# An Analysis of Collaboration in Three Film Archives:
# A Case for Collaboratories

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## Abstract

Collaboratories are based on communication technologies such as the Internet and intended to foster increased collaboration and sharing of resources within and among organisations. This study analyses three European film archives to assess the potential of designing a collaboratory that supports, enables, and enhances the work in the archives. The analysis shows that collaboration – the focal point of collaboratories – is an intrinsic element of this work. Though all three archives have preservation, analysis, indexing, and retrieval of films as core activities there are important differences in how these activities are perceived and performed. A work analysis such as the one in this study may facilitate the archives in identifying a common ground on which to base a collaboratory, and in acknowledging the distinctiveness of each archive. The development of a firmer common ground seems a prerequisite for exploiting a collaboratory that goes beyond sharing of data. Coupling of work, readiness for collaboration, and readiness for collaboration technologies are also discussed as conditions for effective use of collaboratories.

## 1. INTRODUCTION

Since silent, black-and-white films began to appear in the early twentieth century, films have crossed national borders to be shown abroad. However, even neighbouring countries sometimes have quite different perceptions of what may and may not be shown, said, and implied in films. These differences, manifested in national censorship regulations, have led to countless country-specific cuts and changes to films, and to many films appearing in different versions in different film archives. This makes film research a truly international affair and it also makes films a valuable source of input for research on cultural and societal issues. Unfortunately, access problems severely impede the exploitation of the comprehensive collections held in film archives. This study analyses three European film archives to understand the work that goes on in the archives and assess the potential of designing a collaboratory that supports, enables, and enhances this work.

The film archives analysed in this study are Deutsche Film Institut (DIF), Filmarchiv Austria (FAA), and Národní Filmovy Archive (NFA). These three film archives – from Germany, Austria, and the Czech Republic – participate in the Collate project, the context in which this study is performed. The field data from the archives have been collected and analysed according to the principles of cognitive work analysis (Rasmussen, Pejtersen, & Goodstein, 1994). Following these principles work within the archives has been categorised into goals, tasks, and

other discrete units, achieved through a means-ends analysis of the empirical data. By conducting such an analysis this study aims at illustrating how cognitive work analysis offers a conceptual framework for structuring and guiding the analysis of a complex, dynamic work domain.

The purpose of the work analysis is to clarify the needs for and prospects of a film collaboratory – a distributed multimedia repository where archivists are provided with the means for collaborating and sharing resources. A first step in devising such a collaboratory could be to provide online access to digitised versions of the original materials, such as film footage, film posters, and censorship documents, as well as to more dynamic information such as reviews, previous requests from users, and the replies to these requests. Shared access to data is, however, a limited and superficial way of supporting complex activities such as preservation, analysis, and indexing of film materials. Hence, at a general level a film collaboratory should:
1. Provide access to materials and resources.
2. Enable national and international collaboration among archivists and other users of the stored materials.
3. Enhance archivists' possibilities for analysing, indexing, annotating, and otherwise working with film materials.

Section 2 briefly introduces cognitive work analysis, the methodology we used in conducting and analysing the field studies. Section 3 provides an introduction to the concept of collaboratories. Section 4 documents the collaborative nature of the work in the archives and, thereby, provides a basis for contemplating the application of a collaboratory. The work analysis is completed, in Section 5, with a discussion of the extent to which the archives satisfy four general conditions for making effective use of collaboratories.

## 2. METHODOLOGY: COGNITIVE WORK ANALYSIS

Cognitive work analysis (Rasmussen et al., 1994) is an approach to the analysis of complex, dynamic work domains, such as archives. These domains are characterised by a rich set of interactions between, on the one hand, the goals and constraints of the work domain and, on the other hand, the actors' skills and performance criteria. In such domains stable, proceduralised work tasks are not the norm. Consequently, the unit of analysis cannot be restricted to the task.

| Level of abstraction | Means-ends relations | Examples (from the film archives) |
|---|---|---|
| Goals and constraints | Why | Active cultural mediation of films and film history |
| Priority measures | Why    What | Visibility and uniqueness of services and collections |
| Tasks | Why    What    How | Collect new materials; transfer nitrate films to safety stock |
| Work processes | What    How | Screening meetings; enter information into databases |
| Physical objects | How | Film footage; scripts; posters; restoration equipment; databases |

Figure 1. The abstraction hierarchy.

