Chapter 4 --- The Tools of the Research Web

The tools discussed in this section are all software that the team may use in its daily work of the RW. The tools were appropriated from commercial or academic sources, where available and suitable; but the core tools were built by the author specifically for the Research Web. Frequently inadequate tools must be used out of necessity, due to limited resources, temporal and financial. No tool is perfect and no RW is static in its needs, so tools must be revised or new tools acquired in order to support the team.

Tools must meet several standards in order to be useful:

1) The tools should be familiar to operate, or transparent[1]. Difficult tools will be avoided by the team members, and will severely degrade the effectivity of the RW.

2) The tools should support a known or appropriated communication genre.

3) The tools should be priced reasonably.

4) The tools should be maintainable by the facilitator.

4.1 E-Mail

Email is the universal communications tool. It is a genre that is adopted from the familiar office memorandum[2]. The genre is very highly augmented in the Internet environment, including numerous very useful features such as hypertext links to web pages, personal message archiving systems and the ability to transmit files attached to the message. E-mail programs are abundant, reliable and employer or ISP provided, or free. The team members may use the program of their choice. In the RW e-mail is used for three primary purposes: private communication, team communication, and notification.

Private communication is frequently necessary to protect the social functioning of the team. Care should be taken to prevent the hiding of information that is of potential value to the team. If matters discussed may be of importance to the team avoid mixing in private material. Above all, avoid the corrosive tendency to store topical information for personal or subgroup advantage. If a private message is to be made public, all parties to the message should be consulted.

Team communication takes the form of management announcements, topical queries from individuals, responses to queries, perhaps requests for opinions on a hypothesis or proposal, and many others. The originator of messages addressed to the entire team should copy the message to the team's e-mail address. If the sender operates from the MailRoom, this is automatic. Notification e-mail is sent to team members when a new page is added, an existing page is modified, or when a comment is made in a DocReview, HyperBibliography card, or a HyperGlossary page (see What's New §4.7). Notification lists are customized to notify only those who wish to accept notification.

4.1.1 Searchable E-mail Archives

E-mail messages are a primary source of information for the team. Tacit knowledge often first becomes expressed to the team through e-mail. In order to utilize the data, information and knowledge content from this source, all messages must be indexed for full-text searching. The ability to examine the entire e-mail archive for messages on a single topic is a powerful tool. The search engine must display the message headers for all messages meeting the search query's specifications. These headers will contain links to the full text, which should highlight the keywords in the text.

In order to be archived, all team communication (except for notification messages) is copied to a team e-mail address. Any team member may also archive a private message

simply by copying the message to the team e-mail address. A computer program may be activated automatically to reindex the archives on any schedule the team requires. Once a day indexing is a minimal requirement.

4.1.2 MailRoom

MailRoom is a program that allows the user to send mail from a web page. *MailRoom* gives the team members a single point from which they may send public e-mail to any team members, all members or members of authoring groups. The facilitator can set up group lists on request. All communication through the *MailRoom* is copied to the team's e-mail archive address for permanent recording. The advantage for users of *MailRoom* is that they know they are archiving their communication. They are also spared the necessity of maintaining addresses for all members, the many authoring subgroups, and the team's listserver.

MailRoom does not offer services such as attachment of files, blind cc, return receipt, etc that e-mail programs offer. If any of these services are deemed necessary the sender can always revert to private e-mail with a copy sent to the team's listserver.

4.1.3 Listserver

The RW has a team listserver that serves all members and the team's e-mail archive address. The listserver duplicates the MailRoom's send-to-all services, though there is no conflict between the two. The management of the site may find some reason for making the listserver open to a different set of people than the set of members listed in MailRoom. The listserver should have archiving and search capability, if not then MailRoom should be used exclusively.

Suitable listserver software with archiving and full text searching is expensive. Research teams can take advantage of institutional cooperation by utilizing the site license of one of the cooperating institutions. There is no reason for the RW to be sited at a single institution. The facilitator should have access to the listserver in order to correct or delete messages and to edit the address list of members.

4.2 The World Wide Web

The World-Wide Web (WWW) is both part of and the foundation of the infrastructure of the Research Web as currently designed. This WWW is a peculiar foundation, however; as a revolutionary and recent innovation it is very much a work in progress (Berners-Lee 1999). As time passes and more people use the WWW, the need for change exerts itself inexorably. As changes are incorporated, they open new ways for humans to interact with each other and with the machines that may be utilized from the WWW. The hardware environment also changes as entrepreneurs and research labs invent new machines that allow us to realize the powers of the web. At the time of writing, the most common environment for web users is the personal computer workstation plugged into the Internet with the wires and cables offering services of varying capacity. This environment will change, just as the WWW itself. Wireless access to the WWW will allow portable machines to display web pages anywhere in a variety of devices. One of the most promising devices is the wireless electronic book[3] that will eventually offer portability, access, freehand input of annotation, and all the power of the current PCs.

The software environment is changing even more rapidly than the hardware environment. Currently, there are a plethora of file types that can be read with web browsers, but most files are coded in HTML (HyperText Markup Language). HTML is a markup language that controls how the browser displays content. Access to databases cannot be done with HTML, but must be done with a very complex set of software installed on the server. The introduction of XML (eXtensible Markup Language) allows several services to be

added to the web page including access to databases and display of very exotic notations, such as complex mathematical notation[4]. Unlike HTML, XML programming will require real computer programming ability. This fact and the growing importance of other computer languages, like Java and JavaScript underscore the need for a technically qualified facilitator to manage the RW web site.

