

# User-Driven CHAOS: Tags and Annotations in Radio Broadcast Research

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**Abstract:** CHAOS (Cultural Heritage Archive Open System) provides streaming access to more than 500,000 broadcasts by the Danish Broadcast Corporation from 1931 and onwards. The archive is part of the LARM project with the purpose of enabling researchers to search, annotate, and interact with recordings. To support the researchers the optimal way, a user-centred approach was taken to develop the platform and related metadata scheme. Based on the requirements, a three level metadata scheme was developed: 1) core archival metadata, 2) LARM metadata, and 3) project-specific metadata. The paper analyses how researchers apply the metadata scheme in their research work. The purpose is to gain insight into broadcast researchers' tagging practice and motivation for tagging to inform future design of digital cultural heritage systems. The study consists of two studies, a) a qualitative study of subjects and vocabulary of the applied metadata and annotations, and b) five semi-structured interviews about goals for tagging. The findings clearly show that the primary role of LARM.fm is to provide access to broadcasts and provide tools to segment and manage concrete segments of radio broadcasts. Although the assigned metadata are project-specific, they have been applied to serve as invaluable access points for fellow researchers due to their factual and neutral nature. The researchers particularly stress LARM.fm's strength in providing streaming access to a large, shared corpus of broadcasts.

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## 1.0 Introduction

Digitization of cultural heritage collections is progressing rapidly and has opened up new possibilities of accessing, using, and re-using the knowledge embodied in the rich variety of cultural heritage collections across media. In recent years, the focus of digitization projects has turned to the question of how to provide efficient and effective access to these digitized collections for both academia and the general public.

One such project is the Danish project LARM Audio Research Archive (LARM is an acronym for the Danish words LydArkiv for RadioMedier which means sound archive for radio media. At the same time, it is a word-play as LARM means noise or sound in Danish). LARM is an interdisciplinary project, the goal of which has been the production of a digital infrastructure to facilitate researchers' access to the Danish radiophonic cultural heritage. Accordingly, a main outcome of the LARM project was the establishment of the CHAOS archive (Cultural Heritage Archive Open System) providing streaming access to more than half a million radio broadcasts by the Danish Broadcast Corporation (DR) from 1931 and onwards. The archive aims to support radio and audio based research by enabling researchers to search, annotate, interact with and communicate about radio broadcast.

Access to radio broadcast resources in the CHAOS archive is hampered by little and inconsistent metadata (Lund et al. 2013). The same challenge is described (Hollink et al. 2009; Raimond et al. 2014) in the context of similar audio-visual collections. In order to increase the number of access points and to support humanities scholars' research work, end-users can apply both metadata and free annotations in the CHAOS archive. The focus of the present paper is to analyse how radiophonic researchers apply metadata and annotations in their research work. The study is practice-oriented (Dourish 2003) and focuses on the researchers' incorporation, adoption, and adaptation of the developed metadata schemes into working practice. The analysis consists of two studies, a) a qualitative study of subjects and vocabulary of the applied metadata and annotations, and b) five semi-structured interviews with researchers about their goals for tagging. The following research question guided the qualitative study:

How and with what purpose do radiophonic researchers apply metadata and annotations to radio broadcasts as part of their research work?

The main purpose is to gain an understanding of broadcast researchers' tagging practice and motivation for tagging in order to use this knowledge in future design of digital cultural heritage systems. From a user perspective

the present study analyses core elements of knowledge organization in the context of radio archives. Digitization of cultural heritage resources such as radio broadcasts results in new research practices and tools, which are important to understand in order to support future scholarship in the era of digital humanities.

## 2.0 Metadata in broadcast archives

There is a substantial body of research literature that investigates collaborative user tagging and annotations systems especially in relation to textual resources. The main strengths of such systems are flexibility, simplicity, user perspective, etc. (Golub, Lykke and Tudhope 2014; Lu, Park and Hu 2010; Spiteri 2007), whereas some of the major research challenges (Hunter 2009) relate to 1) how to improve the quality of community-generated metadata without destroying communities' enthusiasm for tagging or compromising simplicity; 2) how to manage and adapt to changing terminology; 3) how to apply hybrid schemes that mix community tagging and professional approaches; and, 4) how to apply standards. In addition, the domain of audio-visual archives represents some specific challenges in relation to user-generated metadata. First of all, the temporal nature of both audio and moving images makes the annotation process particularly time-consuming (Oomen et al. 2010; Raimond et al. 2014). Secondly, the annotation process (Oomen et al. 2010) is more complex since each shot or time segment can potentially have specific semantic meaning. In a recent literature review, Oomen et al. (2010) discern the following four motivations for cultural heritage institutions to engage in social tagging: 1) bridging the semantic gap between the terminology used by professionals and search terms of end users; 2) enriching cultural heritage collections with factual and contextualized information; 3) increasing connectedness with the archives; and, 4) defining the future annotation workflow. The fourth motivation related to defining the future annotation workflow describes how archives look for alternative ways to create annotations due to the high cost of manual professional metadata. User annotation (Oomen et al. 2010) is seen as a potential alternative source in archives' annotation workflow just like technologies such as OCR and speech recognition.

There are several examples of cultural heritage institutions that experiment with user tagging and annotation of three-dimensional objects (Trant 2006) and photos (Hollink et al. 2004). In contrast, projects related to audio-visual material are scarce within the heritage domain. The following section will describe two notable exceptions.

