



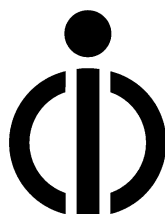
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The Domain Help System (DHS)

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User Oriented IT Design

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THE DOMAIN HELP SYSTEM (DHS)

By Henry Rodríguez

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Introduction

All systems (known to this writer) share the characteristic that the help information only pertains to the tool itself, ("tool help"), e.g. how one uses the search facilities of a word processor, and do not offer any help regarding the relevant domain, e.g. advice on how to write a good novel. A bit maliciously, one could claim that present systems focus on trivial issues and leave the difficult ones at bay. Nils-Erik Gustafsson

Computer programs can be oriented to support different fields of knowledge, for example, social sciences, numerical analysis, the writing and learning process, medicine, art, and finance. The diversity of the audience makes it difficult to have common elements among computer programs. However, we could say that an ever-available feature for most computer programs is the help system feature embedded in them. Usually, a help system is a separate module embedded in the software tool that is oriented to give a quick reference or a task-specific help. Traditionally, help systems are designed to solve problems concerning how to use a computer program, or to improve users' performance while using it. The main purpose of this project was to break with this traditional approach in the design of a help system by creating a help system in which users could add, or modify the information given by the help system.

Knowledge is vast, so computer programs can cover only predefined areas of it. We can reference these areas as domains. For example, the domain for a word processor software (e.g. WordPerfect, MS Word, LaTeX) is the writing process. Traditional help systems offer little support for the domain knowledge that a computer program supports because they are designed to answer questions related to their computer program, or to some basic rules that constitute the domain knowledge in relation. A Domain Help System (DHS) would be a help system that will not only be concerned with the tool itself but also with the relevant domain knowledge that the tool is supporting. While you are interacting with a computer program many questions could arise about how to perform a specific task using the computer program. Also, questions about how to apply one domain's rule could be formulated. At this level traditional help systems offer support to user in a good way. However, traditional help systems do not answer to questions related to the domain as a whole, one example as regards the writing process, which are the characteristic or technique that writers use to write their novels. Users are left without any assistance.

In this report we motivate the creation of a Domain Help System and describe the most important parts of its development pointing out the versions or prototype's characteristic and how differs a version of the DHS with the previous one. We also report

the results of user studies we carried out and finally we give the conclusions relevant for the design of web-based applications and a description of our future work.

With the construction of a domain help system in mind, we arrived at a web-based collaborative tool, that has helped us to collect valuable experience about a) web design, b) the design of computer supported collaborative tools, and c) the design process in general.

Why a Domain Help System

Users will know eventually how to use the computer program or the software tool they work with. At least, a low error performance could be expected after some practice. Help systems usually describe all the conceivable actions that can be taken while using the software tool. A direct consequence is that the examples that are given by the help system to support users are reduced to a limited number giving the whole structure a static nature. Furthermore, these help systems are closed systems to users, e.g. no changes to their contents can be made (no addition, modification, or correction), so what is given, will remain!

It seems that help systems are designed with the word “performance” in mind, so what you get from them obviously are actions to follow. This is an important drawback to point at, as knowledge is not limited just by one word: how. Dealing with domain knowledge is (in general) a matter of interacting with a set of objects, say, concepts, and rules that can be applied to these objects. These rules tell us how they can be applied, and are subordinated to the concepts belonging to that domain knowledge. Traditional help systems are oriented to give response to the basic question how, so they are concerned mainly with the rules related to the domain the computer program support, and how, using it, you can manipulate an object within the domain.

Dealing with knowledge usually ensues with the creation of new knowledge, its modification, or its partial or total rejection. The outcome in such process, in the sense of quantity, will not be static but dynamic. The structure of traditional help systems cannot fulfil the requirements for a DHS. This led us to reject for the design of our DHS a close-to-users-help-system approach, as in traditional help systems. We need an open-to-user-help-system, so that, new knowledge items could be introduced, modified, shared, or rejected. We need to “feed” the domain help system.

Typically, knowledge is based on what people do while solving problems. For solving a problem you might need more information or just make use of what you know already. Commonly, after solving a problem how it was solved is lost for others that, very likely, will need to solve the same or a similar problem in the future. Even more frustrating is this situation: for a previous problem you solved, you cannot remember how you achieved the solution. One way, maybe the best, not to forget this is to make annotations about it. Traditional help systems lack this feature.

To tackle this deficiency of traditional help systems, we thought that we should design help system open to users and not only problem-oriented. A help system that will be open to users could be:

- A potential solution for the “I did it but do not remember how” problem. We do not know if users will be willing to make annotations about how a solution was found but it will be unknown as long as computer programs do not support users to make this kind of annotations.

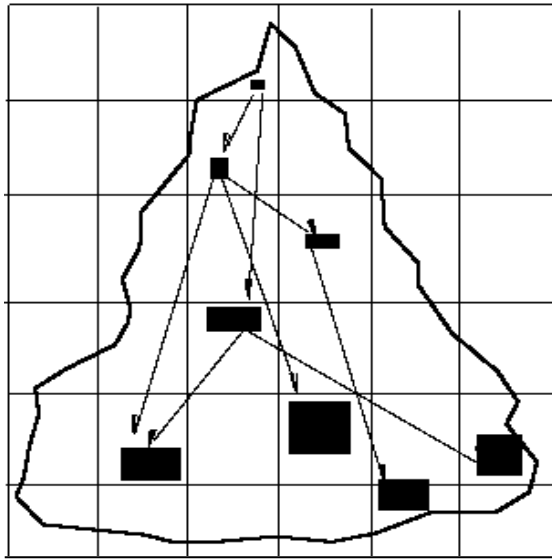


Figure 1. The iceberg model of information. –

- A common repository of knowledge. If users “feed” the DHS with knowledge items and at the same time make them available to others we would have found a way to share knowledge within groups. It could encourage people to show what they know to others; for instance, looking for prestige within an organisation. Experts could take some of their time to “feed” the DHS knowing that this will decrease the amount of direct request they get. Users will report their experiences using examples this

means that examples presented by a DHS could constantly increase. Going through a large amount of examples are one of the must that a person needs to reach an expert level. All these points will improve performance within an organisation because solutions could be found quickly (Groth K, 1999).

- User will know where to look for “help” when an unsolved problem is present (frequently asked questions). Novices could have a new source of information, solution, or advice besides experts; who usually are not willing to share their time

These are only some remarkable advantages that we could get with a DHS.

Versions and Prototype of the DHS

In this section we give a history of the different prototypes that were developed by the design group and how elements were included to the design process to highlight their impact. We also motivate why we took some decisions that were relevant for the system development and design.