4.2.1 Browsers

There are two major browsers in use at the time of writing, Netscape Communicator and Microsoft Internet Explorer. All web pages must be tested for proper operation on both of these browsers. There are many other browsers available and team members may use the browser of their own choosing, but it should be made clear that other browsers may not work properly. The facilitator should design materials to operate in browsers at least two years old (Nielsen 2000), since some team members might not upgrade their browsers on a regular basis. Older browsers are generally quite capable of meeting the needs of the RW; most of the "improvements" offered by more recent versions are market-driven features of marginal value. Practice conservative design; just because some feature may be used does not mean it should be used!

4.2.2 CGI Programs

Interactive behavior of web pages, such as annotation facilities, requires the use of fill-out forms. Each form must be backed up with a computer program called a CGI script (Common Gateway Interface). These scripts are computer programs written in any one of many computer languages. The team members, except for the facilitator, are not exposed to these programs in any way. The CGI programs can perform many functions far beyond the capability of normal web pages. E-mail may be sent, databases may be accessed for data manipulation and computer programs of any complexity may be run on the server computer with a report of results returned to the client's browser.

4.2.3 Helpers, Plug-ins, and Other Programming

Special multimedia presentations such as audio, video, motion pictures, postscript displays, pdf displays, slide shows and others require that the browser be augmented with special programs. These programs are called plug-ins or helpers. Many documents, for instance, are displayed in a special format called PDF, display of these documents require that the Adobe Acrobat Reader be installed in the browser. While installation of such programs is very simple for those who have modest computer skills, some people simply do not have the time and inclination to install plug-ins. For this reason, the web site needs to use only the most essential plug-ins. Detailed instructions and help with installation must be offered to all team members when plug-ins are required.

4.2.4 Calendar

When there is a synchronous component to the operation of the Research Web, meetings can be set up with the use of a web-based calendaring system. Meetings are much more effective with an agenda, and the calendaring system allows negotiation of agenda items. A calendar may also provide a hypertext link to minutes of meetings just past. There are many free or inexpensive calendaring systems available the facilitator can set one up for the team in a couple of hours. Typically the calendar allows anyone to enter events on the system, but on an active site, the facilitator may want to manage the entry of information.

4.2.5 Discussion Groups

One of the Internet's most well-known and used pieces of software is the threaded discussion group[5, 6]. Discussion groups are likely to be a useful tool in any RW as they offer an informal free-form discussion; however, the success of discussion groups should not be assumed! There appears to be a critical mass effect in discussion groups. Palme

suggests that the lower limit for success is 20 to 50 active participants[7]. There is an upper limit as well, established by excessive message traffic; but this is far beyond the likely membership of a research team. Developing a successful topic may require leadership in the form of gentle admonitions and occasional reminders often in the form of questions and summaries. Discussion forums allow very general discussions to mutate into a branching structure that is confusing to novices. Extensive discussions frequently lead to topic spread, and even topic loss—these shortcomings were the impetus to develop DocReview (see §4.3). DocReview is a very highly directed critical annotation tool that does not encourage discussion of comments.

4.2.6 Development Tools

Composition of content for the RW's web site can use two methods: conversion of word processor files, or direct editing in an HTML editor. Content prepared by scholars is almost certainly done with a word processor. The programs that convert word processor files to HTML do not produce HTML compliant with industry specifications. The files created by these conversion programs are bloated files full of unnecessary tags. Not only is the quality poor, but also the code produced is not compliant with practices designed to produce copy that can be read by visually impaired individuals who may be more comfortable with a larger type font. One company actually uses, as a marketing point, the fact that its product (DreamWeaver) weeds out unnecessary tags ("trash") from MicroSoft's Word HTML converter[8]. There are standalone programs that do a better job of conversion than the programs provided in the word processors. Both popular browsers have editors that produce HTML code. Nonetheless, the code from these simple HTML editors frequently needs to be corrected.

The tool used to correct faulty HTML is a plain text editor[9]. The advantage of a plain text editor is that it does not produce unwanted characters, as all word processors do. The code produced is ASCII characters. Should the facilitator be writing programming

in Java, JavaScript, or CGI programs in Perl, such a plain text editor is essential as none of these languages tolerate the gratuitous characters inserted by word processors.

Programs that can produce and edit digital images are necessary for all but the simplest site. The facilitator needs a good assortment of graphic tools in order to create diagrams for the team, to convert from one format to another, to create "thumbnails", and to edit images. A tool to create image maps (hot spots) for diagrams and pictures is necessary. There are many tools in all these categories, for all budgets.

4.3 DocReview

The World-Wide Web (WWW) provides an interactive mode of operation, CGI scripts, that allow asynchronous distributed collaboration by means of critical review of documents. DocReview is web-based software that facilitates the review of documents by user annotation. The commentary is permanent and immediately available to the collaborative team. In the Research Web almost all documents are annotatable using either DocReview or an e-mail link.

Critical annotation of documents is a practice fundamental to scholarly activity. A product that uses a frame of reference familiar to the user's culture is more likely to be well received[10]. DocReview is designed to provide collaborators with a tool whose success is based on ease of use and familiarity[11]. A document presented for review with DocReview becomes a *boundary object*[12], a place in cognitive space where members of interdisciplinary teams can come together to share their knowledge about the document's content, and their opinions on its presentation as well. Critical review is an activity that attracts both learners and professors, thus DocReview also becomes a recruiting device for the collaboration, a *conscription device*[13].

An annotation program must satisfy several general design requirements to be successful. First the program has to be accessible and interactive. Both of these requirements are met by designing the tool to operate on the WWW. Second, the tool has to be easy to learn and use. The widely known behavior of the WWW largely satisfies this requirement. Ease of use, which includes learning the behavior of the tool, is aided by the tool's simplicity. DocReview uses links sparingly: in the latest version there are only two buttons used to go to additional services or more information, and two linking tags which are repeatedly used for reading and writing annotation on pre-selected segments of the document. Simple: click "W" to write, "R" to read. Finally, the behavior has to satisfy most annotation functions in a manner that closely follows customary "hard-copy" annotation.