First, the large scale pilot project, Waisda?, concerns (Gligorov et al. 2011; Oomen et al. 2010) user tagging of moving images. Creating value for both the end-user and

the audio-visual archive is the overall design principle behind Waisda?. Value creation for the end-user was sought by integrating social tagging into a game format where users tag television broadcasts in an online game environment. Value creation for the archives (Oomen et al. 2010) is optimized to ensure trustworthy tags that can be of added value for search and retrieval. Results from the Waisda? project regarding usefulness of added tags (Gligorov et al. 2011) show that at least 30% of the verified tags are proper Dutch words that, however, would not be used by a professional cataloguer. That is, tags describe the audio-visual material in a different way than professional metadata. Further, a qualitative analysis of a sub-sample of 1,354 tags shows that users (Gligorov et al. 2011, 151) “predominately describe *what* appears in the video using generic tags. Although the tags also provide some coverage of the subject, the *who*, and the location, the *when* in the video fragments.” A general observation (Oomen et al. 2010) from the Waisda?’s project on the differences between professional metadata and user generated tags is that tags focus on describing what is seen and heard within a programme and in contrast the professional metadata focuses on the topical subjects to which a programme refers.

The second study (Raimond et al. 2014) explores how user tagging can be applied to audio-visual material in the BBC World Service Archive and thus addresses audio archives specifically. As a consequence of the very time-consuming process of creating metadata manually, the British Broadcasting Corporation experiments (Raimond et al. 2014) with automatic annotation of audio programmes in the World Service Archive prototype. The experiment has investigated an alternative approach for publishing large audio archives on the web using speaker identification and automated tagging from both pre-existing textual metadata and the audio content. To compensate for the inaccuracy of the automated data, crowdsourcing mechanisms allow users to validate, correct, and add metadata. The analysis of types of tags added to the prototype archive is based on three broad categories. A total of 9,720 tags were added (Raimond et al. 2014, 7), and 19.5% of the tags belong to the “people” category, 7% of tags relate to “places,” and 73.5% of tags to “other concept.” Evaluation further shows that recall and precision improves as more users contribute to the prototype.

The two projects described above support the idea of working with user-generated content in audio-visual archives; however, the reported results can be considered preliminary and it is difficult to compare across the projects. Nevertheless, both projects (Skov and Lykke 2012) show that user-generated metadata can provide additional search entries that have the potential of supporting interaction and search processes of humanities scholars with a diverse range of information needs.

### 3.0 The venue of our study

The context of the present study is the LARM research project (2010-2013). The LARM project was a joint initiative between the Danish National Broadcasting Corporation (DR), the State and University Library (SB) hosting the Danish Media Archive, and a consortium of Danish university humanities departments. The main purpose of the LARM project was to establish the CHAOS system (Cultural Heritage Archive Open System), a research infrastructure that enables radio and audio based research. As part of the CHAOS system, the LARM.fm archive ([www.larm.fm](http://www.larm.fm)) was launched in November 2012. The LARM.fm archive provides streaming access to more than 1 million hours of Danish national, regional, and local radio broadcasts from 1931 and onwards. Furthermore, the archive allows researchers to search and annotate the recordings of the radiophonic cultural heritage and to communicate about and interact with the radio broadcasts. Radio broadcast forms an invaluable source to Danish culture and history and the multidisciplinary project included scholars from arts and cultural studies, literature, media studies, music studies, linguistics, and sociolinguistics.

To optimally support the researchers in their work (Skov and Lykke 2012), a user-centred approach was taken to develop the LARM.fm archive and metadata scheme. Lund et al. (2013) expressed a need for not only metadata that supports the effective retrieval of radio broadcasts, but also for adding research-specific annotations at both the broadcast level as well as at segments of broadcasts, e.g. specific sounds. A main outcome of the requirements analysis is that the needs are so diverse that it is unlikely that a single unified metadata list will suit all. As a consequence, three levels of metadata were developed: 1) core archival metadata; 2) LARM metadata; and, 3) project-specific metadata. The main objective in creating the CHAOS metadata schema was to develop a metadata scheme that was easy to work with, easily extensible, and would provide for flexible data exchange. For this reason, the metadata scheme was built on top of the Dublin Core Metadata Element Set (Dublin Core Metadata Initiative, 2012) as implemented by the European Broadcasting Union (EBU 2011). For each of the three metadata levels, a number of administrative metadata were identified. The metadata architecture provides for different help systems to support data entry and the annotation process. Their main purpose is to secure uniform entry points to help users in the retrieval of radio material. Figure 1 illustrates the proposed metadata architecture developed for CHAOS based on these requirements.

We describe each of these metadata levels and the annotation support systems in more detail below in this section.