The First Steps Toward a DHS

The main approach of the DHS was to present information according to an iceberg model of information. The idea of this approach was that initially only a minimum of information is presented, even that information which an experienced user could request for, consecutively more information is available. Like an iceberg the system shows only tips of information, but there is an entire mountain of information to be accessed as we descend deeper in the iceberg model of information (see figure 1.)

An important requirement for this project was that a user should be able to add easily knowledge items to the system while he/she was interacting with it. We therefore decided to have a simple representation of knowledge items in the form of written comments or annotations.

The initial bounds that we had when the project started can be summarised in this sentence: a help system working on the WWW that could be fed by users and simple to use. Our design process started with these elements.

The writing process is a domain that is very complex, writing is an open-ended task, and to write could be seen as consisting of planning, formulating text, and revising what has been done. We decided to take the writing process as target domain to create the first prototype of a domain help system. The reason was that one member of the design group was an expert in this domain.

There was a project at IPLab about the design of a language-checking program for writers and another version of this was planned. We considered that DHS could work together with this “Word and Grammar Checking Program” (WGCP) as the rules of a language are often debatable. The idea was that users were going to make comments on the rules of the WGCP. The design of the project was then centred in both formal and informal rules and making comments on them. A rule in this particular case could describe the use of subordinate clauses in English for instance.

Figure 2 gives an overview of the first version model to create a DHS version.

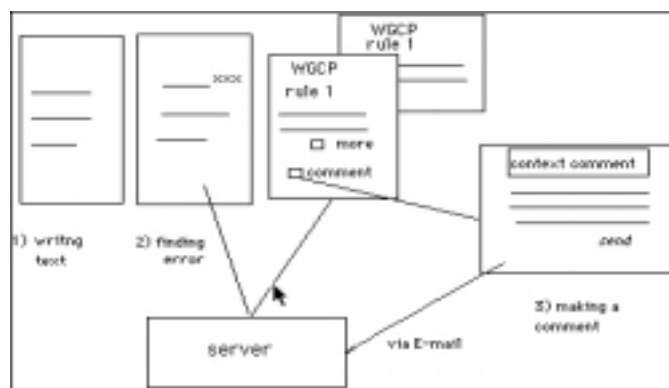


Figure 2. The first model to create a DHS.

1. A user writes a text using a word processor with a WGCP and could be connected to the WWW.
2. When an error in the text is found, say, by the WGCP, some information about the error is given, imagine that is given only in two levels. More information was available by request on the web.
3. The user could send via E-mail a comment and add it to the help system (optional action). After this, all other users have access to the just added comment. The purpose of the comment is to discuss the language rules used in the WGCP.

We started to work independently from the WGCP and the word processor. We did not decide how to make the connection between the word processor used to create the document and the program managing the comments made by the users (the DHS). We expected to find a solution to this later. Meanwhile, we decided to develop the program that was going to manage the comments on the web. The DHS was going to be embedded in a

web browser. The design group was using Netscape 3, so we decided to use the same environment.

The First DHS Version

The idea for this version was that users could access a list of rules through the WWW and that for each rule they could make comments. Users could also add a rule if they wanted. Each rule was represented by a document, which contained the description of the rule.

Figure 3 shows that different rules could be accessed and that during the time users could add comments to it. Knowledge items to be added to the DHS were going to be in form of comments tagged with the following information:

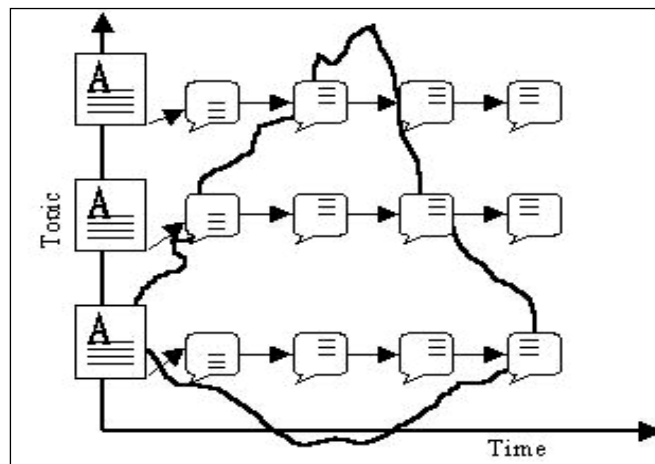


Figure 3. A DHS model. A set of topics commented by users. Note the variance with the iceberg model of information. (figure 1).

- When the comment was made (time and date)
- Who made the comment
- The topic to which it referred

In this model there is no way to connect comments that relate different rules. Each rule, or document, could get comments that would originate a discussion among the users. An added comment could belong only to one rule (or document) and the comments were registered chronologically; time was the unique factor considered to sort the comments for each rule. No complexity degree for the comment was considered, so we did not define where was the top, or the bottom of the iceberg. We thus started to deviate from one of the main concepts for this project, i.e. the iceberg model of information. In summary, what we had was a rule to which comments were going to be added dynamically, so we needed to create a document that was also generated dynamically. Rules were going to be represented as documents on the web. Documents on the web are, somehow, “static” and could be modified just by a direct handling of the file; that is, someone must open the file, modify the file and then save the changes. It is easy to understand why it was unrealistic to perform these actions whenever a comment was added to the system.

Then, the WWW Study Circle started at IPLab. The goal of this study circle was to provide participants with up-to-date information about web technology, development, design, and use. Taking part in this circle we found out that by implementing an interface in Common Gateway Interface (CGI) we could make on-the-fly web pages, making them dynamic (just what we needed). We thus made our first version that was actually running on the web. The screen layout of this version is shown in figure 4. Users could:

1. Select directly from a list of rules or write the number of the rule the user wanted to check.
2. Get a description of the selected rule and all the comments made to that rule so far by clicking on a “submit” button. The window that contains the list of the rules was overwritten with this information.
3. A filtering function was provided. Users could select to read comments made by one or several users by selecting the users’ name. “All”, the default value for the filter function, was the short-cut to read all comments regardless who made them.
4. Modify or delete their own comments if wanted.

