts the utilized recipes, i.e. the presentation strategies realized by the layout specifications. For instance, in Figure 6, the actions (`act(elaborate_parts)`, `inform(attention_items)`, `inform(problem_solution_items)`) realize a strategy for providing information about the object `telephone`. These actions are further refined by the selection of information items and information views for the actual presentation. When the user clicks on a telephone part (e.g. telephone front) then, this action is recorded in the discourse context (indicated with a bold line). In this way, the dialogue context is gradually constructed.

The dialogue context enables the system to locate the focus of attention, to infer the

information needs, interests, and knowledge acquired by the user, and to participate in consistent and coherent dialogues with users. In the current implementation of INFO-PRESENTER, the dialogue context is utilized for locating the focus of attention and for presenting information consistently.

User Model

Currently this is a set of facts concerning user abilities, background knowledge and preferences about media-modalities. It is associated with simple update and maintenance procedures.

The user model is updated from the answers of users to a questionnaire displayed in the start of a dialogue session.

Concerning knowledge about domain aspects, it is assumed that when information items are displayed, then the user acquires the presented information. The user model is updated with new facts indicating the information acquired by the user.

INFO-PRESENTER modules are as follows:

Goal Formulation

The task of this module is to convert messages into goals that are understandable by the system. There are two types of messages: External messages from the user (when the user requests information about an aspect), and internal ones from the layout design and goal refinement modules.

Goal Refinement

This module refines the goal statement forwarded from the goal formulation module with user characteristics. It further recognizes whether the goal is about an object or an operation, and whether it concerns (a) the aspect itself, (b) a macro, (c) an information category concerning that aspect, or (d) an information view type of an information category.

In case (a) the system directs the request to the layout design module.

In case (b) it decomposes the macro to a set of goals of type (b), (c) or (d) and directs them to the goal formulation module.

In case (c), the system directs the goal to the content selection module and finally,

In case (d), the system directs the goal to the media design module.

Layout Design

The layout design module determines the layout specification that should be used for presenting the requested information. Towards this goal it checks the conditions of layout specifications. In case conditions are satisfied, a layout is selected and the module parses the extended HTML text. For each information section, it issues a request to the goal formulation module.

Based on the input from the media design module, the layout design determines whether optional information sections shall be presented and substitutes information sections with the determined information views. The output is forwarded to the layout realization module.

Content Selection

The content selection module retrieves and filters information items that belong to the requested information category of a domain aspect.

Questions about information items issued by the content selection module can be considered to correspond to rhetorical acts, given the correspondence between information categories with them.

The content selection module issues requests concerning information types of the selected items, to the media design module.

Media Design

The task of the media design component is to select the appropriate views of the information items mentioned in the request. The request may also state the particular information type to which these views must belong.

In any case, the module checks whether each selected view satisfies the user characteristics (abilities, preferences, background knowledge), whether it is consistent with previous presentations of the same item, with presentations of related items and determines the number of views that shall be presented for each item.

Selected views are forwarded to the media realization module and to the layout design module.

Media Realization

Based on the information views selected by the media design component, the media realization module retrieves the selected media objects and adds stylistic guidelines (HTML tags) for their realization. For instance, a list of views may be itemized or be tabulated, certain text segments may appear in bold or italics, with a particular colour, or an item may be formed as an anchor.

Layout Realization

The task of this module is to merge the results of the layout design and media realization module. The result is an HTML page that is sent to the client.

The generated document is presented using standard WWW software (e.g. a standard web browser).

4. Implementation and current status

INFO-PRESENTER has been implemented using SWI and AMZI! Prolog. The system uses the AMZI! Logic Server for interaction with CGI and the WWW Server. The representation framework and system's knowledge base have been developed using the BACK Description Logic. Currently, the knowledge base contains concepts, information items and views describing parts of a telephone device, as well as tasks operating such a device. Figures 7-11 show presentations generated by the system during a dialogue session. All presentations contain information for a novice that prefers text to other forms of information.

The presentation of the telephone device is given in Figure 7. We must notice the correspondence of the presentation with objects' presentation layout specification. The system presents the label items for the telephone device, summary items about its constituents, a list of all telephone parts, attention items, problem items and solution items, as well operations in which this object participates.

Continuing the dialogue with the system, the user requests information about the telephone front. Information about it appears in Figure 8. This includes just labels and telephone front parts.

Presentation of the speaker, as Figure 9 shows, includes only a text label and a textual description of speaker's position.

For the presentation of information about operations, the system exploits the corresponding layout specification. Examples are shown in Figures 10 and 11.