To understand the activities of the involved actors it is necessary to analyse not only what the actors are doing but also how and why this course of activities was chosen. This involves analysis of the array of actions available to the actors as well as of the constraints they operate within. In support of such analyses cognitive work analysis proposes to study work domains in terms of means-ends relations (see Figure 1). The means-ends relations form an abstraction hierarchy where reasons propagate downward from goals toward specific work processes and physical objects whereas causes propagate upward from work processes and physical objects toward goals. If we focus on *what* goes on at a certain abstraction level then the level above provides the reasons *why* it is going on and the level below describes *how* it is carried out.

An analysis in terms of the means-ends relations of a work domain provides a structured view of the general work contents. The means-ends structure relates goals and constraints to a variety of functional resources but says nothing about *who* is doing what or *with whom* they do it. The first step toward recognising how the individual actors' skills and performance criteria impact on the work that is being done – and thereby on the work domain as such – is to extend the means-ends analysis with a breakdown of the involved actors into stakeholder groups. This way the goals, constraints, tasks, and other elements of the means-ends analysis become specific to distinct stakeholder groups (see Section 5.1 for an example). A very important part of the analysis is to ensure inclusion of all the groups that have a stake in the work, including managers, the people who perform the tasks, and those who use the results of the work. Different stakeholders may hold different and even conflicting goals, which are balanced against each other by a variety of criteria. In dynamic domains the relative weight of these criteria will frequently change. Such changes are, for example, likely to occur when cognitive work analysis is used in systems design as a precursor to the introduction of a new or modified system.

In addition to the means-ends analysis of the involved stakeholder groups, cognitive work analysis comprises analyses where the focus is shifted from the domain to progressively narrower objects of analysis (see Figure 2). This includes analyses of selected task situations, decisions, and strategies. Common to this progression is a move from a disembodied means-ends description of the domain toward analyses of individual actors' behaviour, skills, and performance criteria. Analysis of the collaborative element of the actors' work is currently less developed. A supplementary aim of this study is to work with the analysis of collaboration and, thereby, provide input to the ongoing elaboration of cognitive work analysis.

The present work analysis consists mainly of a means-ends analysis at the work-domain level (as indicated by the thick grey arrow in Figure 2) but the multiple analytic perspectives involved in cognitive work analysis are highly interrelated. Thus, while the abstraction hierarchy is the main thread in the present work analysis it will, due to the interrelatedness of real-world affairs, also contain elements of the other analytic perspectives.

The levels of the abstraction hierarchy are reflected in the overall research questions for the analysis of the film archives. This way the research questions open up for an analysis that uses the concrete activities performed in the three archives as starting points in an effort to uncover the goals that are being pursued and the manifold resources employed in pursuing them. Concretely, the research questions also provided the agenda for a focus group meeting in each

film archive, and they were worded with this purpose in mind. In abbreviated form the research questions were:

1. What are the strategies and organisational structure of the archives? (i.e., goals and constraints)
2. What are the services of the archives? (i.e., tasks)
3. What kinds of collaboration take place within the archives and with outside parties? (i.e., work processes)
4. What tools do the archives apply in providing their services? (i.e., physical objects)
5. What do the archivists envision in terms of future developments?

These research questions were addressed through field studies at the archives. The three field studies, which lasted 2-5 days each, started with a focus group meeting and then continued with interviews and more informal interactions. Across the three archives we conducted 14 interviews and collected a total of 23-25 hours of focus group and interview data. These data have subsequently been transcribed and analysed, followed by discussion with the informants about assumptions and preliminary results. The data analyses have consisted of means-ends analyses combined with analyses of collaboration.