How do people annotate hard copy? The first act of annotation is to fix the location of the comment. DocReview provides tags at convenient locations so the reviewer can click on a link that applies to a section of text (a paragraph or cognitive chunk), or to an embedded graphic or table cell. Wordsmithing (minor edits) usually applies to single words or phrases. Comments on grammar or errors in the content generally apply to sentences or paragraphs. Occasionally entire paragraphs or sections may be the subjects of annotation. The sponsor or editor of the DocReview must determine the segmentation to suit the anticipated annotation behavior of the users. Typically each paragraph is made a review segment, but the dense sentences of some scientific works may be made into individual review segments. Abstracts are often rich in such sentences. Often there are comments that apply to the entire document, or simply have no locational focus. DocReview has a dedicated area for making general comments.

Ease of use is critical. Collaborators have only a limited amount of cognitive energy available for the collaboration. That energy should be focused on the content of the collaboration, not on the technical environment and tools. The great advantage of using the WWW is its very simple interface. Any web-based tool should be careful not to add

complexity to the environment. The tool will ideally be completely transparent, that is, *will look and behave just like any other web page*. If a reluctant user finds difficulties by having to learn a complex user interface, then that user is not likely to participate.

The existence of a permanent record of the critical dialog is very important to collaborators who reflect on the commentary again and again on their way to understanding[14]. DocReview permanently records the base document and all commentary. After the review has served its purpose it may easily be archived. All archived DocReviews are instantly available in read-only format. Besides performing the necessary recording function, this permanence encourages quality annotation. Knowing that your words are forever on the record sharpens the mind and cools the emotions.

Notification when annotations are posted is very important. DocReview has a feature which allows participants to request notification when comments are made on any particular DocReview. This feature is not only a service to the requester, but also acts as a stimulus to the collaboration itself since the notification messages tend to generate further participation from the requester. It is possible for a sponsor to sign up the entire research team on a mailing list for notification. The notification messages are designed to discourage off-the-record direct e-mail replies, so the requester must return to the DocReview in order to respond.

Collaboration must be encouraged at every opportunity. The knowledge that your participation or lack of collaboration is a matter of public record is a powerful incentive[15]. When the sponsor of the DocReview sends out an e-mail announcement of the review, everyone on the mailing list receiving the announcement knows who was invited to join the collaboration. Any social process creates its own in-group. If someone consistently fails to participate, they are soon perceived to be outside the group. Non-participants are unlikely to be included in any credits for the work.

Collaborators are psychologically motivated by many factors, not the least of which is vanity. We all want our colleagues to know that we are hard at work on the products of the collaboration. In addition to vanity there are mass and threshold effects. These effects suggest that social activity indicators should be included in any software intended for group use[16]. DocReview displays a message in its 'header' that tells the readers how many comments have been received, who the latest contributor was, and when the annotation was made. The sponsor of the review can often stimulate lagging participation by injecting a comment to "get things moving."

One of the strengths of asynchronous communication is its reflective nature. Recognizing the need for researchers to reflect on what they've read, and that the user's environment does not always include a computer connected to the WWW, DocReview provides a display option provided that inserts annotations into the document just below the appropriate review segment. This display, the "on-the-plane DocReview," can be printed, enabling the traveler to reflect on the document and its annotations while away from the office. Handwritten marginal notes can be keyed into the DocReview when the traveler returns to the Internet. DocReview soon may be enhanced to allow downloading a DocReview into a Palm Pilot, allowing comments to be uploaded to the server when the user returns to an office workstation.

Providing easy navigation to the services offered by the tool encourages use of any tool. All services beyond the basic commentary facility may be accessed in any DocReview by clicking a button marked "Special Features." An active collaboration may have many DocReviews in use at the same time. An index, which operates from a pull-down menu of active DocReviews, encourages navigation to any review at a click. A "What's New" feature provides the user with an itemized list of activity in any or all DocReviews on the site since any given date. Readers can get a complete activity log for the entire site by leaving the date open and selecting "All" from a pull-down menu of active DocReviews. The editor can see from the activity log who is contributing, and who isn't.

Users employing HTML in their commentary, or who cut and paste comments into the DocReview may use a preview feature to review the comment for typographical errors. After receiving the comment, as a polite gesture, DocReview thanks the contributor for each comment and offers to display all the comments made in the review segment just commented on. Notification of annotation to those who wished to be notified of changes is e-mailed by DocReview. The DocReview itself is updated immediately.

4.3.1 Universal Commenting Facility

In large research projects findings are often reported in essays or monographs. Position papers are frequently produced to clarify views on a topic. All these web documents, while finished, are, in a collaborative environment, always contingent and open to revision, correction, and qualification. DocReview has the ability to display the base document without review segment tags, the instruction headers and copyright notice. We can use this ability to give the editor the ability to present documents in plain form, but to offer the ability to comment on this same plain text. Clicking a "Read and Write Comments" link at the head of the page enables commenting. If you click that link the document is displayed on a new window in DocReview format ready for commenting. Each document then has a universal commenting facility.

4.3.2 Applying DocReview to Documents

Thought provoking messages or memoranda can be distributed on the WWW as DocReviews just as easily as through e-mail. The collaboration facilitator or other skilled staff member can manage the extra work of converting the memo to HTML. If cast in DocReview, all readers may comment on a common copy rather than engaging in a blizzard of repetitive and hard to follow e-mail replies (often not addressed to all recipients).