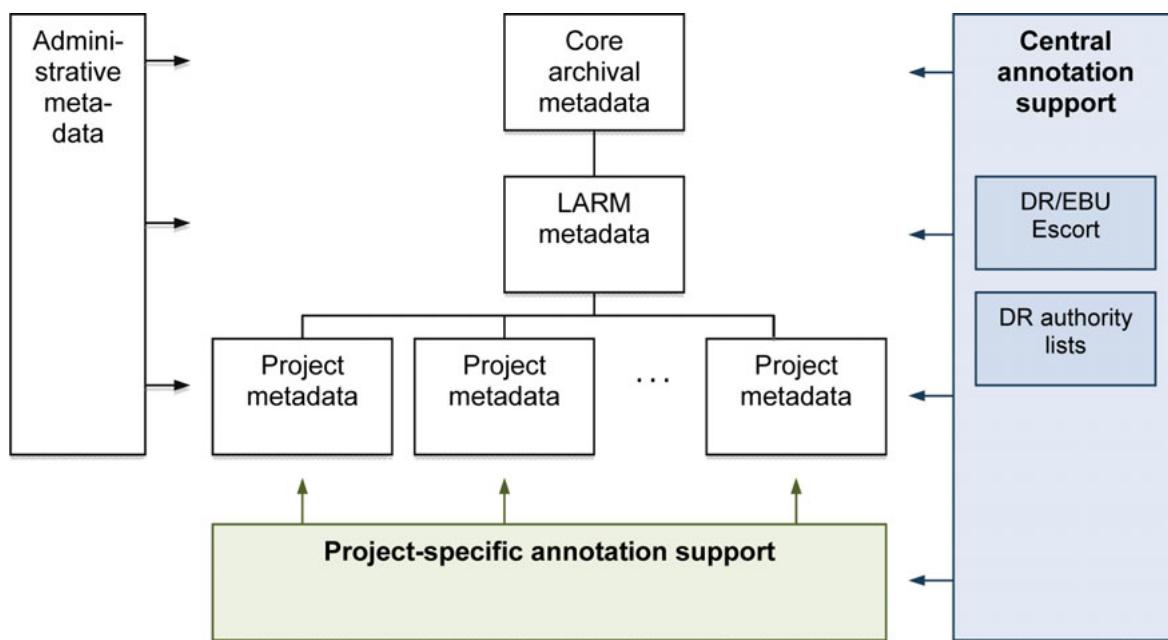


Figure 1. Metadata architecture in CHAOS. The architecture contains three different levels of metadata and provides for both central and project-specific annotation support.

Metadata element	Description	Example
Radio channel	Broadcast channel	P2
Program title	Original title	Til Italien!
Program start (time)	Date and time for beginning of program	18. mar. 2006 kl 19:00:00
Program end (time)	Date and time for end of program	18. mar. 2006 kl 19:30:00
Abstract	Description of content	Mendelssohn: Symfoni nr 4. Den Italienske. Stuttgarts Radiosymfoniorkester. Dirigent: Roger Norrington
ID of origin	Unique Production ID	
Creator and role	Producer, etc.	Hans Hansen (Producer)

Table 1. Example of core archival metadata elements

Core archival metadata covers metadata inherited from the original data source—usually the Danish Broadcast Radio (DR) or the Danish State and University Library (SB). This core metadata is immutably tied to each broadcast and is regarded as historical data, with all the possible flaws this might contain. Core metadata is assigned at the level of individual broadcasts and is intrinsic to the broadcast. The amount of data is limited to technical information for the most part, with a few descriptive additions, e.g. program title, creator, and abstract. Among the descriptive metadata, subject terms assigned in the abstract metadata field and creator in the Creator and role field are the most frequent metadata. Table 1 shows an example of some core archival metadata elements:

### 3.1 LARM metadata

LARM metadata is descriptive metadata with the aim of enriching the sparse core metadata with more detailed information about content and participants of a broadcast. LARM metadata are also assigned at the level of individual broadcasts and are editable by all LARM members. Typically, the first researcher to use the radio program for research purposes adds metadata. Table 2 shows an example of some LARM metadata elements.

Metadata element	Description	Example
Program title	If title at the archival level is absent or incomplete.	
Person—participant	From help system (controlled)	Roger Norrington
Person —subject	From help system (controlled)	Felix Mendelsohn Bartholdy
Genre	From help system (controlled)	Koncertoptagelse
Related objects	Webpage, podcast, photo, etc.	URL to ressource
Subject	From help system (controlled)	Klassisk musik
Tag	User defined keyword (uncontrolled)	
Annotation	Annotation related to entire show	

Table 2. LARM metadata elements, descriptions and examples

Metadata element	Description	Example
Title	Object title	Introduktion til koncerten
Person—participant	Person participating in show	Magnus Møller
Person —subject	Person as subject for the show or part of show	
Genre	Project defined genre (from help system)	Speak
Related objects	Webpage, podcast, photo etc.	
Subject	Project defined subject (from help system)	
Tag	Project defined subject (uncontrolled)	
Object start	Time for start of part of program	19:00:00
Object end	Time for end of part of program	19:05:30
Annotation	Project annotation to entire show or part of show	

Table 3. Project-specific metadata elements, descriptions and examples

### 3.2 Project-specific metadata

Project-specific metadata are of a more analytical nature and are associated with one or more individual research projects within the LARM project. Project-specific metadata can describe an entire broadcast or parts of a broadcast. Project metadata are assigned by the researchers working on a LARM research project, and are owned by that research project. Metadata at the project level are designed to be open and flexible, but the suggested metadata elements are shown in Table 3.

Controlled keywords and genre information could originate from an existing support system within CHAOS or each project could define their own authority lists.

### 3.3 Administrative metadata

An important part of a working metadata system is the administrative metadata. In CHAOS, administrative metadata are related to each of the three metadata levels and

provides information about the metadata record, i.e., when and by whom the record was created. These data can be generated automatically, e.g. from user login. Table 4 shows some examples of administrative metadata related to the archival level.

Administrative metadata at LARM and project-specific levels should also include information about when and who has edited records. Here, administrative metadata does not only have to be related to the record as a whole, but can also apply to actions taken on individual metadata elements in the metadata records, i.e., who changed the title information and when.

### 3.4 Annotation support

The proposed metadata architecture (see Figure 1) provides for different help systems to support users in their data entry and annotation process. Such support systems could take the form of standardized vocabularies or taxonomies, authority lists of person names, etc. Their main

Metadata element	Description	Example
ID	Unique ID in CHAOS	
Source system	Originating source system	DR
Original ID	Unique record ID in source system	7776671
Date	Date and time for injection in CHAOS	

Table 4. Administrative metadata elements, descriptions and examples

purpose is to secure uniform entry points to help users in the retrieval of radio material.

