# How to Incorporate Collaborative Discourse in Cultural Digital Libraries

**Holger Brocks, Adelheit Stein, Ulrich Thiel, Ingo Frommholz, Andrea Dirsch-Weigand**
Fraunhofer Institute
Integrated Publication and Information Systems
Dolivostr. 15
64293 Darmstadt, Germany
{brocks, stein, thiel, frommhol, dirsch}@ipsi.fraunhofer.de

## ABSTRACT
Discourse structure relations can be used to establish collaborative discourses within a cultural digital library. Ranging from factual to more interpersonal levels they describe the intended relations between data and metadata objects, especially annotations. Pragmatics aspects are covered by communicative acts, which complement the discourse structure relations and provide means for meta-communication. The resulting interrelations between the various domain objects can be employed to perform advanced context-based retrieval.

## Keywords
task-guided collaboration, discourse structure relations, communicative acts, context-based retrieval

## INTRODUCTION
Content-based access to cultural heritage content is a fundamental requirement for Digital Libraries in Arts and Humanities. In order to offer adequate access functionality we must go beyond current practices of merely providing digital reproductions of the documents in the collection. Instead, results from current and previous scholarly work like evaluating and indexing these sources must be continuously integrated into the digital data repository in the form of various kinds of metadata like annotations or keywords. This, in turn, enables improved content-based access to these value-added sources.

Digital library systems offer new ways of working with source material, i.e. scholarly users actively contribute to collections rather than simply access the data stored in the repository ([11]). To support collaborative aspects of cultural work, a digital library system has to reflect the complex interactions involved in group activities.

Collaboration can be regarded as a process in which two or more participants coordinate their actions toward achieving shared goals. Collaborative discourses describe extended communication between two or more participants in a shared context ([12]). Annotations represent our core concept for establishing a discourse context.

In the remainder of this paper we will describe in detail how discourse structure relations and communicative acts can be combined to introduce collaborative discourses to a cultural digital library system.

### The COLLATE Project
As an underlying platform-independent and cross-organizational infrastructure the World Wide Web (WWW) can support scholarly work across the Internet in various ways. The European-funded **COLLATE** project (IST–1999–20882) is set out to design and implement a collaboratory for professional communities in the Arts and Humanities working with digitized historic-cultural material.

Historical film documentation serves as example domain for the setup of a technical environment for shared access to a digital repository comprising digitized multi-format documents on several thousand European films of the early 20th century. An extended description of the project can be found in [6] and on the project website (http://www.collate.de).

In our view a cultural Digital Library has to offer support for task-guided collaboration, i.e. it should provide an environment for structured scientific discourses by defining and maintaining a model of its users' tasks and goals as well as of the potential interrelations between these discourses and the objects in its domain.

The main contributions of COLLATE will include:

- A *Web-based collaboratory* that provides a comfortable working environment and user interfaces for supporting end-users in their annotation, indexing and retrieval of multi-format, multimedia historic archive material; and

- A *comprehensive digital multimedia collection* on European historic films and film documentation, annotated and interpreted by a multi-national team of experts using the COLLATE system.

## TASK-GUIDED COLLABORATION
Digital Libraries offer new opportunities for collaboration and communication that were unfeasible in traditional libraries ([11]). Our goal is to develop a cultural collaboratory, supporting interpretative work on mostly textual material. The starting point for collaborative work comprises already existing data in form of binary image representations of the digitized source documents. Therefore, we do not focus on cooperative data acquisition but on collaborative content-based indexing, i.e. supporting

user groups in their joint work with documents, allowing additions, modifications and explicit negotiation of the interpretation of documents and document passages.

Annotations are notes and comments added to a document (or a document region) to explain and interpret it. But to serve as building blocks in a formal representation of a discourse, an annotation has to consist of more than unstructured and uncontrolled text which comments on a document.

A cultural digital library should not only provide means for simple access to the data stored in the underlying repository, but should also support its scholarly users in actively contributing to the collections (see, e.g., [11]). For this reason we go beyond the mere replication of traditional domain-specific workflows by providing a comprehensive model of the various types of COLLATE domain objects (e.g., documents, annotations), and their potential interrelations. Our notion of task-guided collaboration includes the recognition of structures as well as relations between different types of annotations. By taking the users' roles, tasks, and goals into account we aim to provide comprehensive support for the various levels of indexing and interpretation.

In a collaborative environment each user maintains her own view on the digital repository, which might be dependent on her current role in the indexing process as well as on the actual task she is trying to perform with the system. For this reason, the heterogeneous roles users can take up as well as the social aspects of collaborative work have to be taken into account. In order to cope with spontaneously emerging profiles of interest and information needs an adequate collaborative environment has to maintain a model of the roles its users can take up as well as of the tasks they are supposed to perform (cf. [3]).