In the further versions we decided to exclude features 3 and 4 of this version. The reasons were that at this level of the system development no filtering function was needed and the possibility to modify or delete previous submitted comments was rejected because after

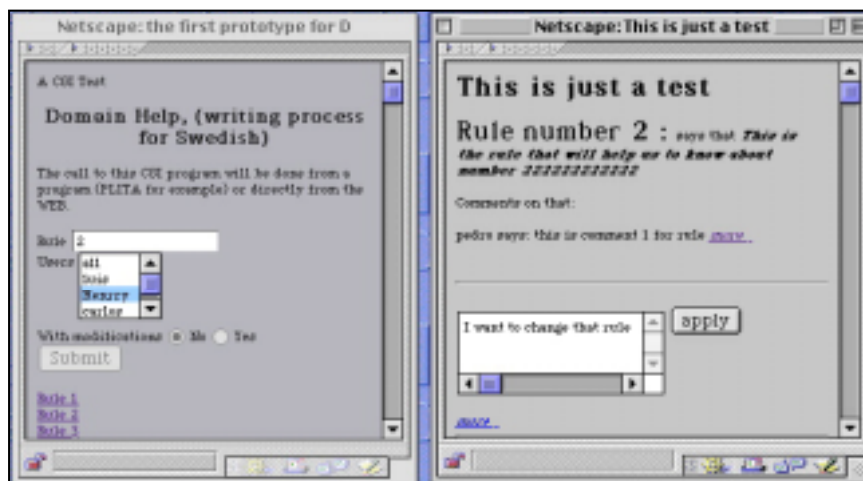


Figure 4. The first version of DHS

you had made a comment somebody else could also make a comment on earlier comments. If the comment was modified, or deleted, and a comment had been made on the earlier version of the comment, then the comment made before this modification might not be valid any longer. The information given by the system to users was thereby not consistent. We decided also to reject feature number 4 because we tried to provide an environment where users should “keep their words”. We thought about a new entity in the system, an “editor” who should be responsible for this kind of changes in the information held by the system. We realised that we needed someone who should monitor the comments added to the system. We briefly defined which functions were supposed to be given to the editor of the domain. In the version that was tested with users, the third version, the programmer played this role (delete, move, or change comments by users’ request). This version was not presented to users and was evaluated only by the design group.

The Second DHS Version

We were dissatisfied with the idea of overwriting the window containing the list of rules to show instead the description of the selected rule and its comments. Users were left without the possibility to check directly other rules from the same window. They had to go back using the back button of the browser to do so.

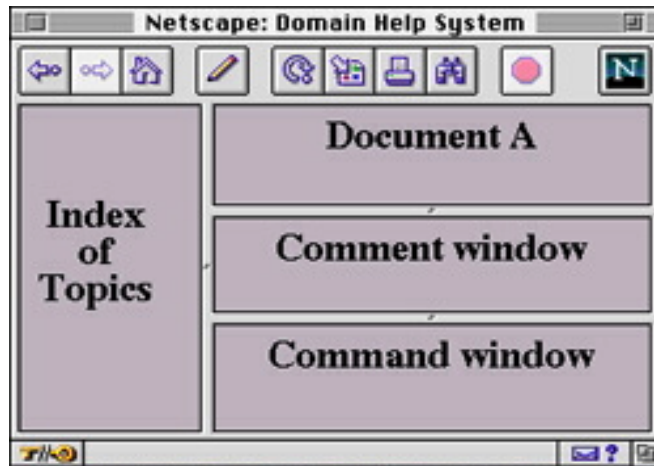


Figure 5. The layout of the web browser's window in DHS

A new element was introduced to the design: the frames which divide the web browser window into multiple, scrollable regions. In this way we could present information in a more flexible and useful way. Using the frames we got an interface with a totally different screen layout. We needed to show: 1) a list of rules, 2) the description of a rule, 3) comments made on a rule, and 4) a field from where the users could add a comment.

The web browser window was divided into four frames as shown in figure 5. Figure 5 shows the word document because the rule was a document itself.

- The left frame, for the list of rules (index frame).
- The right frame that is divided into three frames (topic-frame).
 - The top-right frame, for information about a selected rule (description frame).
 - The middle-right frame, for the comments made to the selected rule (comment frame).
 - The bottom-right frame, where a new comment could be written and submitted (comment-input frame).

This layout was used to build the third version of the DHS. It was developed using CGI and the programming language Perl 5. In this version, the list of the rules was displayed in the form of hypertext links in the index frame. Users could select a rule from this list by clicking on the link. This action updated the frame displaying the corresponding information according to the selection made by the user. The comment-input frame had a text area where users could write a comment and send it. The text area field was visible in order to suggest to users that they could write in the text area. In this way the interface was motivating the user to make comments. This version is presented in figure 6. This version was tested and evaluated only by the design group.

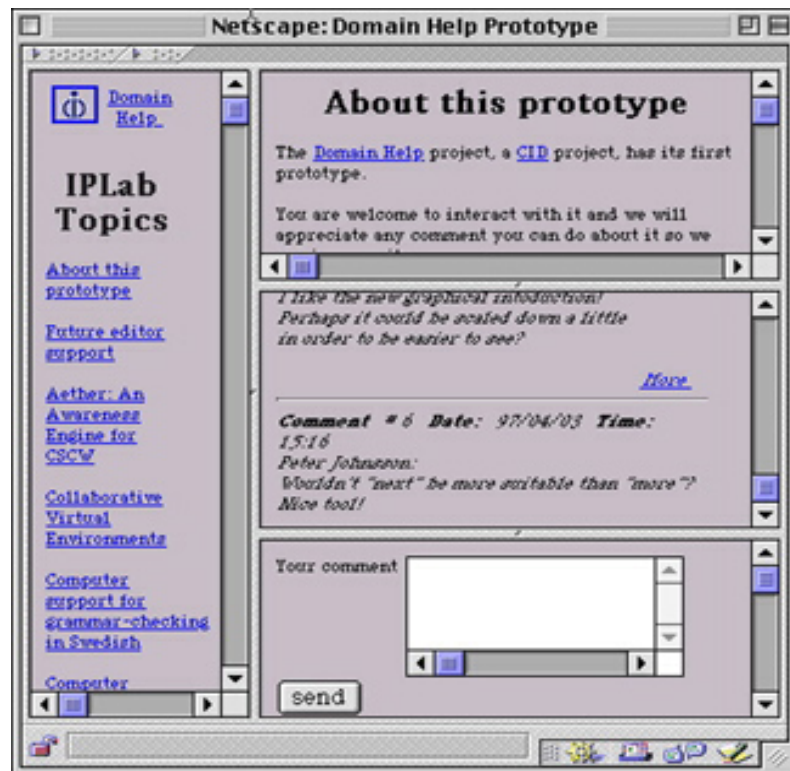


Figure 6. The second version of DHS. Note the text-input area for submitting the comments.

The Third DHS Version

One problem emerged from the tests of the second version: the spaces that were given to the sub-frames in the topic-frame were not proportional. The comment frame was bigger (about 60% of the whole sub-frame) than the other ones. Thus, the discussion about what was more relevant for users while using the system arose among the design group. Were users more interested in reading the description of the rule or the comments made to that rule? We decided to give them equal proportionate size. Let us remind you that until the second version we did not have any user using the system but only members from the design group.