#### 4.0 Research design

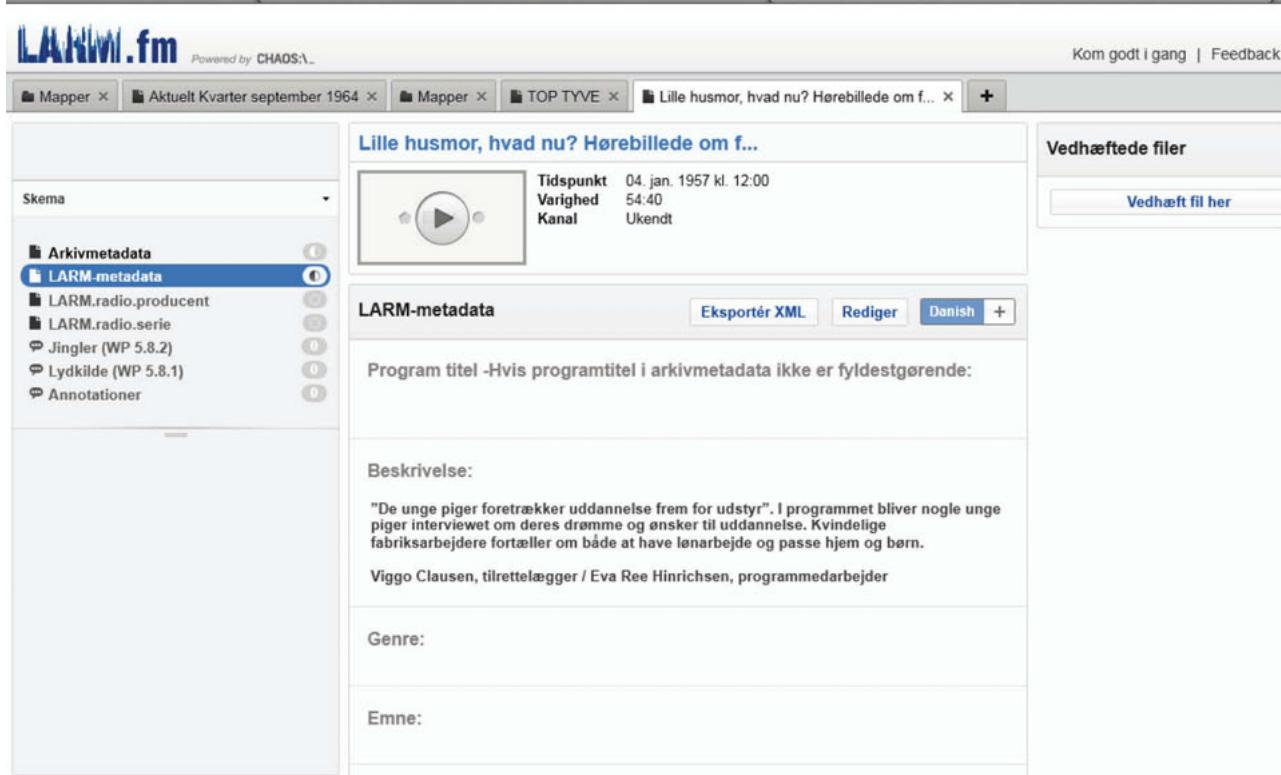
The overall methodological approach for the present study is virtual ethnography as defined by Hine (2000). She describes virtual ethnography as the transference of the ethnographic tradition as an embodied research instrument to the social spaces of the Internet. Like Hammersley and Atkinson (1995, 1) she sees ethnography as a research methodology where the researcher participates, “overtly or covertly in people’s daily lives for an extended period of time, watching what happens, listening to what is said, asking questions, collecting available data to shed light on the issues that are the focus of the research.” In virtual ethnography the key ethnographic principle, of developing understanding through participation and through a progressive collection of data and focusing on enquiry, remains consistent with the traditional approach to ethnography. The difference (Hine 2000, 45) is the field site that is virtual, consisting of experiential rather than physical displacement. The basic of online ethnography is a form of learning through immersion into the digital environment, supported by more systematic forms of enquiry, online or in the physical space.

The first virtual ethnographic studies began to appear in the mid-1990s where the ethnographic study of social interactions was moved to online settings, often existing independent of physical space. Early ethnographic studies of online environments (Hine 2008, 7) tended to stress the importance of understanding online social life in its own right. Later studies recognised the importance of offline contexts, and today virtual ethnographic studies often cross between online and offline settings.

An important issue for the online ethnographer is the question of presence. There is a range between full participant observer and full observer where the observation is covert and has the character of lurking. Participation at some level is important (Hine 2008, 9), since it allows developing conceptualizations to be tested through experience and exposed to critique by other participants. Some virtual researchers (e.g., Beaulieu 2004) comment that

lurking should not be taken as ethnographic approach in itself, since lurking implies a lack of engagement and ability to develop the in-depth understanding from the inside. An ethnographer who simply collects a corpus of messages in one visit would miss experience of interaction, will miss the experiential knowledge that comes from feeling what it is to post a message, wait to see and experience how it will be received. Hine (2008, 11) points out that lurking may be a useful part of the virtual ethnographer’s repertoire when it mirrors the practices of ordinary members of a group, and where it allows for a period of familiarization in order to facilitate a smooth entry into active participation. In practice, each ethnographer (Hammersley and Atkinson 1995) has to find an appropriate way to be present for his or her own field site.