The current task the user is trying to accomplish plays in fact a dominant role as it specifies the view on the domain objects in the repository and the relevant retrieval operations on them. Satisfying the various kinds of (spontaneously emerging) information needs forms the basis for maintaining a continuous flow of information between the system and its users by allowing them to contribute new knowledge derived from material accessed before.

The COLLATE system supports asynchronous collaboration in indexing for non-technical users. The scanned documents refer, e.g., to films, plots, or censorship cases. Together with their associated metadata objects, in particular annotations, they represent the main focus of collaborative work, i.e. collaboration is performed through annotating the various types of domain objects.

The interrelations between the various domain objects can either be unspecified or it can be modeled in a more explicit way by defining specific types of admissible relations. In addition, certain communicative acts on the

meta-level (e.g., request for clarification) are part of the COLLATE collaboration model.

This kind of system-internal collaboration can, of course, be complemented by external communication mechanisms, e.g., by email or discussion forums.

## DISCOURSE STRUCTURE RELATIONS (DSR)

According to Rich and Sidner (see [12]) collaboration can be regarded as a process in which two or more participants coordinate their actions toward achieving shared goals. Most collaboration between humans involves communication. Discourses represent extended communication between two or more participants in a shared context, such as collaboration.

It becomes obvious that the users' individual tasks and goals have to be taken into account for modeling a collaborative system. Content-based indexing of a specific document – in this sense – can be considered as a global task, which can be decomposed into partial tasks. In the COLLATE context, the result of these partial tasks, which are to be performed by various users, is value-added information in form of metadata objects associated with the original document. But these partial tasks are only rarely performed in isolation. On the contrary, in most cases a specific annotation will be part of a thematic thread, e.g., some newsgroup-like discussion about a certain topic. Digital signatures are employed to ensure authenticity of the individual contributions as well as the chronological order of the annotations.

To capture the coherent aspects of the discussions, we employ a model of discourse structure relations between a) binary image versions of the original document and annotations and b) discussion threads realized as annotations on annotations.
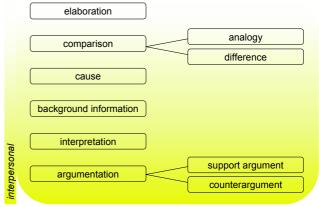


*Figure 1:* Discourse Structure Relations

Our document-centered discourse model is loosely based on concepts derived from discourse theory. In particular we adopted the concept of discourse structure relations (or rhetorical relations as defined by Mann & Thompson [10]). Even though it has originally been developed for monologues in the linguistic context of text cohesion we think that discourse structure relations can be used to

describe admissible relations between various data and metadata objects in the COLLATE context, especially between annotations.

*Figure 1* shows the specific subset of relevant relations we employed for COLLATE, ranging from factual to more interpersonal levels (i.e. focusing on certain qualities of the participants of the discourse).

For detailed reviews on other existing approaches and a meta-taxonomy of discourse structure relations see ([8], [9]). In the following we just briefly paraphrase the discourse structure relations used in COLLATE:

- **Elaboration** – Providing additional, more detailed information (e.g., "…it's Paris in USA, and not in France…").

- **Comparison** – Comparative relations can be further sub-structured to emphasize semantic similarities or contrasts between two elements of a discourse.

- **Cause** – To state a specific cause for a certain circumstance.

- **Background information** – Using information about the background of the author of the other annotation (e.g., "… As a lay-person the author does not take psychological aspects into account…").

- **Interpretation** – (Subjective) interpretation of a statement being referred to (e.g., "…the author actually means…").

- **Argumentation** – The statement or argument of the other author is either supported, or a counterargument/antithesis is formulated here.

The seamless transition from factual to interpersonal discourse structure relations depicted in *Figure 1* also corresponds to the illocutionary aspects of an annotation, i.e. the specific communicative intention its author had in mind at the time of creation (e.g., from stating factual information towards active participation in a discussion thread).

Even though discourse structure relations proved adequate for modeling the interrelations between annotations it turned out, however, that there are some relevant pragmatic aspects of collaborative indexing work, which are not yet covered. In the next section we describe how discourse structure relations can be complemented by communicative acts to introduce meta-communication, i.e. explicit communication about domain objects, in a seamless way.