Specifications are documents that move interested parties toward the completion of a common task. Specifying the design and planning the completion of any large product is a rational and prudent action in any group activity. Several types of tasks are sufficiently complex to warrant description and design by specification: large documents, WWW sites, and software. Presentation of information on a large scale requires consideration of goals and means, audience, resources, information content and presentation. These requirements are quite similar in both text and hypertext. Software specifications are central to the successful production of useful programs. Both users and programmers use this common design document. Coming to a common understanding of functions and behavior of the software saves time and money. Having a permanent DocReview record of the dialog provides a necessary case history of this important phase of document or software development.

The writing task and annotation of drafts are key tasks in the final stages of most scholarly collaborations[17]. Drafts and outlines of professional papers may be reviewed with DocReview. Papers are usually far too long to be reviewed electronically as a single document but may easily be fragmented along the paper's logical divisions. The DocReview of a paper or other large work is entered through a DocReview of the Table of Contents of the work. The organization of the document in the large can be annotated in this DocReview, and each heading in the table can be made a link to a DocReview of that section of the work. In other words, there can be hypertextual organization within the DocReview itself. Collaborative grant proposals can be handled just as papers are.

In 1997 DocReview was used in the analysis of user evaluation questionnaires about an information collection and dissemination system. The questionnaire was presented on the WWW as a form with several free-form text inputs. Eight responses were received. These responses were blinded and redisplayed in DocReview to allow an analysis team to deconstruct the responses of each responder to determine what was causing the problems (or successes). These DocReviews were then used to create a document that summarized

the analyses of the responses, question by question, and then recommended corrections to the design and presentation of the system. The recommendation document was itself mounted in DocReview to allow comments to be made on the recommendations. After the end of the review period and negotiations with the commenter, a report was issued detailing the changes to be made. The report was given to the software developers for implementation and letters were sent to the responders thanking them for their participation and detailing the changes made or not made in response to their comments.

While DocReview is an easy program to use, the work of the editor requires a modest knowledge of the server computer's operating system (UNIX) and HTML. Setting up the review segments in the base document requires some learning and practice. Furthermore there are some finer points of DocReview that are rarely used by an infrequent (or busy) editor. These skills are often not required in many of the collaborator's professional environment. We have found it almost imperative to have a technical person (collaboration facilitator) assigned to act as the editor for the entire team. The collaboration facilitator is called on often enough to stay "fresh" and on becoming familiar, by use, with the fine points can produce more effective DocReview installations.

4.3.2.1 Conversion of the Base Document

The document to be reviewed must first be converted to HTML. If the document was written in a WYSIWYG HTML editor such as Netscape Composer, then few if any modifications are necessary. Documents written in plain ASCII text may be converted to HTML manually or by first converting the to word processor files. Documents that are prepared in word processors may be converted to HTML with a converter provider in the word processor. The converted file is likely to contain many unnecessary tags that should be removed for clarity, compactness, and robustness. Dreamweaver makes a product that will clean up Word conversions[18]. The facilitator will act as editor for the mounting of DocReviews, so must be familiar with HTML and converters.

4.3.2.2 Tagging the Base Document

The base document HTML must now be tagged to identify the "review segments." A complete set of tagging instructions is available in the DocReview Editor's Guide. Review segments are sections of the document that may be individually annotated. There are two ways to tag review segments: use of existing HTML tags, or insertion of "special tags." For simple documents, a checkoff list may be used to select any or all of these elements to be designated as review segments: paragraphs, list elements, tables, and table cells. For more complex documents, using the "supplemental" special tag may also be used. The supplemental tag is a user-defined tag, defaulted to <rs> that will designate review segments. The supplemental tag is simply inserted wherever the editor wants to start a review segment. All review segments end at the start of the next review segment.

Other tags that may be used to make the review segments better defined are the "no tag" (<notag>) tag and "segment end" (<endseg> or <segend>) tags. The segment end tags are used to specify the ending of a review segment before the beginning of the next one. This is commonly encountered when the editor wants to leave section headings or quotations outside the review segment. The notag tag is used when the editor is using existing tags for review segments and wishes to declare that a particular review segment tag is to be disregarded. This allows a single review segment to include more than one paragraph or list element.

4.3.3 Managing the DocReviews

The management of the DocReview is done through a set of HTML form pages that may be called up from the "Managing the DocReviews" page. This page allows the editor to select, by button click, which of four operations (Create, Archive, Delete, Remove Comment) is to be performed.

4.3.3.1 Creating the DocReview

Once the base document has been converted and tagged, the creation of the DocReview is managed by filling out a form selected from the "Managing the DocReviews" page. The

creation form contains many options that are explained through hypertext links from the form page.
Fields that must be filled out are:

- *HTML file name (the file name for the marked base document)*

The file must be located on the server where the DocReview programs can open it.

- *Review title (a short name for the review)*

In several places the DocReview program inserts a title for the DocReview. The purpose of the title is to differentiate between DocReviews in the index of DocReviews, not to describe the document under review. The length of the DocReview title is limited to sixty characters.

- *Review Nickname (the name of the directory for DocReview files)*

All the files for each document installation are kept in a single subdirectory. This directory needs to have a directory name for the URL that accesses the DocReview installation. The directory name has to be a unique legal directory name. In the case of UNIX machines this means some combination of upper and lower case letters, digits, and the underscore character. The program checks for this, so if your operating system accepts other characters, don't use them.
The DocReview "nickname" must be relative to the DocReview directory. Suppose you would like to create the nickname directory on the same level as the DocReview directory; in that case you should enter ".../Nickname" in the form. If the nickname directory is to be within the DocReview directory, then "Nickname" should be entered in the form.