The research design of the present study consists of two studies: a) online observation of the radiophonic researchers’ interactions and application of metadata and annotations to radio broadcasts in the LARM.fm archive, and b) semi-structured interviews with five radiophonic researchers about their motivation, goals, and experiences with LARM.fm and the metadata scheme. The online archive was studied for an extended period of time, from November 2012 when LARM.fm was opened to July 2014 when the LARM research project officially closed. All three authors were part of the LARM research group and had a profile in LARM.fm, assigning metadata and annotations as part of their research activities concerning metadata description and indexing of radio broadcasts. Thus, in one way the authors participated fully and overtly in the activities and interactions of the online archive. At the same time one can discuss whether our participation can be characterised as full participant observation at the utmost range as we participated as “metadata researchers” studying metadata, facets, and indexing practices in broadcast research as opposed to the “radiophonic researchers” who searched for and assigned metadata and annotations as part of their research on broadcast, media, language, or sound research. We were not lurkers since we were true and full members of the LARM group and LARM.fm. One can say that we assigned metadata and annotations with another focus, but we shared engagement and intention with the radiophonic researchers in studying how to


 A screenshot of the LARM.fm website interface. The top navigation bar includes links for 'Mapper', 'Aktuelt Kvarter september 1964', 'Mapper', 'TOP TYVE', and a search bar for 'Lille husmor, hvad nu? Høre billede om f...'. On the right, there are links for 'Kom godt i gang' and 'Feedback'. The main content area shows a program titled 'Lille husmor, hvad nu? Høre billede om f...'. It displays the following details: 
 

Tidspunkt	04. jan. 1957 kl. 12:00
Varighed	54:40
Kanal	Ukendt

 Below this, a section for 'LARM-metadata' includes buttons for 'Eksportér XML', 'Rediger', and 'Danish'. A note says 'Program titel -Hvis programtitel i arkivmetadata ikke er fyldestgørende:'. The 'Beskrivelse:' field contains the text: 'De unge piger foretrækker uddannelse frem for udstyr'. The 'Genre:' field is empty, and the 'Emne:' field is also empty. On the left sidebar, under 'Arkivmetadata', the 'LARM-metadata' tab is selected, showing categories like 'LARM.radio.producent', 'LARM.radio.serie', 'Jingler (WP 5.8.2)', 'Lydkilde (WP 5.8.1)', and 'Annotationer'.

Figure 2. An example of a LARM metadata description in LARM.fm.

build a research infrastructure for radio and audio research.

During the study period, we equally tried out the metadata schemes and LARM.fm features and watched what happened online—who was tagging, what types of radio broadcasts were tagged, what type of metadata and facets was used, what vocabulary was used, what communication and comments appeared. The observations and experiences from the participation were discussed currently during the observation period with the radiophonic researchers at project meetings. In order to obtain a more detailed insight into the tagging practice, the informal discussions were followed up with individual interviews with five of the primary members/taggers in order to shed light on their motivations, considerations, and practices in the use of the LARM metadata schemes and annotations in their research process. The interviews were carried out in April 2015 and although the LARM research project had closed down, the researchers continued to use the LARM.fm for searching and description of radio broadcasts selected for research.

#### 4.1. Analysis of the virtual ethnographical data

Our primary data are the metadata and annotations generated and shared by the LARM researchers during their research work. For the present study, we have extracted an

xml-file from LARM.fm and processed the xml-file using a XSLT-style sheet to generate a file suitable for import into MS-Excel. We used the Excel file for the coding and categorization of the metadata. During the categorization process, we consulted the live Larm.fm to see the context for the metadata. Figure 2 shows an example of a LARM metadata description in LARM.fm and Figure 3 an example of the Excel file.

We use the typology of metadata types developed by Gilliland (2000) who divides metadata into content, context, and structural metadata as the overall methodological and theoretical framework for the analysis of metadata and annotations. We base the facet analysis of subject metadata on Vickery's (1960) understanding of facets and facet analysis. The description of annotations is inspired by the typology presented in Lancaster (2003).

The coding was carried out as open coding in four steps: 1) identification of categories of metadata descriptions; 2) description and labelling of the identified categories; 3) comparison of categories; and, 4) definition of categories based on a common analysis and the theoretical framework mentioned above. The coding was carried out by one of the authors who later discussed and validated the coding with the co-authors.

A	B	C	D	E	F	G	H
ID	Larm.Archive/F	Larm.Archive/Title	Larm.Metadata/Title	Larm.Metadata/Genre	Larm.Metadata/Subjects	Larm.Metadata/Description	Larm.Metadata/Tags
93aec0af-2cd1-c04f-8d2c	1956-11-01T1	AKTUELTT KVARTER. BLA. NASSER OG EISENH				GOD KILDE!	
ea71d8af-ff44-4945-b1de	1900-01-01T0	DM i Rock 1993	DM i Rock				Kashmir DizzyMizzLizzy
85b2859a-6640-d041-85	2001-09-11T0	EKSTRA RADIOAVIS PÅ P2/P3. 17.30					GeorgeBush
2d9f76a5-7797-7745-806	1900-01-01T0	PROGRAMOVERSIGT.					
59187da8-4127-b04b-83	1940-08-01T2	Reportage - En rejse i Tyskland - Arbejdstjenes					
e18f4c98-f4c2-7049-919c	1900-01-01T0	Klinkemand og landevejsridder					
f654d69f-59f7-3947-a6c5	1952-10-01T1	ENGELSK FOR BEGYNDERE					
8f037fa4-e987-c546-a0dc	1900-01-01T0	UDSENDELSE FRA BBC.					
c20137a7-4ea7-e341-b7f	1951-03-21T1	Pressens Radioavis - Afsløring af mindetavle					
bd4917a3-3042-9248-80	1900-01-01T0	VERDENSBANKSDEMONSTRATIONER SEPTEMBER 1946					
689886a3-e551-3243-8a	1946-10-26T1	AFTENPASSAR MED KAREN BLIXEN.					
c0a094ad-e37e-6841-bb	1900-01-01T0	Det sidste juletræ					
4e7b38a1-e65c-8942-a3c	1900-01-01T0	ISLANDS FLAGSANG.					
25b288a4-a792-dd4e-b41	1963-01-23T2	Astrologi i fortid og nutid					
						Start: 32:10 Indslag i portretudsendelse om landsretssagfører Carl Madsen. Han støtter Christiania og kritiserer den københavnske byggejuntas forsøg på at lukke fristaden. Kan ikke forstå sig et tilsvarende eksperiment i Sovjetunionen, fordi de sociale forhold der er så meget bedre. Carl Madsen beskriver	

Figure 3. An example of the Excel file.