Another detail was that the comment-input frame was not expected to be used very often. We decided to make this frame smaller and in this way we would save space that the description and comment-input frames could use. We made the comment-input frame smaller but kept the size of the text area field that was used to write the comment. If a user wanted to make a comment, he/she had to resize the comment-input frame, so that the text area was visible, write, and send the comment. To resize a frame users had to drag-and-drop the frame border. This created two problems. The first one was when you resize a frame; the browser reloads the whole window (in our case, the index frame and the topic frame) and displays the information in the frames according to the new sizes. If the user wanted to make a comment on the rule or to a previous comment to that rule, when he/she resized the frame for making the comment, the browser presented the information, very likely, in a different way that it was when the user decided to make a comment. The user was losing the overview of the object of interest he/she was trying to comment on. The

second problem was that the user had to know how to resize a frame, not mention that to drag-and-drop the border frame was, somehow, capricious: sometimes it worked, sometimes it did not.

Trying to find a solution to this problem was when JavaScript was introduced to the design process. JavaScript is Netscape's cross-platform, object-oriented scripting language. JavaScript supplies control to a browser, for example, it allows an application to place elements on an HTML form and respond to user events such as mouse clicks, form input, and page navigation. With JavaScript it was possible to open an independent window in the browser by clicking on a button. We decided that the comments should be written from a temporary window and we got our third prototype that you can see in figure 7.

This version was user-tested several times in different areas. The experiences are described in the section "Analysis of the Case Studies". While testing the prototype, we solved some usability problems, made new features or improved previous ones. Using this prototype we started to work using a text-based asynchronous distance communication. In this way we also involved users in the design of the DHS. A detailed description of this version is given in the next section.



Figure 7. The third version of DHS. Note the temporary window for submitting the comments.

How the Third DHS Version Works

In this section we explain how the third version works from a technical point of view. The word domain in this report from now will mean each of the instances we created to test DHS. The definition of a domain within this project follows.

A domain, in the DHS project, is a site on the WWW that presents a hypertext link list, each link shows the user a d document that describes a topic or situation and the comments users have made so far on it. The documents refer to a particular content and

are included in the domain by the domain's editor. The nature of comments could be about the content, the formatting, the design of the document, or even a response to a previous comment. The domain is said to be closed-from-inside because once the document or comment is inside it, users cannot delete or modify them, they just can retrieve or add new comments,

Technically, each domain is a directory where all the HTML files belonging the domain are located. The DHS gathers all the HTML files in the directory (domain) and uses the title tag description of each file to build up the index of topics for the domain. The title tag is mandatory for the HTML files constituting the domain, if it is not included in the source of the HTML file, a warning message is sent by the system. The index of topics is presented as hypertext links, clicking on one of them is interpreted as a request to the system for the description and comments (if any) of that topic. When a user enters the system, the default document presented by the system is a brief description about how the system is used, this document is called "About this prototype" (ATP). The use of the ATP document is discussed in the section "Analysis of the case studies". To provide users with an easy and quick access to this document the system reserved for its link the first place in the index of topics.

When a topic is selected by clicking on its link, the prototype looks for the document describing that topic and the comments made to that document. The DHS makes "on the fly" a mirror copy of this document and displays it to the user. This copy has always the same unique name for each user, say userX.html. If another request is made, the system overwrites userX.html with the description of the just requested topic and displays the new content to the user. As several users could use the system at the same time and browse different documents we had to keep an unique name for each user, so that if the browser reloads automatically the web page the user will present the one he/she was browsing before the reload.

Additionally, the prototype adds a line to the userX.html file that makes this file "out of date" for the browser (an HTML feature in conjunction with the browser). This ensures that the browser looks for the userX.html version that was on the server and does not use the one that is in the cache memory. The cache memory is a local space used by the browser to keep a visited document saved for increasing the file access speed. Let's describe shortly how it works. When the user requests a file, the browser checks first whether it has a file with the same name in the cache memory. If there is a copy of the requested file and this copy is not expired, then the browser presents a copy of this file from the cache memory, otherwise, from the server. We need the browser to show always the document from the server. As in the cache memory there is a copy of the userX.html file (if the user has used the system at least once before), we must force an "out-of-date" for each copy the browser takes from the server, so that the copy in the cache memory is expired for the next request. That is why we add the "out-of-date" line to each copy of the topic requested. This also depends on a browser parameter: check-on-server. If the value was set to never, the browser was going to show always a copy of the requested file from the cache memory and never from the server, irrespective of the expire date of the copy. This was the reason for the most common complaint we got from users who interpreted it as a system error: "the never leaving text". This problem consisted in that even though the user requested another topic, namely, clicked on another link, the topic's

description and comments given by the system were always the same, as if the text did not want to leave the user's screen.

When a topic was selected, the DHS presented the result in this way: a) the content of the document describing the topic was in the description-frame, b) its list of comments (descending chronologically ordered) showing the end of the list, that is, the last comment, in the comment-frame, and c) an “add comment” button in the input-frame. Clicking on the “add comment” button, the system shows up a separate input window with two fields: 1) The name field to identify the author of the comment; this could be ascribed by the user or the user could decide to identify him/herself anonymously, and 2) the text of the comment. If the comment was submitted, then the system immediately appended it to the previous comments made for that topic and it was immediately available to all users. A navigation facility was given to user so they could navigate through the comments. Each comment had a hypertext link so user could navigate to the first, previous, next, and last comment.

It is important to point out that DHS is a system running “inside” another system, namely, the web browser. Therefore, there are problems that depend on the browser and not on DHS itself.

Analyses of the Case Studies

In this section we talk about the experience we had using DHS. For the analysis of the communication within the domains we used mainly the users' response (comments) in the system. Also, we performed interviews for three of the cases trying to evaluate the usability of DHS. We will first report on some general aspects that were present in all the domains. Later, we will describe the users' experiences of each domain we created and remark what was relevant in it, and finally, we give some comments concerning the About This Prototype document (ATP) because we consider that this document was handled in a special way in all the domains.

Overview

We were exploring different areas where we could evaluate this prototype. We created four domains in total. Two domains were used in courses given at The Royal Institute of Technology (KTH). We selected the educational field because it was possible to get more potential participants using the DHS and also because I was taking these courses as part of my education program. In this way we had the possibility to be closer to the domains and members of the group could ask me directly in case there was any question or problem. Students could use E-mail and we explained to them how to use it personally during the class. In one the courses, the Writing Scientific Papers domain, the use of the DHS was not mandatory, whereas in the other one, the CSCW domains, it was mandatory.

Two domains were created where users could comment on a particular topic. One, the IPLab domain, for the discussion of the on-going projects description in a research department among its members. The other one, the Survey Results domain was created to discuss the result of a survey that was carried out specially to use the DHS.

For these domains the concept of help system is no longer relevant because the main idea was to collect comments from users and present these comments to the rest of the users.