- *Sponsor's Name (usually the author of the document)*

When the user submits a comment, the program sends an acknowledgment message. The sponsor's name is appended to the acknowledgment as a signature. If you wish to append

a facsimile of your signature automatically to all acknowledgments, all you need to do is to create a scanned image of your signature and store it as "sig.gif" in the directory immediately above the DocReview directory.

If the editor accepts the standard default selections for the remaining fields, the DocReview may now be created by clicking the "CREATE DocReview INSTALLATION" button. But if the defaults need to be overridden, then the proper values may be entered in the fields provided for:

- *Review tags (default paragraphs and list elements)*

You may check off any or all of these elements to become review segments: paragraphs, list elements, tables and table cells.

- *Replacement review tag (default <rs>)*

The replacement review tag is simply a user-devised review tag that you may insert into the base document. You might make the tag <RS>, <FAKE>, <REPL> or any other non-standard HTML tag. You might need to place a review tag at a graphic, or at the document title. The replacement review tag allows you place a review tag anywhere in the document.

- *General Comments Allowed (default yes)*

Review segments allow the user to comment on a short section of the document, but frequently the user will want to comment on the entire document. This commentary may refer to the absence of some information, the general tone of the document, or perhaps even some general praise! Some documents may have special instructions such as a request for approval/disapproval, voting, a request for permanent annotations for an enterprise-wide annotated bibliography, or suggestions for entries in a glossary. The general comments section provides a place for special remarks. To add a general comments segment, accept the default (checked).

- *Suppress bolding of comments in the comment pages (default no)*

When the user clicks on the W tag of a review segment, the program pops up a page with a form to enter the commentary. In order to remind the user what is being criticized, the text of the review segment is written above the field for the comment. This text is normally presented in the bolded italic face. To eliminate this emphasis, accept the default value (checked).

Materials that benefit from eliminating the emphasis are review materials that contain bold face or italic text that provides meaning. Bibliographic materials are an example of material that projects meaning through typeface. Suppressing the program's emphasis allows the HTML tags for this material to function properly.

- *Log comment authors and their address (default yes)*

In order to automatically fill in the user's name and e-mail address in the comment form, DocReview's comment filing script creates cookies. These same cookies are also used to log the user's annotations in the log file (log.txt). If you check off this box, reading sessions will be logged using the cookie data, if not, the reading sessions will be logged anonymously. There is an ethical issue for you to decide. If you choose to log the reader's name and e-mail address do you need to inform the reader beforehand? Do you know all the readers?

- *Color of DocReview tags (default FF6508 -- orange)*

There are color accents throughout the DocReview pages, usually in the titles. If you don't care for the Insignia Orange color accent of the default setting you can change it by entering a six character hexadecimal code **RRGGBB**: where **RR** is the saturation of the red, **GG** is the green, and **BB** the blue.

- *Special Instructions to users (default blank)*

For most text documents the simple instructions in the header on how to read and write are sufficient. Special instructions might be in order for some documents. There might be a deadline for participation, say to reviewing meeting minutes that are to be published on a fixed schedule. Documents that accumulate new data in addition to commentary on existing data may refer the user to the general comments area to suggest new materials for the collection. You may use HTML in this field to provide emphasis, lists, or links.

- *Restrict writing of comments (default no)*

You may wish to restrict the ability to contribute comments to a select group, while leaving the review open for reading. If, for instance, you are reviewing a controversial document, open public commenting may dilute the comments of your reviewers or attract graffiti. If you wish to restrict both reading and writing, then simply use the .htaccess and .htpasswd methods of protection common to UNIX machines.

If you wish to restrict writing, enter a password of your choosing on this line. It is effective for this single document review. It is best to keep it short and in lower case. Be sure to notify your reviewers of the password. This can be done at the same time you announce the installation of the document for review.

- *List of people to notify of comments (default blank)*

If you are, as either a user or editor, involved in several reviews, it is quite burdensome to have to scan every DocReview installation to see if any comments have been made since last seen. DocReview can issue e-mail notification as comments are entered.

To notify someone, just enter the e-mail address(es) in the field provided. Separate the addresses by comma. Use no spaces! Addresses must be legally formatted, but the program cannot check to see if the legal addresses actually point to the right person. You may add names on this list, and add everyone on a separate list (see next item).

- *File name of comment notification list (default notificationlist.txt)*

To notify an entire list of people you must create a file of comma separated addresses. Use no spaces! Addresses must be legally formatted and correct because the program cannot check to see if the addresses actually point to the right person. Enter the file name (relative to the DocReview directory) in the form. The default file name is notificationlist.txt. You may add the names on this list, and add separate addresses (see item above). If notificationlist.txt is empty or nonexistent, no notifications are issued.

- *Name of directory for commonly used graphics (default .../graphics)*

In order for graphics to appear in the DocReview, the graphic files must appear in the nickname directory, which is created when you create the DocReview installation. Many graphics are used in several html pages and DocReviews. If you have copied every one of the commonly used graphic files into a single directory, the installation program will automatically create links from the nickname file to the common graphics directory. Specify the common graphics directory by entering the relative path from the DocReview directory to the common graphics directory. For example, if the common graphics directory is at the same level as the DocReview directory, and it is named "graphics" enter ".../graphics" in the input box.

After the form is filled out, the "CREATE DocReview INSTALLATION button is clicked and the computer creates the directory for the DocReview, creates the necessary files, and updates the list of active DocReviews. If there is a problem encountered, the computer sends back an explanation of what is wrong without making any changes to the files on the computer. The errors encountered are usually errors made by the editor in tagging, or providing a "nickname" directory that is illegal, or already exists. If the DocReview was successfully created, then the editor should carefully review the results to see if the tagging produced the desired review tag segmentation. If not, delete the DocReview and start over. If everything is OK, then announce that the DocReview is open to the team members.