#### 4.2. Semi-structured interviews

When users annotate radio broadcasts in the LARM.fm archive, their username is added and displayed in the system. Based on the analysis of user-generated content five primary taggers were identified. They were invited to take part in a focus group interview, the aim of which was to explore the use of the LARM metadata scheme. These five members/taggers were chosen, because they are among the main contributors to the annotations in LARM.fm.

All five scholars agreed to participate, however, due to geographical distances, two of the scholars were interviewed individually and three scholars took part in a focus group interview. One of the individual interviews was conducted via Skype and the other two interviews at the participating scholars' university office. The interviews were carried out in April 2015; they were sound-recorded and the individual interviews lasted, respectively, 25 minutes and 65 minutes, whereas the focus group interview lasted 75 minutes. A main methodological advantage of focus group interviews (Halkier 2010) is that it generates an opportunity to collect data from the group interaction and discussion. In this study the focus group interview method provided the opportunity to discuss and compare diverse examples and practices of searching and annotations in the LARM.fm archive. In this way the focus group interview provided different perspectives on applying metadata and annotation due to variances in research area and work processes.

The interview participants came from different academic disciplines. That is, one linguistic researcher, one researcher within media studies, two researchers from arts and cultural studies with focus on auditory resources, and

one researcher from mathematics and computer science. In that way, the interview participants reflected the multi disciplinary concept of the LARM research project. The participants consisted of three postdoctoral researchers, one assistant professor, and one associate professor.

The interviews were semi-structured (Kvale 1996) and addressed four topics:

1. How do researchers use and apply LARM metadata in the LARM.fm archive? (Research context, purpose of and motivation for adding LARM metadata, and how do LARM metadata add to the Core archival metadata?)
2. How do researchers use and apply free text annotations? (Research context, purpose of and motivation for adding annotations, how do annotations add to the metadata, and types of annotations used? The different types of annotations (see Table 6) were discussed).
3. What is the researcher's purpose of using the LARM.fm archive? (Searching, access, sharing data and knowledge, analysis, communication with peers, etc.)
4. What is the researcher's view on the crowdsourcing idea behind LARM.fm?

The interviews were conducted by two of the authors and were sound-recorded. The interviews were not fully transcribed. Instead, summaries were written representing a meaning condensation of each of the interviews. As

part of the meaning condensation, summaries were structured according to the four main topics addressed in the interviews. The summaries were read and discussed by the three authors aiming at understanding the user practice of radio researchers in regard to "how" they use and apply metadata and "what" motivates their tagging behaviour. Findings and quotes from the interviews are presented in the following section.

## 5.0 Findings on broadcast metadata and annotations

A broad range of persons affiliated with the LARM project tried out the metadata scheme during the project period from November 2012 when LARM.fm was released to the present; in total, 75 persons. These persons consist of different types of members contributing to the project. It is possible to divide the members into two main groups. The largest group is the radiophonic researchers that used LARM.fm and the metadata scheme as part of their radio broadcast and sound research. Their research projects cover subjects within radio broadcast, media, language, or sound research. The "radiophonic researchers" consist of the principal investigators (PI), PhD students, affiliated researchers, and masters students from the partner universities. The radiophonic researcher group also includes student assistants who form half of the radiophonic group. The other group of members are the "metadata researchers" who work with the development of the LARM.fm infrastructure, either from a technological or archival perspective. We have studied the practice of all members, but our primary focus is the radiophonic researchers that also account for most metadata and annotations. The metadata researchers only tagged a few radio broadcasts in order to test the functionality of the system.

Nine hundred ten radio broadcasts were tagged with a combination of LARM metadata and annotations. Altogether, the annotations and metadata represent a variety of aspects. Basically, the descriptions relate to content, only one refers to context in form of a link to a related website.

### 5.1. LARM metadata

LARM metadata has been assigned to 480 broadcasts, most frequently to the Title metadata field, followed by Tag metadata, Genre, Description, and Subject. No data has been assigned to the Contributor field. Table 5 shows the number of programmes per metadata tag type. None of the suggested annotation support systems have been generated and applied to ensure quality and consistency in the metadata assignment. In effect, some data is placed incorrectly in wrong metadata fields, e.g. subject data and

Metadata tag	Number of programmes
Larm.Metadata/Title	112
Larm.Metadata/Genre	16
Larm.Metadata/Subjects	10
Larm.Metadata/Description	384
Larm.Metadata/Tags	12
Larm.Metadata/Contributors	0
Larm.Metadata>Note	38
Annotations	529

Table 5. Number of programmes per metadata tags and annotations.

genre data have been placed in the Title metadata field, or information about rebroadcast has been applied in the Title or Subject metadata field. Genre is the most correctly assigned metadata.

The Title metadata is the most varied, with data about time for rebroadcast or specification of the title as the most frequent data. A few taggers add data about cast, genre, and subjects in the title metadata field. The applied genre metadata represent classical genres, e.g. News, Drama, Music, Book reviews, Reportage, and Quiz. The term "raw recordings" has been assigned to some broadcasts, representing a technical aspect rather than the genre. Only very few Subject metadata terms were assigned and those were at a broader conceptual level, e.g. Nazism, Unemployment. Half of the subject metadata are rather specific genre metadata, e.g. program outline, hit lists. Another frequent subject metadata category is rebroadcast information. Description metadata consist of two primary types of annotations. Half of the Description metadata are descriptive annotations and the other half a mix of informative and critical annotations. The Tag metadata primarily describe either subject or main characters. No administrative metadata have been applied, and no annotation support systems have been generated.