There were some common characteristics for all these domains:

- Participants shared a common interest on doing something or were working together.
- The only way to include a document into the domain was through the DHS editor. Usually group members sent via Email the document they wanted to include in the domain and the DHS editor made an HTML version of the document.
- Participants knew each other and there was a common physical location where they could meet face-to-face (once a week, once a fortnight, daily, etc.).
- Groups for all the domains were not specially created to use the prototype. Groups were formed for other reasons, i.e. they were members of a class course, or they were in the same project, or they were working in the same department.
- Group members had access to different ways of communicating with each other, for example, using E-mail, phone, face-to-face, etc.

General Aspects of Communication in the Domains

Here we describe some general aspects of all the domains we created such as the way user identify themselves while using the system, which comments we considered relevant in order to include them in the analysis, the privacy policy we took in account for the domains, and who were the users that we labelled as participant.

How users identified themselves in the domains.

When sending a message, users could write their names or any nickname they wanted. That is, the submission of a comment could be anonymous or attributed to the user. To let users send comments anonymously could be somehow dangerous because anything could be written but we did not experience any embarrassing serious situations. Though users tried to identify themselves with homogeneous names or nicknames, there was often a discrepancy, for example, *Luis Mayor*, *Luis*, *mayor*; *Hasse R*, *hrom*; *Kai-Erik*, *kai*. If the user did not write any name at all, intentionally or not, and sent a comment, it was still accepted by the system. We had nine comments with anonymous identification in the four domain we describe here, e.g. “anonym”, “ghfg”, or no identification at all.

What we considered as relevant comments in the domains.

In the four domains we found 29 comments that we considered as not relevant comments: “54t6yrethr”, or, “this is a test”. These comments were not taken into account in the analysis. We consider “relevant comments” those that made sense and transmitted an opinion or new information: a question, a suggestion, or a reply to a previous comment.

Restrictions to enter in the domains.

To enter a domain users just needed to have the domain’s URL (web address). This URL, most of the cases, was sent via E-mail to the group and in some cases it was given personally. In three of the domains we did not implement any security system to ensure

that those who visited the domain were members of the group working with the domain. Only once, (in the CSCW domain) a person, who identified himself but still was unknown for us, made a comment that could be considered as impolite but in any case was relating to the document it belongs. We do not know how this person got to know the URL to the domain but it was probably through one of the group members. In the Writing Scientific Papers domains, members asked explicitly for a security protocol so we provided a login-password policy to use this domain. To ensure the anonymous function we did not track users activities using any logging file.

Whom we considered as participants in the domains

For the analysis of the domains, we consider as participants only those who entered at least one relevant comment. There were some members of the groups that entered no comments.

The IPLab Domain

The third version was finished, so we decided to introduce it to some users. Then, IPLab members were asked to make a draft project description of their research activity. These reports in a finished form were supposed to be published on IPLab's web site later, and each member would know easily about other members' projects. Knowing about others' project IPLab's members could, probably, make comments on them during the drafting stage.

We decided to create a domain for IPLab's topics. The idea was simple. The index frame presented a list of the topics of the research that was going on at IPLab. IPLab's members could read about other colleagues' work and make comments on it. Here we made an important change: from the entity rule to the entity document describing a topic. This change was very important because it meant that the system started to work as a CSCW tool, more specifically for collaborative writing. Area on which our further research has been focused on.

A total of 15 projects were presented, which means 15 topics in this domain. All members of this domain had a HCI background. Members were asked several times by the head of the department, via E-mail, to use the prototype but no benefit or reward for using the prototype was established. Despite this request, very few contributions in the form of comments were made in the domain. Participants readily made instead comments on the interface of the prototype forgetting, maybe, the original task that was to make comments on the content or design of the documents that were presented on the domain. The ATP document got the major amount of comments. No active discussions about the topics were registered except for the one in the ATP document. Using this domain we realised that this tool was more appropriate for supporting asynchronous discussions than the first idea we had of the project: a help system.

We had interviews with the users to study the DHS's interface and the potential uses that could be given to this tool. The result of this study was a list of improvements in relation with the usability that have to be considered in the design of a new version.

From this case study we got the following result:

- Participants in most of the cases identified themselves non-homogeneously, e.g. sometimes starting with capital letter, one misspelling error, abbreviations, etc.
- Participants were not interested in other colleague's work unless it concerned them directly. Members of the department did not show much interest in others' work. Furthermore, after the interviews, we noticed that many of them were not aware of what was going on in other parts of the department
- A bad publicity strategy was used to invite potential users to use the prototype. We used E-mail to give IPLab's members the domain's URL so they could use the system and to inform them about the task they were supposed to do. It seems that it was difficult for them to locate again the E-mail where the URL was given; they usually get several E-mails per day. It might be that asking via E-mail for something is easier to forget, or to avoid, or the commitment is not as strong as in face-to-face communication.
- People like to talk about collaboration and are in favour of it but when they have to demonstrate so, they do not co-operate. IPLab's members welcome the idea of using DHS to receive feedback from other colleagues about their work, however, the result do not corroborate this.

The CSCW Domain

This domain was created for the CSCW course given at KTH for 26 computer science and graduate students. DHS was introduced to them as a prototype system designed to support reviewing and commenting on web documents. The assignment they got was to write a text where they would tell about a collaboration experience with or without computer. They could submit their homework assignments in groups of two. Twenty-one documents were submitted to the DHS editor and they were included in the domain. The index for this domain was a list of the students' names. If one wanted to check somebody else's work, one had to click on the link that was labelled with the student's name. Students were asked to read all the documents in the domain. It was required for partial fulfilment of this course that everyone must enter at least 2 constructive comments on others' work. The students got the CSCW domain's URL and they started to do the lab in a period of two weeks. When the lab was finished, they were asked to answer a questionnaire that evaluated the DHS and its functionality. In one of the sessions of the course the results were discussed with the students.

Most of the students that took part in the course had a HCI background or software development experience. In this domain the ATP document got 29 comments. This was almost twice as many comments as the next most commented document (14 comments). The 26 students who took part in the course submitted 90 comments excluding the ones made to the ATP document. It is important to notice that 65% (17) of the students just made the minimum required number of comments to fulfil one of the requirements of the course (2-3 comments). Probably, they just wanted to fulfil the course's requirement so they could obtain credits for the lab. All the documents in this domain got at least one comment. One of the participants said that he browsed all the documents and decided to make a comment on the document that had fewer comments. It seems that commenting in an electronic format still is not very common, and they did not get used to the idea of making a comment on a document using the Web; usually it is done on paper (Kim C-H.

& Severinson Eklundh K. 1998). Few discussions, not very interactive ones, turned out. Again, the most active one was for the ATP document.