4.3.3.2 Deleting a DocReview

Often a DocReview is prepared incorrectly and, on review, it is decided to correct the errors and reissue the DocReview. On other occasions, a DocReview that has served its purpose and does not need to be archived needs to be deleted. When a DocReview is created, there are several actions taken that need to be undone; directories and files need to be deleted, and other files need to have entries removed. There are so many small items to be done that there is a program in DocReview in order to automatically take care of deletions.

Deletion of a DocReview is managed by filling out a form that is presented when "Delete a DocReview" is selected from the "Managing the DocReviews" page. The deletion form asks the editor to select the name of the DocReview to be deleted from a list of all active DocReviews. When the editor clicks the "Delete the DocReview" button a verification page pops up with the directory name as well as the DocReview name and asks the editor to verify the deletion operation. If the "Yes" button is clicked, all traces of the DocReview are removed from the system.

4.3.3.3 Archiving a DocReview

The normal operation of the document refinement process leads the document through a sequence of edit/annotate/revise cycles. Before document revision, the DocReview of the current version must be archived in order to preserve the old version and all the annotations on it. In this way a complete revision record is maintained of every document. DocReview allows the archived versions and their annotations to be read, but not revised or added to.

A DocReview may be archived by filling out a form that is presented after "Archive a DocReview" is selected from the "Managing the DocReviews" page. The form asks the editor to select the name of the DocReview to be archived from a list of all active

DocReviews. The archiving form contains many options that are explained through hypertext links from the form page. Fields that must be filled out are:

- *the nickname for the archive.*

All the files for the archives are all kept in a single subdirectory. This directory needs to have a legal directory name for the URL that accesses the archive. In the case of UNIX machines this means some combination of upper and lower case letters (a-z), digits, and the underscore character. The program checks for this, so if your operating system accepts other characters, don't use them. An archives "nickname" must be relative to the DocReview/archives directory.

- *the title of the archived DocReview*

When a DocReview Installation is archived, an index page is updated. The entry in the index page contains a title, which is set up as a link tag.

- *a description of the archived DocReview*

When a DocReview Installation is archived, an index page is updated. The entry in the index page contains a description that informs the user of the contents.

4.3.3.4 Deleting an Annotation

From time-to-time it becomes necessary to remove a single annotation from the record of an active DocReview. When an annotation is submitted, several actions are taken, all of which must be undone to properly expunge the annotation. An annotation may be expunged by filling out the form that is presented when the “Delete a Comment” button is clicked on the “Managing a DocReview” page. The form requests the following information:

- *the DocReview*

The form asks the editor to select the DocReview from a list of active DocReviews.

- *the number of the review segment*

The number of the review segment may be read from the filename of the annotation file for the review segment (the *nn* of point*nn*.html).

- *the number of the annotation within the review segment*

The number of the annotation may be read from the annotation file.

4.4 The Annotated HyperBibliography

The Annotated HyperBibliography (AHB) is the tool that manages the references for all the literature used in the Research Web (RW). The primary functions are: to display bibliographic information by clicking citations in RW Essays; to display abstracts of the works; to display full text of the work where available; and to provide a place for research team comments on the work. The AHB is an important component of the Research Web Essay (§3.4), providing a link to several increasingly detailed representations of the cited literature. If it were used in electronic journals, this facility would provide a way that "classical citation behavior may reach a much higher level of activity ..."[19].

The AHB is a suite of programs and web pages. A personal bibliographic manager (PBM), for example ProCite or EndNote, must be available on the facilitator's workstation. The PBM contains the basic bibliographic information for the AHB, all the bibliographic fields, abstract, URL for full text, and an identifying key. The PBM must have a "style template" installed that will translate the PBM data into an interface file that the AHB server software uses to display the information on web pages. There is a suite of management tools that accomplishes the conversion of the interface file into web pages. The only "manual" editing of files that may be required is the excision of inappropriate annotation.

4.4.1 Preparing the Bibliography

Bibliographic information is entered in the PBM largely just as one would for a conventional bibliography. The exceptions are to add a unique ten digit identifying key in one of the fields (usually the time of data entry in yymmddhhmm format is added to the ISBN or ISSN field); and to add the URL for full text if available (a seldom used field is usually appropriated). The fields used are at the facilitator's option. The "style template" will need to reflect the choices made. Any corrections to the AHB's bibliographic information are made in the PBM.

4.4.2 The Interface File

The interface file is produced using a PBM command to write a bibliography using the "style template". The style template is a modification of a copy of the file that produces the bibliographic format selected, for example Chicago B or APA. The style template causes a text file to be produced that contains not only the correct bibliographic format in HTML, but also keywords that the AHB's management software recognizes. Here is an example of one record of an interface file:

***key*9803031043**

***biblioentry*Agre, Phil. 1998. Designing genres for new media: Social, economic and political contexts. In <I>CyberSociety 2.0: Revisiting CMC and Community</I>. Editor Steve Jones. Sage.**

***abstract*This Chapter is a revised version of a manifesto for a course on conceptual design for a new media, taught to communication undergraduates at the University of California, San Diego from 1996 through 1998.**

***URL*http://dlis.gseis.ucla.edu/people/pagre/genre.html**

***author*Agre, Phil 1998**

***title*Designing genres for new media: Social, economic and political contexts**

EOR

Figure I An Interface File Record

4.4.3 Creating, Updating and Maintaining the AHB

Once the interface file has been created for the latest version of the AHB, the interface file must be transferred from the workstation to the web server. The management software of the AHB is then used to either create or update the AHB. The creation and updating programs are run from the WWW by clicking a button on the "Managing the Annotated HyperBibliography" web page. A form will be displayed for the facilitator to enter the necessary information, the name of the interface file and the directory of the AHB. After clicking "Submit" no further action is required. The management programs create or update the "catalog cards" and the author index and title index. The only maintenance tasks performed on the server are the occasional correction of an annotation, or the excision of inappropriate annotation. Correction of the bibliographic information is performed on the facilitator's PBM.