In the follow-up interviews, participants were asked how they use and apply LARM metadata. Two of the researchers have never added LARM metadata and have only used them incidentally as an extra search entry. The three other researchers mainly apply LARM metadata either to add to the incomplete Core archive metadata or to correct errors such as spelling errors, wrong transmission time, OCR errors, etc. The following two quotes from the interviews show that adding LARM metadata is considered a secondary task done for the benefit of other LARM.fm archive users and to help improve metadata quality in the archive:

If you add LARM metadata, it's usually something that you already know yourself. It's extra work....It's something you do for the benefit of future users, not because it's essential to your own work process. (Interviewee E)

(I have) sometimes corrected metadata if I could see that the title or transmission time was not correct. For example, a radio broadcast that I have used as empirical example is described as a radio programme lasting 40 minutes. But when you read the radio programme listings you find out that it's a 4,5 hours programme. Then I have added to the metadata that this broadcast is just a section of a longer programme. I pass on the research that I have done. (Interviewee C)

The interviews further show that the researchers aim at providing neutral, descriptive LARM metadata. Interviewee C explains how adding metadata is part of his research practice:

I participate as a researcher. I always try to add information that is relevant to my own research and to other researchers....I would never comment like you do on YouTube.

They trust metadata provided by other LARM.fm users, however, they would prefer knowing the name of the user providing the metadata in order to be able to understand the context and validity of the metadata provided.

## 5.2. Project metadata and annotations

The Project metadata is primarily content metadata describing a variety of aspects of the broadcast content, e.g. "subject—9/11," "main character—Nasser," "speaker—male speaker" or "name of speaker," "origin of speaker in form of location name" to specify the dialect spoken "Aulum, Hobro, Herning," "genre—British WW2 reportage." A larger group of the Project metadata describes "sound elements." Sound elements refer to the source of the sound, e.g. footsteps, railway station, sailing, voices.

The Project metadata has several forms, e.g. single terms, transcriptions, citations, long annotations, short annotations, annotations in form of headlines. The most frequent form is annotation. The majority are indicative annotations, simply summing up the content of the broadcast. A few are informative, summarizing the substance of the broadcast or analytical, relating the broadcast or the broadcast subject e.g. into a historical context. Some Project metadata is evaluative and critical commenting on the quality of the content of the broadcast. A few other annotations

sum up that parts are missing, unclear, or inaudible. A special case is annotations that, in a very detailed form, describe the composition of a broadcast from a formal perspective (for examples see Table 6). Specifically, the annotations describing sound elements and annotations describing broadcast composition have each been applied by a specific group of researchers that respectively study soundscapes and sonic logos. Only very few contextual metadata appear in form of link to related websites.

An ongoing research project called CoSound (<http://www.cosound.dk>) is using the LARM.fm archive and has applied a distinctive set of Project metadata. These metadata have been applied with a technical purpose as a means to support automatic extraction of broadcast sequences with known or recognizable voices. The CoSound researchers use this sample of voices to develop an algorithm for speech recognition. The applied CoSound Project metadata describes the location of the voice and the status of the voice, whether familiar or known. When known, the name of the speaker is also applied as metadata. The metadata has been applied for automatic purposes but provide useful access to known speakers.

The interviews show that applying annotations is intertwined in the individual scholar's research process. That is, the purpose of applying annotations is to support the aim of the specific research project and to support different steps in the research process such as identify and mark-up broadcasts of potential interest, identify and mark-up relevant sections in a broadcasts, or start the initial analysis process by adding annotations reflecting the researchers scope. For example, interviewee D explains how he uses annotations to mark-up broadcasts of potential interest such as the radio news or sections with people speaking different Danish dialects. Likewise, interviewee B annotates the intro and outro of specific radio programmes, because contextual programme information is often included in these snippets. Both are examples of annotations used as a segmentation tool in the initial steps of the research process. Interviewee C uses thousands of annotations to identify and mark-up occurrences of urban sound or noise such as "door slamming" or "foot steps." The detailed annotations of urbane soundscapes can be seen as part of the analysis process.

Based on the different types of annotations identified, the interviewees also discussed descriptive versus analytical, interpretative annotations. The researchers mainly viewed their annotations as descriptive and, as with the application of LARM metadata, they aimed at objectivity. The interviewees discussed the sometimes-invisible boundaries between descriptive and interpretative annotations; nevertheless, they maintained that annotations about, for example, specific soundscapes or dialects, could best be described as segmentation of broadcasts based on specific research