Analysing how many times the participants took part in the same discussion we found that a great number, 90%, of the participants, took part in the discussion only once. The author of the document was always the one who took part in the discussion more than once replying to others' questions about his/her document. However, there were also cases when the author did not make any comment on his/her document despite the fact that a question was directed at him/her.

One important aspect was that during the discussion, participants most of the time made an explicit and direct reference to the content of the document in discussion. For example, "*what you wrote*", "*the situation you describe*", "*the people in the examples*", "*I found your text to be interesting*". That means that the conversation was around the document presented in the description-frame, namely, the document was the centre of the ongoing discussion. In other web-based forum tools, like newsgroups for example, the original text that started the discussion is not easily reached by users and the discussion usually gets far away from the original topic suggested in the first text. Losing the initial focus gets more distinguished when time passes. In DHS, we found that the centre of the discussion, in this case, the one proposed by the document, was always recalled in the comments. The "orbit" of the comments was always covering the topic mentioned in the document. Even if the new comment was made a long time after the very first comment was made, the new comment was, somehow, touching the document that originated the discussion. This is, most likely, because users can always reach and read the original text while using DHS and the discussions is not threaded. Also in our system, the document has a more important role than the start message of a news group discussion.

Special problems The problem of awareness is reflected in the time that took to the author of the document to react to a comment made by someone. DHS does not support efficiently awareness because the system does not alert users when a new element, a document or comment, is included in the domain. The only awareness the system offers is implicit: it shows users the last comment in the comment list for the document the users are browsing so that users could recognise if they have read the comment or not before. Another problem is that users have to remember which was the document they were browsing the last time they used the system or which documents they have browsed before. The system cannot recognise who is the user. In general it took 2-3 days as a norm, 10 days in other cases, for the author to reply to a direct question made to him/her. In the worst case, the author never replied.

From the questionnaire were derived the following suggested improvements of the prototype:

- Threading of comments. Often, before than the reply to a previous comment is made other comments have already been submitted. Between the comment and its reply there are other comments that makes it difficult to follow the structure of the discussion. The chronological order in which the comments appear makes it possible that a reply could appear far away from its related comment. It forced also users to write a reference in the text of its comments to make clear to which comments he/she is intending to reply. Threading will facilitate to follow the discussion in its logical order. However, it is

possible that it may distract from the original document and cause the discussion to diverge.

- A subject item for each comment to immediately see if it is worth reading at all and enable threading, search, sort, and filtering facilities for comments, submission of private comments.
- Continuous awareness of which is the document you are reading. After clicking to one topic the document describing it will appear in the document-frame. This document starts with its title, but if you scroll the document there is no way to know which document you are reading unless you scroll again to the beginning of the document. This could be annoying for the users.
- May be annoying to enter your name every time when you are making a comment. To avoid this, the system could offer an authentication protocol that will provide also the basis for a better awareness system as it could recognise the users and trace the changes that happened in the domain after his/her last visit to the domain. This will also let the system give editing rights to users under their comments, e.g. modify, or delete a comment and to have a “What is new” facility. Also, awareness of whether a document has got new messages after the last time a user visited the domain can be created.
- The DHS editor puts documents that were part of a domain “inside” it because he was the only one who had file access rights to do that. It would be better that users could insert their contributions to the domain topic by themselves instead of doing this through the “DHS editor”.
- Possibility to save a draft of a comment so it could be submitted later.
- A more advanced graphical interface, e.g. buttons icons, etc. DHS’s graphical interface is very simple and only uses the default values that HTML offers. A better graphical interface could increase the use of DHS.
- A possibility for users to set up the default size of the frames.
- A parallel site where you could contact or get to know more about the participants in the domain. The size of the group and its characteristic should be also defined.
- A “My comments” link that will show to the user all the comments that he/she has made on each document in the domain

The Writing Scientific Papers (WSP) Domain

This domain was created for a course that aims to teach academic English writing style to graduate students (non-native English speakers). This course is given simultaneously to three groups and only one of them was using DHS. The students, 15 in total, did not have any HCI background but the domain’s editor who was also taking the course. The students had to write homework and review somebody else’s homework each week (during 8 weeks in total). Homework assignments were sent via E-mail and included in the domain by the DHS editor. The index for this domain consisted of a list with the students’ names, so if one wanted to check somebody’s else work one had to click on the link that was labelled with the student’s name. In this case the document was going to be like a pile of homework assignment. The last homework was always placed at the beginning of the document so when a student clicked on one of the links, supposed Luis’ homework, the last submitted of Luis’ homework was presented at first. The students were supposed to

make comments on the writing style of the submitted homework. Also, spelling or grammar errors could be reported but that was not the aim of the exercise.

To support the reviewing process in electronic format a guide “Some tips so you can make comments in electronic format to a given text” was included in the domain as a link in the index-frame. We were looking for a homogeneous format for the reviewing, that is, representing a grammatical error and its correction in the same way for example, so students could recognise them easily. If we would have not provided a start point to make correction, then each student could have developed his/her own way. The students started to use this guide at once, maybe because they did not have any previous experience doing this (commenting on electronic format) and because they had it inside the domain, so they could make reference to it whenever they needed it. The teacher also took part in the corrections and used the same guide to make corrections. All students got feedback and for each homework assignments they got a review made by the teacher or by another student. It is also relevant to mention that when one of the students started to use special HTML tags, e.g. font, colour, size, style, others also started to use them. One of them asked, via E-mail, to the DHS editor what to do so he could use these facilities.

There were 130 E-mails received by the DHS editor during the course. Usually, the students identified the E-mail in the subject field of the E-mail writing, for example, “My assignment- Introduction”. This was in the best of the cases, sometimes they just wrote: “My homework”. This was extra work for the DHS editor because he had to identify which homework was included in the E-mail. One student complained saying: “*that is not what I sent*”. This conflict was solved when the student realised that the wrong file had been sent in the E-mail the student sent to the DHS editor.

The teacher of the course and some students (7) were interviewed to evaluate the use of the tool from an educational point of view. All of them agreed that the system was easy to use. The most important feature for the teacher was that she could see the text very quickly and the comments other people made at the same time but she considered that writing the comment itself was difficult because of the medium. She thought that the students were forced to see other people’s comments and this is an advantage for this kind of course. DHS helped the teacher to see the whole picture of what a student has done. The students reported that they did not think DHS helped them to learn more about the content of the course, but sharing in such an effortless way everybody’s assignment made the work easy. The teacher noticed that the students’ comments were more oriented in trying to catch misspelling error and grammatical errors instead of remarks concerning the application of the writing style or guidelines given in the class. This problem, according to the teacher, was not so remarkable in the group that was not using DHS. Probably one reason was that once the text was in electronic format, e.g. computer processable, they just could use a grammar or spelling checker program to detect errors, then they just make that comments and part of their assignment (to make a comment on someone else’s homework) was already done.