4.4.4 Uses for the AHB

The principal use for the AHB is to support bibliographic annotation of the Research Web Essays. The user of the essay can with a click pull up the bibliographic information for a citation. The popup window displaying that information has a button that will bring up a "catalog card." The catalog card provides the user with an abstract of the work (if present) and offers buttons to view full text (if on the WWW), and gives the user the opportunity to annotate the reference. The AHB also provides the EssayAssistant program with the information used to automatically build the references section for the RW Essay.

The annotation feature of the AHB is what sets it apart from static bibliographies. Criticism is a sharp intellectual tool that can perform several functions, many of them quality related. Errors or omissions may be noted. Interesting ideas can be highlighted. If a reference is superseded or challenged by new work, then that work may be linked directly from the annotation. Works that form the foundation of the team's research may be identified. Relationships between references may be established. Annotation allows the research team to add value to the references of the enterprise.

4.5 The Annotated HyperGlossary

The Annotated HyperGlossary (AHG) is a tool that allows the research team to document the language of the research enterprise. In an interdisciplinary research team, the vocabulary may contain terms that have substantially different meanings. The AHG allows not only the entry of definitions and alternate definitions, but technical glosses as well. The definitions are each contained in a web page that may be displayed at the click of a marked term within a document, usually a RW essay. The entire AHG may be displayed on the WWW. Each term and alternate definition may be annotated or glossed by any team member.

The AHG is a suite of programs and web pages located on the server. There is a program that allows insertion of a new term by filling out a form on the WWW. Every time a new definition is added the Annotated HyperGlossary web page is regenerated with the new material included in the proper place. Access to this program is usually restricted because the definitions and glosses usually contain cross-references to other terms, and cross-referencing requires some minor programming by the facilitator. When a definition is displayed, there is a button that may be clicked to bring up an annotation form. Annotations are displayed on the definition page. Should any annotation, gloss, or definition need to be revised, the facilitator must perform the editing as the text is contained on the server machine.

4.6 The EssayAssistant

The *EssayAssistant* is a tool that enables the author or facilitator to insert specialized popup windows into HyperDocuments, principally Research Web Essays. Displayed by a single click, these popup windows allow the reader to obtain additional information about the content of the document without leaving the HyperDocument. The windows may contain footnotes, sidebars, bibliographic information, glossary definitions, or simple notes. These features constitute the scholarly apparatus of the Research Web Essays, and they are complemented with the critical apparatus provided by DocReview. In order to create these popup windows, "poptags"— HTML-like tags, must be inserted into the base document.

The base document is then processed by a computer program, poptags.pl, that automatically converts the poptags into the much more complex JavaScript code. The program produces an output HTML file which contains all the HTML tags and scripts required to make the output file pop up the windows containing your information. The program also inserts, after the text, appendices for references, notes and definitions, all with return links. These insertions make the document read well in hardcopy where the user cannot pop up windows. As a matter of course, this HTML file is provided with a

link to a DocReview of itself. This gives each HyperDocument a built-in critical apparatus.

4.7 What's New?

A distributed work group needs powerful tools to stay "glued together." One of the principal needs is to be informed about the group's activities, or "What's New?" What's New essentially allows anyone to receive a list of notification messages that were sent to members at the time of accession or document revision. As currently implemented *What'sNew?* only provides information on DocReviews. It needs to be expanded to include new documents, document revisions, comments on Annotated HyperBibliograpy (AHB) references, comments on Annotated HyperGlossary (AHG) definitions, and perhaps new entries in the AHB and AHG. When completely implemented, there will be a checkoff list for types of documents to be listed. Eventually, *What'sNew?* may be augmented with a program running in background on all team members' computers. This sort of background program could instantly inform the member of any activity as it happens: rather than seeing or hearing "You've got mail," you might see "New RW activity."

Notifications not only inform, but also remind members that there is work to do. These notifications, which are without cost to the contributor, are expected to increase access to the content of the RW[20] and thus participation. Xerox provides e-mail notification to changes in its Web-based repositories, including URLs rather than attachments[21].

What'sNew? presents the user with a form that asks for a beginning date for notifications. For instance the user may as for all comments on all DocReviews or a selected DocReview from some date forward. If no date is provided, the program will present a complete page showing the selected activity since project inception. This page will present transactions (creation/acquisition, commentary, archiving) chronologically and will have clickable links to the comments, archives, or current document.

4.8 Lexicon

The language of discourse for the Research Web must be well defined, especially in a multidisciplinary team. *Lexicon* is a tool designed to tease out the terms used by every discipline associated with the issue domain. The basic idea is very simple; a set of carefully central terms is defined and entered into the tool. Each of these definitions is then opened to criticism, and a request is made to identify and define terms associated with the parent term. Each of these new terms becomes a parent term of a new subhierarchy. Since a parent may suggest many terms, only a few steps can produce a very large number of terms. The lexicon of the issue domain is then fairly well established and can be moved to the more formal alphabetically ordered Annotated HyperGlossary where it can be further refined.

> *"There is a strong sense that the encyclopedic method, grouping words by themes, meets far more efficiently the need to see links and method amid the chaos of existence."* --- Jonathon Green, 1996[22]

The purpose of *Lexicon* is to convert the mental lexicon of the participant into a glossary that can be shared with other participants. The process of reflection and explaining helps the participant sharpen the internal personal meaning of the term. The existence of multiple meanings and nuances helps to explain the existence and causes of misunderstanding among colleagues.