Annotation—indicative summary	Introduction to broadcast / Annotator 1 - Mr. Lindum is saying good evening in English / Annotator 1 -
Annotation—informative summary	He was married at the age of 20. Earned a living by harvesting peat and lawn mowing/ Annotator 2 - Talked about his adventures during the 1864 war./ Tilde Ranis - Talked again about his missionary work./ Annotator 2 - Talked about life as an old man. His daughter is also talking./ Annotator 2 - Second 100-year old man from Borghede? (located in Southern Jutland) Did also participate in the 1864 war Married for the first time just after the war and has been working as a tailor. Talked in this segment about his wife and children./ Tilde Ranis Talked about and recited a poem he wrote about the war in 1870./ Annotator 2 - Talked about health and walks./ Annotator 2 - Talked about his adventures during the 1864 war./ Annotator 2 - Talked about the war in 1870./ Annotator 2 - Talked about birthday arrangement for Hans Poulsen and his own up-coming 100th birthday. His daughter's voice heard./ Annotator 2 - Talked about greeting the king./ Annotator 2 - (continued)
Annotation—analytical summary	WW2: Wives of Danish soldiers invited by Himmler to visit husbands in Germany / Annotator 3 - Patriotic speech/ Annotator 3 -
Annotation—summary of sound elements	CAR/ Annotator 4 - DOOR SLAM/ Annotator 4 - DRIVING/ Annotator 4 - SPEAKER VOICE/ Annotator 4 - SPEAKER VOICE/ Christian Dresler - SPEAKER VOICE/ Annotator 4 - MUSIC/ Christian Dresler - BAR/ Annotator 4 - MUSIC/ Annotator 4 - BAR/ Annotator - MUSIC/ Christian Dresler - BELL/ Annotator 4 -
Annotation—transcription	Ladies and gentlemen. A new year begins and we leave the old year without sorrow. We have lived a year which shaped itself very unusual. A year that brought us all surprises and disappointments but a year that functioned with its solemn lesson which has caused us to realize how much good and beautiful our country holds... / Annotator 5 (continued)
Annotation—information about incomplete or inaudible broadcast	Error in sound file (loud noise)./ Annotator 6 - / Annotator 7 -
Annotation—research related information	Various test data
Annotation—information about formal composition	No outro. Direct pass to news broadcast./ Annotator 6 - "Harddisken" intro end/separator: "Harddisk" time repeated three times. Dramatic expression. Separator #2 followed by separator #1 Annotator 6 - "Harddisken" separator #2 Same as intro end. Begins with a "Harddisk" time and three markers made by a symphonic orchestra. / Annotator 6 - Jingle: separator #2 followed by separator #1. / Annotator 6 -

Table 6. Examples of annotation types (examples translated by the authors).

aims. Accordingly, the researchers viewed these annotations as non-interpretative.

### 5.3. Vocabulary and specificity

The LARM metadata are expressed in Danish everyday vocabulary, except for the analytical data, e.g. genre or composition, that are expressed by the special language used within the research field. The level of specificity is

generally high. Only the LARM Subject metadata tend to be at a broader level. Sometimes the Subject metadata is enriched by synonyms.

### 6.0 Discussion and implications

A large and varied group of LARM researchers used the LARM metadata scheme during the project period. The true taggers are the radiophonic researchers; the metadata

researchers primarily carry out test work. In general, the researchers use the metadata scheme as intended. They mostly apply project-specific metadata and annotation to be able to retrieve and access segments of broadcasts for individual research purposes, but for about half of the annotated broadcast, they assign the common LARM metadata as well. Here, their purpose is twofold. LARM metadata is assigned to support individual retrieval and access, but as qualitative, domain-specific metadata is rare, they also assign LARM metadata to provide better access and background information for the research community in general.

Understanding user motivation is a key element when working with user-generated metadata. In the present study, the users' main motive for applying metadata and annotations was to support their personal scientific analysis. Studies of collaborative tagging in the context of other media types have similarly found that (Golder and Huberman 2006, 207) "a significant amount of tagging, if not all, is done for personal use rather than public benefit. Nevertheless, even information tagged for personal use can benefit other users." Given the relatively low number of tags added to the LARM.fm archive, the question of how to engage and motivate users to take part is central. Related projects in the domain of audio-visual archives have reported interesting results on engaging users either with gaming methods (Oomen et al. 2010) or focusing on communities with specific interests (Raimond et al. 2014) related to the resources. Future work in continuation of the LARM research project will likewise experiment with gaming methods.

The researchers primarily assign factual metadata, e.g. main characters, speaker, origin of speaker, source of sound. Neutral and non-interpretive data are key. That is, annotations predominantly describe what can be "heard" in the broadcast in contrast to describing the topic, which is covered in the Core archive metadata applied by the professional DR cataloguer. Similarly Oomen et al. (2010) report how taggers of moving images predominantly tag "what" appears in the videos using generic tags.

Further, the findings from the present study illustrate the challenges pointed to by Hunter (2009) on how to apply standards and how to improve the quality of community-generated metadata without destroying users' enthusiasms for tagging. On one hand, metadata and annotations should provide the flexibility necessary to describe highly individual research projects, and on the other hand researchers call for high quality metadata, administrative metadata providing provenance and ensuring validity of the assigned metadata, and guidelines for how to apply metadata and annotations consistently and transparent. This tension cannot easily be solved.

The analysis of annotations and interviews clearly shows that LARM.fm is not the venue to share analysis and communicate about research findings. Instead, the primary role of the LARM.fm archive is to provide access to broadcasts and provide tools to segment and manage concrete segments of radio broadcasts.

## 7.0 Conclusions

The two studies provide new and original knowledge to the scarce research about metadata and tagging practice in the audio-visual domain of cultural heritage. The studies clearly show that tagging in LARM.fm is not social or collaborative. The radiophonic researchers tag with the purpose to administer their personal scientific analysis. Researchers' practice and tagging behaviour vary greatly and is highly related to their specific research projects. At the same time, however, the researchers strive to apply factual, non-interpretive, and more general metadata for the benefit of the community—as opposed to analytical, interpretive metadata. They consider the primary role of the LARM.fm archive to provide access to broadcasts and provide tools to segment and manage concrete segments of radio broadcasts. Hence, their purpose is twofold. They assign metadata to support individual analysis, retrieval and access, but they assign the metadata in a form so that the metadata over time may serve as invaluable access points for fellow researchers due to their factual and neutral nature. The interviewed researchers particularly stress LARM.fm's strength in providing streaming access to a large, shared corpus of broadcasts. The applied tags and annotations are highly specific and expressed in everyday vocabulary, except for the analytical metadata that are expressed in special language of the research field. No annotation support systems have been generated and used, thus the applied metadata are free and not controlled to any common authority list. In the future work related to improving the research infrastructure, the study confirms that knowledge organization tools and methods such as metadata and annotations can continuously play an important role. If we want metadata that support cross-disciplinary retrieval, we need to introduce actively or automatically support systems that bridge between disciplines and vocabularies.

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