## 3. COLLABORATORIES: SUPPORTING COLLABORATION IN RESEARCH

When Wulf (1989) coined the term collaboratory – a fusion of collaboration and laboratory – collaboratories were seen as one of the potential tools that could be obtained from the
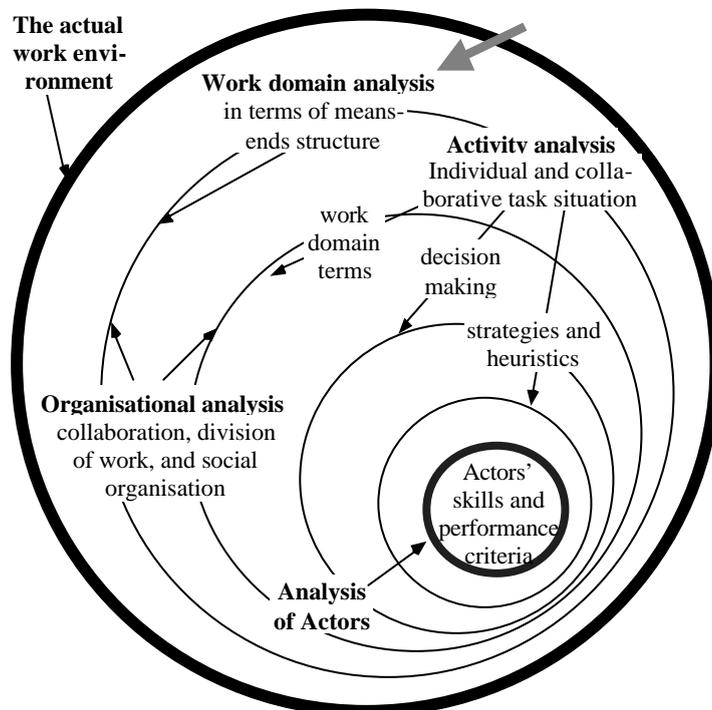


Figure 2. The multiple perspectives involved in cognitive work analysis
(the thick grey arrow indicates the main focus of the analysis in this paper).

anticipated growth in information and communication technologies. Collaboratories were seen as providing solutions, in the future, to problems relating to the increasing specialisation in the knowledge of individual scientists and the concomitant growth in the necessity of collaboration.

The aim of developing systems to support scientific practice is what distinguishes collaboratories from other cooperative work systems. Yet while any individual collaboratory will be designed after the requirements of the work domain it is supposed to support, it is still possible to identify elements in these systems that have been present regardless of the specific support that is being provided. Such generic functions include teleoperation, data sharing and annotation tools, audio and video conferencing facilities, and tools to enable real-time distribution of data and control to remotely located collaborators (Finholt & Olson, 1997). Clearly none of these are unique to collaboratories and it is more in the way that they have been combined and put to work that the unique characteristics of collaboratories can be seen. The respective importance of these different functions has shifted over time. When the concept was first coined teleoperation was seen as the most potentially promising tool to facilitate scientific collaboration. The hope here was that it would be possible to enable the remote operation of experimentation equipment, thereby allowing both intellectual and financial resources to be pooled. Progress on this front has, however, been superseded by advances, driven by the Internet industry, in technology supporting collaborative storage, exchange, and annotation of data and, to a lesser extent, audio and video conferencing.

Looking to extant examples of collaboratories (see, e.g., Bly, 1998) it is possible to identify systems that include all of the generic functions noted above. For example, the Upper Atmosphere Research Collaboratory has, in addition to providing resources for data sharing, allowed researchers from across the world to remotely operate various scientific instruments located in Greenland. For the most part, though, the remote operation of technical equipment remains problematic, partly due to limitations in the technology and partly due to the difficulty of designing interfaces that enable scientists to obtain the requisite level of remote control. Acknowledging these limitations in certain areas, it is also the case that not all scientific activity involves expensive equipment in scarce supply. In such areas of research it will be the tools provided for the management and sharing of data that will be most important. With these areas of research, provision of a level of technical support beyond that found in digital libraries and Internet-based communication tools can only be achieved when the specification of the system is determined in accordance with the specific requirements of the research activity.