*Figure 2* displays a fictious example discourse about the partial ban of the movie "Kuhle Wampe" by Berthold Brecht.
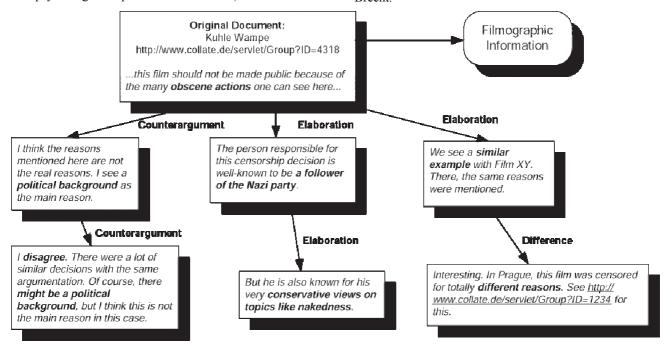


*Figure 2:* Example Discourse

## COMMUNICATIVE ACTS (CA)

Scientific source analysis and interpretation can be regarded as a highly incremental process, which requires extensive domain-specific knowledge. Within a collaborative environment, a user can explicitly perform communicative acts in order to request assistance for accomplishing a particular task (cf. [1]).

The speech-act oriented COR (*COnversational Roles*) has been designed to model cooperative information-seeking dialogues in a domain-independent way (cf. [14], [15]). Focusing on the pragmatics COR covers the basic illocutionary aspects and expectations of specific behavior associated to a role of a dialogue. In essence it provides a set of basic communicative acts (e.g., expectations, commitments, retractions, corrections, and clarifications)

that are categorized on basis of their communicative purpose and role assignment.

For the COLLATE context only a subset of COR primitives had to be adapted in order to cover the pragmatic aspects of collaborative indexing work. From the five global categories postulated by Searle ([13]) and used in COR we identified only three classes of communicative acts to be of most relevance for our purposes:

- **Assertives** – Assertions represent a certain class of communicative acts that can be characterized as being either true or false. Comments represent an important class of qualified assertives. Comments can either be requested or not. The relationship between non-requested comments and the discourse relations described in the previous section will be discussed later.

- **Directives** – Attempts to get some other person to do something are classified as directives. Requests, e.g., a search for documents or specific questions ("Could you please explain…") directed to other users would represent the most prominent examples of this class of communicative acts.

- **Commissives** – The illocutionary point of commissives is to commit oneself to some future course of action. A promise to provide additional information with respect to a certain film would be a good example from the COLLATE domain.

The main purpose of these three classes of communicative acts is to allow for explicit communication on the meta-level, i.e. meta-communication about the various indexing tasks supported by the system.

## INTERRELATION BETWEEN DSR AND CA

Conceptually, discourse structure relations and communicative acts can be considered as complementary: Communicative acts focus on illocutionary aspects of a specific dialogue situation, whereas discourse structure relations describe characteristic relationships between assertive acts, e.g., annotations or comments ([4]).

But on closer inspection it becomes evident that some communicative acts might invoke certain types of discourse structure relations between the corresponding annotations. In our view, the set of discourse structure relations adopted for COLLATE can be considered as specific instances of comments, i.e. they are treated as assertive communicative acts.

From this perspective, we can regard explicit collaboration in the context of the COLLATE project as the combination of specified relation types between annotations, i.e. discourse structure relations, which are complemented by a certain set of admissible COR acts for meta-communication (on the dialogue level) referring to the various types of COLLATE domain objects (e.g., annotations, cataloguing information).

In essence, we regard discourses as results of "cooperative negotiations" where the discourse participants have certain context-related obligations as well as specific expectations.

A concrete example for the interrelation between communicative acts and discourse structure relations would be, for instance, if a user had some questions with respect to a particular annotation, she can *request* some explanations from its author. The system can support this kind of meta-communication by providing certain means for interaction, e.g., a "Request explanation" button located in each annotation dialog. Internally, the specific type of discourse structure relations chosen to describe the interrelation between the original annotation and its explanation (realized as an annotation on the original annotation) has to reflect the difference between requested and non-requested annotations.

## CONTEXT-BASED RETRIEVAL

Appropriate search and retrieval functionality represents a fundamental requirement for enabling the user community to access a cultural Digital Library in a reasonable way. To allow for advanced content- and context-based search the documents in the digital collection must be indexed by content and subject matter (cf. [3]).

In context-based retrieval, a document does not stand for its own, but also the actual context of this document is considered. For the COLLATE case, this means that we are dealing with the discourse context. The RDF statements, which are used to interrelate the various domain objects, are typed according to the discourse structure relation they represent. With this information, we then know the specific type of an annotation with respect to its context, e.g. an elaboration or an example.

Having a second look at *Figure 2* one can see that only the inclusion of the associated annotations would yield it as relevant for a query like "political background". But it also becomes evident that the annotations within a certain discourse context cannot be treated in isolation, e.g., the second counterargument weakens the statement it comments upon in this context.