Special problems In this domain following the comments was very difficult because there was no way to reference the comment with one specific part of the document that contained several homework assignments. Some students tried to solve this problem by adding the name of the homework in the comment. For the students it was difficult to make corrections or suggestions on an electronic format, possibly for two reasons the first one; they were not used to this task and did not have solid knowledge about academic

writing except for what they learned during the class. The second one; it was the first time they used the Internet in a course. They were used to browse in order to find information and to use E-mail. Most of them had no knowledge about the HTML format. Only two of them had a homepage but they knew HTML at only a very basic level.

This case study let us understand that:

- The DHS is good tool for sharing documents. Students reported that was very easy to access others' homework assignments.
- A comment could refer to any paragraph of the document and it should be linked somehow to that paragraph.
- It is not easy to make a review on documents in electronic format. We are used to doing it on paper.
- The web was not used in the educational field very often in KTH at least for the other program but computer science. Students know about it but for them is just a place where information can be found. E-mail was the most well known and used feature of Internet for these students.

The Survey Results (SR) Domain

A survey was done through the web about a controversial topic in the area of cognitive science. The participants target were members of two mailing lists that belonged to two research departments in which cognitive science was an important subject. Participants were sent an E-mail with the URL where they could vote to which extend they were in agreement with the six statements. The members from two mailing lists of two research departments in which the topic to be evaluated is related. Twenty-five of the 61 subjects sent their replies. Three E-mails were sent asking them to participate in the survey. A domain with the results of the survey was created and an E-mail was sent inviting them to see the results of the survey. Each statement was a link in the index-frame to the document that gave the results in number and graphic representation. The results showed that participants of the survey had different opinions in almost all the cases; in most of the cases people were in disagreement, for example 40% for, 60% against, a suitable situation to debate. However, no discussion took place. This probably was due to the lack of practice of the subject to discuss a topic in an asynchronous way on the web.

Unfortunately, we are unable to determine from this data which was the real reason why no discussions were carried out. We made some comments on purpose to provoke some discussion but it was unsuccessful. No study with the members of this group was done.

The “About this prototype” Document

The “About this prototype” (ATP) document described how the prototype worked and some troubleshooting. This document was loaded by default when a user entered DHS. Users could make comments to the interface under it. Users and the system handled this document in a different way compared to other documents. It was often the document that

got more comments than any other document in the domain. We have decided to present a separate analysis of the communication related to this document for three reasons:

1. To understand better how the domain topic was discussed using DHS excluding comments related to the interface of the system.
2. to understand better how the collaboration proceeded
3. To see users' participation in the design process.

In these cases, participants were more interested in making comments on the interface of the prototype than to discuss the domain's topic. A possible reason for this is that in these domains participants had a HCI background and they focused their comments on what they were most interested in. Also, it seemed simpler for these participants to give their opinions on the system than on a document. Inversely, we will see further that in those domains where participants had no HCI background, the ATP document received no comment.

In the comments made on this document we found that DHS could support collaborative design to some extent. All the comments that this document got were related to the interface of the DHS. The design group made 33 of the 51 comments on the ATP document. In other words, 34% of the comments were made by people (10) who were not related to the development of the project. They helped the design group during the design process of DHS through their comments. The discussions we had were asynchronous. Participants could discuss and interchange their opinions whenever they have time by sending a comment that makes reference to an earlier comment. Something we noticed also was that during the design process we were making enhancement and correction to the tool, that is, DHS was also working as a corrective tool. The comments given by the participants were contributing to refine the interface of DHS. It is very likely that in the same way it could be used for the design of documents or to evaluate its content as well.

Also, we observed that we needed to improve navigation through the comments. It was difficult to follow the comments especially when a comment was related to an earlier one and other comments had been made between them. This was possible only if the user added the number of the comment he/she wanted to remark on. Yet, it was a problem to locate a comment by its reference number: scrolling all the way or using the navigation hypertext links, step-by-step, until the reference number was reached. Furthermore, a private facility was required. Participants felt that they might need to make a private comment and the system did not support it.

The ATP document got 51 relevant comments and 13 participants took part in its discussion in all the domains we created.

The following table shows all the case studies on which we tested DHS.

Domain	Number of Documents/Documents without comments	Number of Participants	Number of Comments
IPLab	17 /3	9	35
CSCW	21/0	26	119
WSP	17/0	15	76
SRe	6/3	1	4

Table 1 All the case studies in which DHS was used.

Conclusions

The DHS cannot be considered as a help system according to the definition Dix, et al. (1993, pp. 401) gave. It can not be categorised in any of the four main types of assistance that users require: 1) quick reference, 2) task-specific help, 3) full explanation, and 4) tutorial. The project changed direction and took us to the development of a web-based tool that can be used in several fields. We changed direction maybe because we were working, then, in a new environment: the web, CGI, JavaScript, HTML. Also, we were interested in CSCW and writing. We have intentionally kept our tool, somehow, very general and all-purpose and wanted to explore different ways to use it and measure its potential. Several possible environments where this product could be used were mentioned or tested: education field, forum, transfer of knowledge, commenting tool.

- Educational field. DHS could be used to share the information teachers need to give to their students, for example, assignments for the next class. It also could be used to evaluate students' activity and communicate among members of a course. The teacher will be able to have general overview of what a student has done. The Students could learn from their own work and from others' work.
- Forum. Using DHS documents regarding different topics can be presented and discussed. Participants can then give their opinions and also reply to others' comments on the same topic. DHS, as it keeps the document that originated the discussion always visible, could keep the discussion more centred on the original topic written in the document.
- Transfer of knowledge. Solutions to problems of a certain domain knowledge could be put inside a DHS domain and in this way be reachable for others. In the process of transferring knowledge it is very important also to encourage novices so they can learn more efficiently and faster (Allan Janik, 1994). This could be done through DHS because the expert can evaluate, if necessary privately or in public, what a novice has done.

The DHS version that is running on the web was evaluated and has been used since May 1997. Our experiences using this tool led us to define the use of this tool within the framework of CSCW. DHS needs further work to be useful as general a CSCW tool.