## 4. THE COLLABORATIVE NATURE OF ARCHIVE WORK

It is a common characteristic of the three archives that collaboration is an intrinsic element of the work that is being done (Pejtersen, Albrechtsen, Cleal, Hansen, & Hertzum, 2001). Hence, it would be misconceived to introduce tools that treat the activities involved in the preservation and research of films as activities performed by single individuals. An example from each of the three archives may serve to illustrate the intrinsically collaborative nature of activities such as information seeking (FAA), analysis and indexing (NFA), and research and development (DIF):

**Collaborative information seeking**. FAA's library service has gradually changed into the use of a collaborative information-seeking method, where a team of archivists work together on

satisfying the requester's information need. The collaboration is informal and initiated on an ad-hoc basis according to the content of the request and the other activities competing for the archivists' time. There is consensus among the archivists that they share the archive's users and that this gives the best service because the archivists' different backgrounds and interests complement each other. The collaborative information seeking also helps the archivists maintain a current awareness of what is going on in the archive and share their knowledge with their colleagues as well as their users. If an online facility for handling user requests disregards the collaborative nature of the archivists' work with the user requests it will only support a relatively minor part of this work. The collaborative nature of information seeking has also been analysed in several recent studies (e.g., Ehrlich & Cash, 1994; Fidel et al., 2000; Karamuftuoglu, 1998).

**Collaborative analysis and indexing**. Watching films is vital work and this is precisely why NFA attaches so much importance to its weekly screening meetings. These meetings provide a forum where the filmographers and database manager of NFA meet regularly with national film specialists from other institutions. During the meetings, these specialists watch films and contribute information about accurate titles, film studios, locations, directors, literary model, and so forth. The participants also complement the films with information from secondary sources such as censorship cards and dialogue lists. After a screening meeting the filmographers enter a first version of the indexing of the screened film into the filmography database. Subsequently, this version is revised and refined through further communication, mostly by phone. Online screening meetings could potentially be a valuable collaboratory facility enabling people from distributed geographical locations to share evolving film descriptions and exchange contributions to the analysis and indexing of films. Collaborative aspects of classification and indexing have also been studied by, for example, Albrechtsen, Pejtersen, and Cleal (2002) and Bowker and Star (1999).

**Research and development (R&D)**. At DIF most R&D work is done in externally funded projects. In these projects DIF provides input to the projects in terms of materials and the archivists' knowledge and gains new knowledge, materials, and tools to improve the collections of DIF. The R&D activities include (1) development of common tools such as archive information systems in general and databases containing specific filmographic data, (2) knowledge sharing by visiting other archives and gaining insight in their methods and services, and (3) work on archival development and standards. Collaboration with other archives and organisations is inherent in these activities. Indeed, common tools, visits, and standards can only be accomplished through collaboration across organisational boundaries. However, some R&D activities are performed through collaboration internal to the archive. One example is the work on the acquisition and daily administration of technology. This work is performed by an informally organised group, which meets and discusses. Everybody has his or her own functions, but the group members do the technology work together. The information flows in R&D organisations have been studied extensively by, for example, Allen (1977).

In the three archives collaboration becomes necessary because, normally, no single resource contains all information of relevance to a topic or request. Rather, the connections between requests and materials are established by means of several databases and the archivists' knowledge and expertise (see Figure 3). The archived materials are themselves not enough to

answer the users' requests because the materials as such are not searchable in any other way than by browsing the shelves. Even if all the materials were digitised it would still not be possible to match user requests directly with the relevant films, censorship cards, and other materials. This is partly due to current limitations in multimedia retrieval (e.g., Forsyth, 1999). Another basic complication is, however, that many of the archived films exist in several and often incomplete versions. Some of these versions are simply foreign language replicates of the original film, others are brought about by censorship decisions that banned different scenes at different times or in different countries, and still others are complete remakes by a different director. In many situations it is no simple matter to determine whether two films should be considered independent films or versions of the same film. Further, considerable amounts of footage are missing or in bad condition due to old age. It may be a genuine research task to determine whether individual scenes from different pieces of footage were included in a film or cut out. Consequently, a seemingly simple – known-item – request for a film on the basis of its title, director, and production year may turn out to be anything but trivial.