Currently, INFO-PRESENTER supports mostly adaptation of content. Adaptive navigation support is currently supported in a restricted way: As already mentioned, in case the system has presented a view of an information item, it assumes that the user has acquired the presented information. In subsequent presentations, the same information is replaced with

a link to the information. Links to this information, in subsequent presentations, are hidden. However, we already study and implement more robust mechanisms for link annotation and hiding, exploiting user interaction with the system. We plan to integrate this feature in INFO-PRESENTER within the next months.

5. Concluding Remarks

The paper presented on-going research towards generic tools and methods for fulfilling the combined needs of information users. It presents the principles, framework and key issues of our research, and focuses on developments concerning INFO-PRESENTER. This is an interactive system that provides knowledge-based and layout-driven information presentations, intending to satisfy the idiosyncrasies of information consumers, supporting a great amount of tailoring information to their needs, interests, preferences and background knowledge.

The aim is to provide a comprehensive knowledge representation framework that will guide information specification efficiently, and upon which, efficient and effective information adaptation will be based. The proposed framework is general, extensible and makes the ontological commitments, which are crucial for supporting both of these tasks.

We already designed and start implementing an intelligent authoring tool that will help information producers to make information specifications and produce the required knowledge bases efficiently. However, we must point that even without this tool, information specification is a straightforward task, but of course not for, let us say, technical writers.

Layout specifications have been kept as simple as possible, in order to facilitate their efficient production and their effective utilization during information presentation. However, information producers will need tools for the production of these specifications. This, in accordance with support provided for combining layout specifications in a way similar to the combination of plan operators, is within our future plans.

It is our belief that although this set of tools can empower both producers and consumers of information, their scope is limited. This mostly concerns INFO-PRESENTER: It may support interaction in a high degree and demonstrate the value of the methods and techniques proposed, but it will be difficult to support cooperative behaviour and provide helpful behaviour. To do this, the system must be able to reason about communicative goals, and presentation intentions, taking into account users' mental state. Furthermore, it must enable cooperation between media components, between media and content selection components, reason about user intentions and goals, and tailor information to these settings effectively. Towards this aim we conduct research in agent-based cooperative systems [Vou99b].

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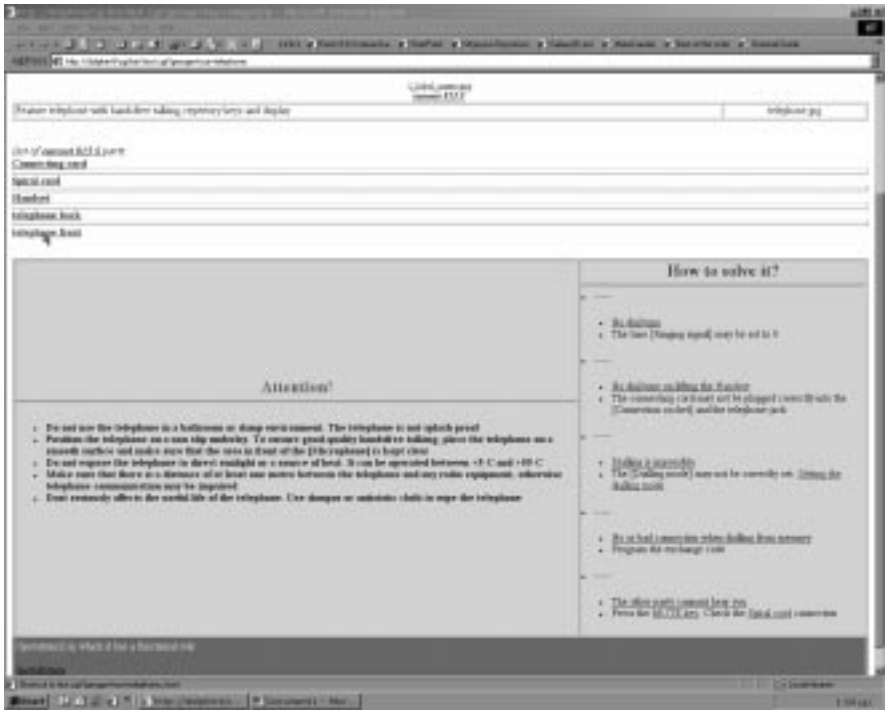

Figure 7

Figure 8

Figure 9

Figure 10


INFO-PRESENTER
Intelligent Cooperative System
Conditions
Effects
List of Setting the volume of tone ringing steps:
Lift the Headset
Initiate procedure
To set the tone ringing volume you have to Press the LOW Volume key or Press the HIGH Volume key or Press the [key No.0] or Press the [key No.1] or Press the [key No.7]
Press the SET key
Replace the Headset
information
To interrupt the setting procedure, Replace the Headset before Press the SET key. The original settings are retained.
Functional Objects
SET key

Figure 11