A list of improvements has been collected from the different domains created to use DHS. This also has let us reflect on some facts that we disclose here:

- The use of DHS as an asynchronous commenting tool for documents has to be tested in groups where, willingly, members should be close related to this activity. We observed that in domains where members had an HCI background they were more inclined to make comments on the interface of DHS than on the document itself.
- Commenting in electronic format is a new medium and still, we are not used to it. We have to admit that the advantages that commenting on paper gives, its flexibility for instance, are far above what electronic format offers. This situation, confronting a new order to do things that we are used to do previously in another way, is always vulnerable. That is why a great effort should be put to facilitate the use of commenting in electronic format.
- A closed-from-inside domain, where users can just put in documents and comments without the possibility to make any change to them once they are in, might be frustrating. The lack of possibility for authors to correct errors, in some cases that they have found; could create a negative attitude to the system and eventually a rejection of it. It is important to be able to rectify when an error is found; a misspelling error that could be very embarrassing for users. On the other hand, this could create difficult situations because the system permits users to make comments on an earlier comment. If the earlier comment is changed, the content of the comment that makes reference to it could be not valid anymore and this will create inconsistency in the information given by the system. We think that this situation, where members of a group are known to each other, is not likely to happen. DHS is a transparent repository of data, that is, all the documents and comments that have been put in the domain can be retrieved by any person who has access to the web and, of course, gets to know the domain's URL. All members will be able to read all the comments that have been made without any restriction so we can say that the information "inside" the domain has a public character. To deny what has been said in public has its social implications that are known for all of us.
- Awareness in collaborative tools where asynchronous activities are performed is very important. Authors of the documents need to be informed if somebody has made a comment to his/her work. A late reply could have the same effects as not replying at all in some contexts. Similar relevance has the feature to warn users about the last changes made within the domain after their last visit to it
- Users attempt to identify themselves in a homogenous way when using the commenting feature. However, as the process of typing could fail, intentionally or not, there is no consistency of this data in electronic format. To get this consistency, if necessary, we should supply an automatically authoring feature.
- It is very difficult to make users collaborate, even when they claim they are really interested in doing so. A motivation for the collaboration should be clearly defined, if not, the process will be very slow and we will need to push them all the time to do their work. We observed that the cases where the users were willing to participate were those domains where a clear award was defined.
- It is very important to notify members of a domain when a new comment is added. They just could never come back again to visit the domain after going several times and not finding any change.

- In a group where members are introduced to each other personally, anonymous messages are not likely to appear. It seems that people, as they know each other, want to be identified when they made a comment. This probably has a cultural background that is not discussed in this paper but for communities where dictatorial political regimen has been a common experience, for example, this behaviour could be different.
- A public domain where non-members could also enter and use the system could bring some unwilling comments from users extraneous to the domain. On the other hand, these users also could bring out an unseen situation to the members of the domain because they could see the domain from a different viewpoint than the one that members of that domain use to see the domain.
- It appears that some users do not realise that DHS is a system that is embedded in another system: a web browser. There are problems that we cannot overcome because no standard profile or preferences have been set up among web browsers, and we think it will still take a long time to achieve a standard profile among web browsers. Problems originated by the cache memory setting of users' browser is something we cannot overcome, and the most we can do is to notify users about the problem in advance. The problem of the size of the windows and the size of the input fields were also charged to DHS, but these parameters are fixed by the platform where the browser is running and the resolution of the screen which could differ from machine to machine. On some platforms when resizing the comment window and some text was already written, this text disappeared. This again has nothing to do with DHS but users experienced it as a bad functionality of the system. Maybe we were not explicit enough about these details.
- It is also noteworthy that people with HCI background appear to overestimate their knowledge in the area related to interaction with new software and they do not read instructions, no matter if they have them in front of them. This was the case with the ATP document. When users entered the domain this document was the very first to be loaded. Furthermore, it was possible to read the sentence "very important" in a big, bold font. Under this heading the solution to the common setting problems to properly run DHS was described, but in spite of this, the problem was always present. This did not happen to the members of the two domains where HCI background was not common.

Further Research

Despite the closed-from-inside characteristic of DHS, we still could imagine that it could be seen as a system to make annotations to a written text by reviewers so that author(s) could later make changes to the document. We have to let users edit the submitted document or comments. DHS uses a split-screen interface to present a document and all the comments made to it. Wojahn, Neuwirth and Bullock (1998) found that using a split-screen interface users communicate significantly less problems (spelling, grammar, or writing style errors) than using other alternatives like interlinear and aligned comments when they were commenting on the text in the document. In the system studied by Wojahn et al. the flow of comments was going only in one direction, namely, from the reviewer to the writers. We can characterise these systems as only "transmission" systems; like the radio where receptors cannot use the same channel to send feedback. The alternative that DHS offers is a channel where a dialog can be supported. That is why we

think that in some way the result obtained by Wojahn et al. could be blurred with advantages that DHS offers and because the nature of the writing process that is very interactive. Co-authors need to dialogue during the writing task and the comments that can be done through the DHS could facilitate the creation of this dialogue.

DHS has paved the way to create a more specific tool where collaborative writing is the main focus. The facility of commenting on a document helped us to start this challenge. Also, the layout of the DHS has created the opportunity to envision a series of tools that can be used in CSCW. We want now use the concept of “Four-Frames” and the meaning that each frame could have for the user and then try to use this meaning for different applications integrating all of them in a bigger application.

This bigger application, tentatively, has the name of 4-Frames because the idea, as we mentioned before, is to explore how users will make use of the frames into which the browser window is divided. We have thought of developing the following applications or environment

- An e-mail program supporting chunks of conversations and giving information about the person you write/receive mail. in one overview. The idea here is to have a list of contacts in form of hypertext links. An item in the list could refer to a person, a project, or an institution. When an item from the list is selected the contact information will be displayed in the one of the frames, for example, mail address, a picture or logotype, telephone number, etc. In the comment-frame we will have the ongoing conversation with the person which will be presented as a whole in which users can navigate and have at a glance a chunk of the conversation.
- A non-real time conferencing system that will try to keep members around the topic presenting the original topic all the time
- A tool to support writing style courses (academic writing probably) in the education field (this tool has been developed), or support teachers in the evaluation of students and a reference site for the students during a course to find related information and share their homework assignment with other students.
- A collaborative tool for gathering a set of sites on the WWW of interest for a group and applying a basic concept of social navigation (developed to a very initial stage). The idea is to have a sort of collective bookmark on the web.
- A collaborative writing tool (this tool has been developed and tested). This tool is oriented to support the communication among co-authors in asynchronous-distributed mode.

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References

- Dix A., Finlay J., Abowd G., Beale R. (1993), Human Computer Interaction, Prentice Hall
- Groth K. (1999), Knowledge Net- A support for Sharing Knowledge within an Organisation, Licentiate thesis, Royal Institute of Technology, Department of Numerical Analysis and Computing Science.
- Janik A., (1994). The concept of knowledge in Practical Philosophy (pp 29)
- Kim Hee-Cheol & Severinson Eklundh Kerstin (1998), How academics Co-ordinate their documentation work and communicate reviewing in collaborative writing, Interaction and presentation laboratory (IPLab), TRITA-NA-P9815. IPLab-151
- Wojahn, P. G, Neuwirth, C.M., Bullock, B. (1998). Effects of interfaces for Annotation on Communication in a Collaborative Task. In Human factors in computer systems: CHI'98 conference proceedings (pp 456-463)