Further, the existing indexes of the archived materials are not enough to answer the users' requests because only part of the materials have been indexed and different parts have been indexed for different purposes. This could be considered a temporary phenomenon, but it is more likely to remain a permanent condition. DIF alone has a collection of more than 11000 films and estimates that it takes them an average of about one day to index a film according to their current criteria. All three archives have developed a number of databases to classify, index, and provide access to parts of their collections. These databases have been developed individually to suit the needs of different projects. For example, FAA has digitised seven of the 50 years of the Wochenschau newsreels and made them searchable on a CDROM. This was done for the Wochenschau's 50th anniversary. The Wochenschau database is, however, not integrated with the other local databases in terms of, for example, a common format or a single point of access. This illustrates the situation in all three archives. The archivists often find themselves in situations where they have to search several databases – and card catalogues – to answer user requests. Knowing where to search and knowing the format, scope, and limitations of the individual databases require detailed knowledge of the different databases. This knowledge cannot be acquired from documents as it has seldom been written down (see also
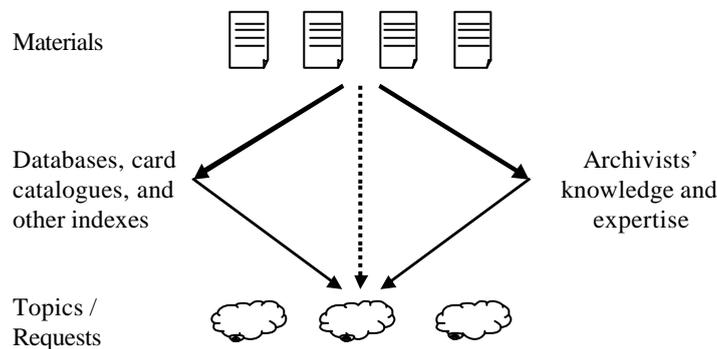


Figure 3. The connections between archived materials and user requests are established by means of databases and, most importantly, the archivists' knowledge and expertise.

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Hertzum, 1999). It is usually held by only a few archivists who have been involved in the creation of the database.

Finally, one archivist is often not enough to answer a user request. Staff at the archives are, however, adept at using each other as information sources. So while it might not always be straightforward for one person to establish exactly what a user requires someone else, with a different area of expertise, can be called upon to assist in this process. Colleagues are a source of expertise in two ways. Firstly in relation to the knowledge they have of the film domain, and secondly through their knowledge of the archive's information content and the ways in which this can be accessed. In the first instance it is often self-evident who the most appropriate person to work with would be as they are the responsible party for the relevant materials. Furthermore, most archivists are aware of areas where their colleagues are interested and well informed. In general, the archivists' personal interests outstrip the areas for which they are responsible. An exception is in relation to knowledge of the databases where those most closely associated with the database are most likely to be consulted. The archivists' reliance on their colleagues' expertise, as opposed to information held in databases, was repeatedly emphasised by the archivists. As one of the archivists expressed it "the best database is the brain of our colleagues".

## 5. DISCUSSION

The conditions for effective, non-collocated collaboration have been analysed by, among others, Dix (1997) and Olson and Olson (2000). These analyses caution that high hopes about what technology has to offer have seldom been attained in actual applications. Olson and Olson (2000) formulate four key concepts for successful introduction and use of collaboratories: common ground, coupling of work, collaboration readiness, and collaboration technology readiness. They conclude that non-collocated groups have a chance at succeeding with collaboratories if they have a firm common ground, loosely coupled work, and readiness for both collaboration and collaboration technologies.

### 5.1 Common ground

At a basic level, it is possible to identify common goals for the three archives. They all embrace the role as protector and mediator of cultural heritage. Also, the archives have a common interest in increasing the visibility of their services and collections to the public domain, for instance through increasing participation in international collaboration. However, a more in-depth analysis reveals that this goal of visibility and service to the public domain is perceived differently in the three archives.

FAA's commitment to the public domain is seen in the commitment to and realisation of user services. More than simply providing users with good resources for accessing FAA's collection, the goal at FAA is to anticipate user interests and develop the archive's collection accordingly. This philosophy is based partly on a particular vision of archives as information centres. However, it is also based in the belief that users are a potential source of expertise that can both assist archivists in understanding their collection more fully and contribute directly to the available knowledge about specific films or personalities.