Lexicon is organized in a hierarchical manner. The start of the lexicon is a set of contributed terms that are hopefully the major root words of the vocabulary of the issue domain. Each of these terms is then presented on a page that allows for discussion of the proposed definition. Every entry page can also propose subtopics which are presented on their own page. This process can extend without limit to finer and finer distinctions.

This sort of organization follows the lead of P.M. Roget who, in 1852, with his sons created one of the indispensable references for the English language, Roget's Thesaurus[23]. Roget took as his issue domain all the words of the English language. His initial categories were only six: Abstract Relations, Space, Material World, Intellect, Volition, and Sentiment and Moral Powers. The Fourth Edition, published in 1977, includes eight initial categories: Abstract Relations, Space, Physics, Matter, Sensation, Intellect, Volition, and Affections. A brief look at the Thesaurus will show its hierarchical organization.

The multiple and nuanced meanings of the terms are explained and debated in the commentary on each entry page. Within the lexicon, this debate will produce variant definitions or glosses. When the lexicon is fully matured, there is little use for the hierarchical organization --- its purpose has been served. Thus, at some point the lexicon is closed and the dictionary or glossary becomes the repository of the vocabulary of the issue domain. In our environment the lexicon is converted into an Annotated HyperGlossary.

4.9 Other Tools

The tools mentioned in this section are not ready for inclusion in the environment, but are needed. PicReview is a tool that allows annotation of any image. The Landscape of Reason is a tool that creates a graphic layout of an argument. This tool will give a synoptic view of the argument surrounding a proposition, including warrants, backing, and rebuttals. Three tools, not further discussed, have potential for use. The IdeaMill is a proposed brainstorming tool that incorporates features that mitigate the production blocking of "standard" brainstorming sessions, and features that capitalize on the advantages of asynchronous dialog. TimeMaps graphically describe the distribution of team members with respect to the position of the sun in the sky, showing how our circadian habits make synchronous communication difficult. State-Graph is a graphic method used to describe process behavior.

Tools appropriated by its team members will augment and evolve each Research Web. All disciplines and most specialties have software and conceptual tools that may contribute to the processes of modeling, understanding, and coordination. Geographic information systems cross all boundaries and find applications wherever physical distributions or differentiations are important. While this dissertation describes Research Webs dedicated to pure research, many if not most team efforts will likely be applied research efforts. Such RWs may need decision-making tools including voting tools and negotiation tools.

> *Rather than impose structure on the [Research Web],from the outset we want to support the evolution of its own gradations of structure, cohesion, and hence community dynamism.* **--- m.c. schraefel 2000**[24]

4.9.1 PicReview

PicReview is a WWW-based interactive reviewing tool that allows the posting of an image that users can annotate by referring to regions demarcated by the user. This tool is the graphic analog to DocReview. Any user may define and name features or regions on the image; others wishing to comment may then reference these features or regions. Each annotation becomes the focus statement or question for public discussion just as if the annotation is a DocReview review segment. A complex image may be subdivided into separate reviewable areas or themes. Types of images that might be reviewed are: maps, diagrams, photographs, etc.

4.9.2 The Landscape of Reason

This tool is to be designed to allow informal argumentation about propositions or hypotheses. It is based on a technique outlined by Toulmin, Rieke and Janik[25] and explored by Liebow, et.al. [26]. This technique is somewhat more formal than gIBIS [now QuestMap][27], a technique that is slanted toward policy and decision-making.

The program builds a graphic presentation that is a map of a dialog about a single topic. The dialog surrounding any proposition is a great branching tree of claims, rebuttals, backing, and modal qualifiers. The tool builds a case graphically, showing the relationships in the argument. Much of the complexity of the argument is simplified by using hyperlinks to move sub-arguments to new pages. The claims, rebuttals, and backing are the findings that will come from documents such as minutes, essays, journals and reports. The Landscape of Reason could provide a framework for the analysis of the dialog. There is an active community of scholars working on this problem, referred to as Computer-Supported Collaborative Argumentation (CSCA).

Conklin, in a position paper[28], reports on the difficulties that inexperienced, or only moderately experienced, people encounter when using QuestMap. The learning curve is steep and for that reason, I propose using The Landscape of Reason only as a representation of the argument as prepared by the facilitator, not as an interactive tool. Like all representations, it will, however, be annotatable. Through annotation the team members may point out errors in the presentation and suggest inclusion of parts of the argument that may have been overlooked.

Notes to Chapter 4

[1] Ruhleder and King 1991, 352

[2] Orlikowski and Yates 1994, 555

[3] Marshall, et.al. 1999

[4] Bosak and Bray, 1999

[5] Valdes 2000

[6] Wooley 1998

[7] Palme 1995, 2

[8] Anon 1999, 348

[9] Holzschlag 2000

[10] Orlikowski 1993

[11] Grudin 1994

[12] Star, 1989

[13] Henderson, 1991

[14] Kaye 1992, 17

[15] Gächer and Fehr 1999

[16] Ackerman and Starr 1996

[17] Kraut, Galegher and Egido 1988

[18] Anon 1999, 346

[19] van Raan 1997,447

[20] Markus 1987, 502

[21] Rein, McCue and Slein 1997, 84

[22] Jonathon Green 1996, 13

[23] Roget 1997

[24] m.c. schraefel 2000, §4

[25] Toulmin, Rieke and Janik 1979

[26] Liebow, *et.al*. 1998

[27] Conklin and Begeman 1989

[28] Conklin 1999