The introduction of discourse structure relations allows for novel retrieval options with respect to the discourse context. They can be used to create a ranking of relevant documents according to the users' queries. Depending on the specific type of its connecting relation, an annotation can possibly raise or lower the overall relevance weight of its discourse context.

## THE COLLATE SYSTEM

The COLLATE system is under development. At its current stage of development, the COLLATE prototype system already supports various tasks like cataloguing, indexing (structured, free), and allows for unstructured discourses based on free comments. Furthermore, it offers simple search options based on filmographic information as well as on transient information recorded as part of the scanning process.
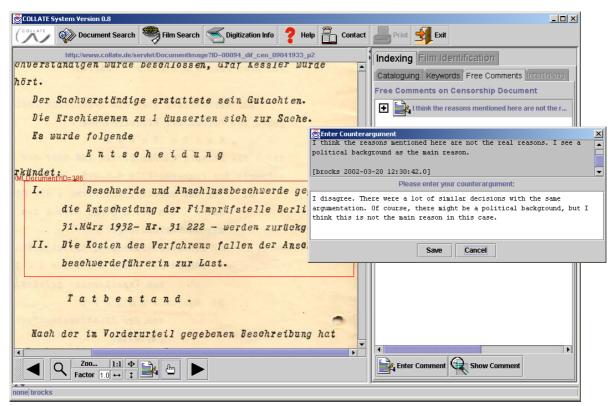
*Figure 3:* COLLATE System Prototype

*Figure 3* illustrates how part of the example discourse (from *Figure 2*) would be realized within the system.

After having accessed a document (via "Document Search") the user is presented a tree-list view of annotations already associated to the document. In this case a specific passage of the second document page, the justification for the ban of the film "Kuhle Wampe", has already been marked-up and commented upon. In our example, the current user disagrees with the reasons stated in the initial annotation. Therefore, she provides a counterargument in which she states her reasons for the disagreement

**SEMANTIC WEB INTEGRATION**

The design of an adequate logical representation of the COLLATE domain model was a challenging task.

In order to be able to identify and define the heterogeneous data and metadata objects in our domain the different types of cultural contents had to be studied and classified into certain categories. The various COLLATE domain objects (e.g., cataloguing information, keywords, annotations) are represented as instances of appropriate XML schema, uniquely identified by their URIs.

Internally, the structured, document-centered discourses are implemented using RDF descriptions, which relate the annotations to the objects they describe according to the COLLATE RDF Schema.

By employing the Resource Description Framework we are able to interrelate the various data and metadata objects in a dynamic way, i.e. depending on users' information needs our system is able to generate corresponding views on the documents and their associated metadata in a distributed repository.

The technical details of the implementation of the COLLATE system are beyond the scope of this paper and will be described elsewhere.

**RELATED WORK**

BSCW provides web-based support for collaborative environments, which represent directories of shared objects and are associated with group memberships ([2]).

1. Lotus Notes represents a commercial groupware product for protected information sharing with limited collaboration support via messaging (http://www.lotus.com/home.nsf/welcome/notes).

Collaboratories, unlike CSCW systems, support more thoroughly studies of the source material, which is stored as a distributed set of digitized source documents (e.g., [7]).

DEBORA aims to provide digital access to a set of digitized printed works. It supports annotation sharing and personal annotation functionality, but without any explicit model for discourses ([11]).

Annotea is a web-based shared annotation system based on an open RDF infrastructure. Its implementation in the Amaya browser treats annotations as statements about web

documents. Even though nested annotations have been introduced in recent versions, discussion threads are realized as unstructured sequences of metadata ([5]).

## CONCLUSIONS

For COLLATE, content-based indexing denotes interpretative work on binary image representations of mostly textual material. In a collaborative environment, several users cooperate in order achieve shared goals, e.g., to understand the rationale why a certain movie has been banned. In our model of collaboration, annotations serve as the primary means for semantic indexing. Discourse structure relations allow us to represent the various types of admissible interrelations between domain objects.

Explicit communicative acts are used to cover specific illocutionary aspects, which are necessary to allow for collaborative meta-communication about the indexing tasks to be performed.

Exploiting the internally represented knowledge about the discourse context of the users' input (current task, role), i.e. the interrelation between the annotations, allows for far more specific and pragmatically relevant search and retrieval methods. RDF and XML Schema guarantee seamless integration of our idea of object-centered interaction between users with other Web-based services.

The incorporation of document-centered discourses within a cultural digital library usability concerns must be taken into account. It has yet to be evaluated whether our user community accepts our approach of task-guided collaboration. We hope that the provision of situation-adequate interfaces helps to perform "traditional" tasks as well as offer support for new working methods, which were unfeasible in traditional environments.

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