NFA has a clear commitment to the public domain in their role as a national institution. They emphasise their role as custodians of unique material that has both national and socio-historical importance. It is against this background that NFA's emphasis on preservation and acquiring new material should be understood. In the services they provide users they supply information about the archive and its information content, primarily through expertise of the staff. This expertise is perceived as NFA's primary resource whereas users are seen as more passive receivers of information.

At DIF it is possible to identify a commitment to the public domain that reflects aspects found in the other two archives. There is, for example, a similar commitment to user service as seen in FAA. For DIF this is, however, primarily about improving the organisation of and access to its collection and less about seeking inspiration directly from users. At the same time DIF also strives to provide services that inform the public about the archive's collection and the activities with which it is engaged. One strategy in this respect is to conduct research that will contribute to the public understanding of filmmaking and film history.

Thus, while major activities, such as preservation and indexing of films, are common to DIF, FAA, and NFA there are important differences in how these activities are perceived and organised. Further, it must be born in mind that each of the archives is in itself a heterogeneous entity consisting of staff groups with different backgrounds and responsibilities. Figure 4 shows three of the staff groups at FAA and hints at the differences in their goals, tasks, and so forth. The figure also illustrates how abstraction levels and stakeholder domains provide a way of breaking the concept of common ground into a number of its constituent elements. Specifically, an analysis may find that the common ground of two organisations is restricted to some levels of abstraction (e.g., the level of goals only) and/or a subset of the staff groups.

In terms of organisational structure DIF is undergoing a transition from a hierarchical to a project-based organisation, FAA consists of self-organising groups that arrange their work according to the overall framework provided by management, and NFA has a hierarchical structure where the management and the heads of departments coordinate the work. These different kinds of organisational structure permeate the archivists' perception and performance of their work and, for example, influence how they communicate about activities. Organising a

| Domain / Level | Archivists | Researchers | Technicians |
|---|---|---|---|
| Goals and constraints | Manage archive collection | Produce new knowledge | Restore/preserve film material |
| Priority measures | Provide quality user service | Reveal archive resources | Historical authenticity |
| Tasks | Seek/retrieve information | Study archive; write articles | Care for film; support archive |
| Work processes | Serve users; work databases | Seek/produce information | Seek information; treat/edit film |
| Physical objects | Film; literature; databases | Archive; other academic tools | Film; editing desks; film literature |

Figure 4. Abstraction level and stakeholder domain matrix, FAA.

collaboratory according to any one of the work organisations found in the archives – project-based, self-organising, or hierarchical – is likely to alienate the two other archives from the collaboratory. It is by no means easy to devise an organisation of the collaboratory that fosters collaboration and sharing among the archives and, at the same time, acknowledges their individual identities, ways of working, and organisatio nal cultures. In this respect the introduction of a collaboratory shares many of the properties of an organisational merger, including that the benefits are most likely to show up gradually and concomitantly with the creation of a firm common ground.

## 5.2 Coupling of work

The archivists in the three archives complement each other's knowledge and collectively possess a detailed and extensive knowledge of the film domain and intersecting disciplines such as history. The spread of knowledge and skills across the archivists also evidences that high-quality results can often only be accomplished through extensive sharing of information and expertise. One task that often leads archivists to seek assistance from other staff groups and other institutions is the processing of user requests. This kind of collaboration is ad hoc and loosely coupled. Other tasks, such as preservation at NFA, are accomplished through a formal division of labour involving several staff groups. Hence, the coupling of work varies considerably from task to task. The amounts of film material held in the archives combined with the limited resources available to the archives mean, however, that the coupling across tasks has not been sufficiently tight to foster a gradual development of an integrated and consistent indexing of the materials. NFA is responsible for the continued development of a national filmography of Czech films and DIF is in the process of creating a complete filmography of German films, but the archives have the resources for only very few projects of this scope. Consequently, the filmography databases are not integrated with the databases covering books, newsreels, posters, and photos. Rather, each database is a standalone system targeted at the needs of an individual project. Extra resources have not been available for maintaining a common format or creating links among the databases. In relation to coupling of work across archive boundaries, the situation is compounded by the differences among the archives and a general lack of international standards for the classification of film materials. Though a complete and consistent classification of all the materials in the three archives is an intriguing thought it would probably be counterproductive to base a collaboratory on it. To acknowledge the conditions of the archivists' work and enable loose couplings across archive boundaries a collaboratory could, instead, provide support for evolving classifications, which can be created and revised gradually as new portions of the archived materials are being analysed.

## 5.3 Collaboration readiness

All three archives are involved in a number of national and international collaborations. These collaborations are necessary for the archives to fulfil their mandate, and they are initiated through the personal initiative of staff and through the archives' participation in the International Federation of Film Archives. For example, censorship material is important to the work of all three archives but NFA does not have its own collection of censorship material. DIF and FAA have such collections but need to develop tools and procedures for working with this material. As a result the three archives have, through their involvement in the Collate project,

initiated collaboration on the further development of a selected area of the archives' research. This collaboration unfolds around the design and implementation of a prototype version of a collaboratory for working with censorship material. Due to its central role in film analysis, censorship material is a good candidate for an area that can both provide an initial focus of a collaboratory and point toward opportunities for the gradual inclusion of a range of activities and materials central to the archives. Thus, the archives are ready for and already involved in collaboration with other film institutions. Parenthetically, it can be noted that the archives hold different views on some aspects of what collaboration entails, such as the extent to which they can benefit from a more permeable boundary between film specialists and laypersons.

## 5.4 Collaboration technology readiness

Due to the tight coupling between the institutional context and investments in information technology, the archives have each developed their particular configuration of information resources. For local databases, NFA's information resources are much more developed and sophisticated than those at DIF and FAA. In contrast, access to global communication channels such as email and the Web is most restricted at NFA. DIF and FAA have created intranets that serve as internal notice boards, and web sites that serve to increase the visibility of the archives and their activities. However, these facilities are neither used for internal debate among the archivists, nor for communication with lay users and collaborating institutions (except for providing contact email information). The differences in the archives' current information resources may instigate different expectations as to the facilities and technical sophistication of a collaboratory and different intimidation barriers for engaging in the use of a collaboratory. Though the criterion of collaboration technology readiness may seem to be of a more mundane nature than the three other criteria for effective use of collaboratories, Star and Ruhleder (1996) show that it may mask subtle issues and be crucial to the success of collaboratories.

## 6. CONCLUSION

Collaboratories are based on communication technologies such as the Internet and intended to foster increased collaboration and sharing of resources among organisations in a domain. The film heritage domain seems suited to the application of collaboratories because films and film-related materials are scattered across institutional as well as national borders. The three film archives analysed in this paper all have preservation, analysis, indexing, and retrieval of films as core activities but there are important differences in how these activities are perceived and performed. The analysis documents that collaboration – the focal point of collaboratories – is indeed an intrinsic element of the work of the archives. It is, however, an important theme how and to what extent the archivists can transfer their knowledge, skills, and collaborative practices to a collaboratory. While the present work analysis calls for modest claims about the short-term benefits of a film collaboratory it also points to the, allegedly, most important area on which to focus in the effort to make effective use of such a collaboratory. This area is the identification of a common ground that cuts through incidental differences between the three archives but at the same time acknowledges and accommodates the essential differences. This puts careful work analysis at the heart of the design and application of collaboratories.

Cognitive work analysis provides a conceptual framework for conducting such analysis of complex, dynamic work domains. Specifically, the analysis of means-ends relations for the various stakeholder groups was an effective means of identifying commonalities and differences among the archives as well as among groups within the individual archives. Such analyses seem suited for the identification of the common ground on which to base collaboratories and, hence, highly relevant to the design of collaboratories. At present, the focus of cognitive work analysis is mainly on decomposing work into its constituent elements. This supports the analyst in seeing beyond the current organisation of work but it also means that analysis of how collaboration is accomplished is currently less developed within the framework of cognitive work analysis. Our ongoing and future work is directed at providing analytic means of describing how actors, in their day-to-day performance of their tasks, bring the various elements of their work together in dynamically determined courses of events. That is, we seek to elaborate on the analysis of collaboration.

## ACKNOWLEDGEMENTS

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