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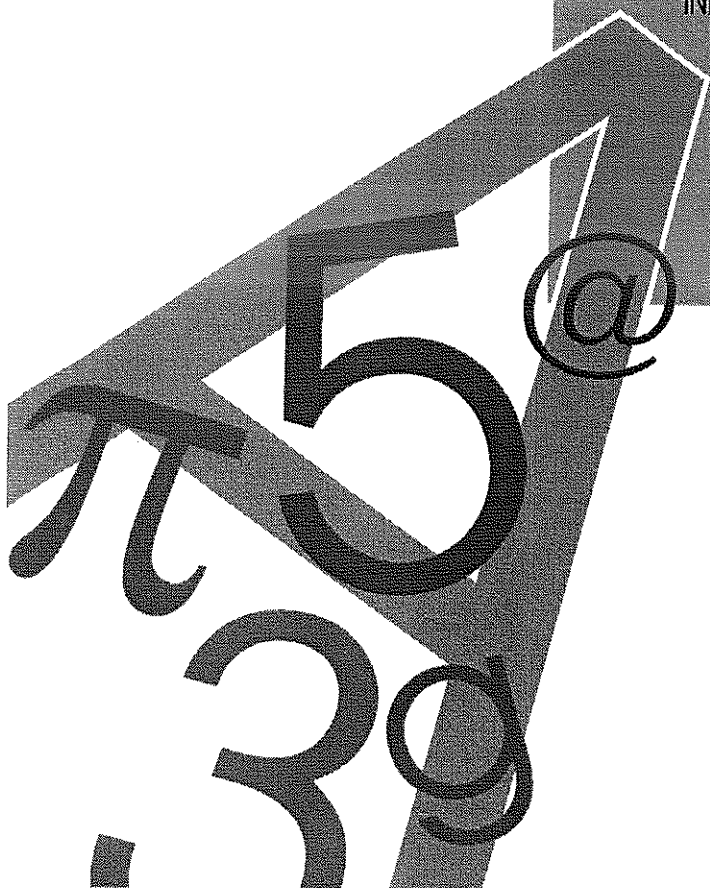
Technical Report

Vanda: A metadata model for supporting new
usage of historical audio-visual archives material

Giuseppe Amato, Donatella Castelli, Paola Venerosi

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VandA: A metadata model for supporting new usages of historical audio-visual archives material

Giuseppe Amato, Donatella Castelli, Paola Venerosi

IEI-CNR -Italy
{amato,castelli,venerosi}@iei.pi.cnr.it

Abstract

The paper proposes a new metadata model (VandA) directed to support innovative exploitation of Historical AV Archives content. After an analysis of the needs of traditional and potential users, the model is illustrated through running examples to show at what extent the new usages can be supported.

1. Introduction

There is a growing demand for different and new ways of using the content of historical audio-visual (AV) archives. These range from different forms of TV programs, new on-line outlets in the Internet, CD-ROMs, etc., that illustrate and interpret events from the past, to research source of information exploited not only by historiographers, but also by teachers, that use it as interactive learning materials, and by program makers and film directors that are interested in observing how a particular actor/film director performed.

Within this emerging context new search methods are envisioned. Traditional search based on textual description and browsing seems to be insufficient. Now users require to express requests able to identify in the visual component portions and structures (shot, sequences, frames, shapes, colours), and in the audio component words and sounds from the soundtrack. They also demand advanced searching methodologies and tools such as the automatic extraction of key-words, visual abstract, story-board, etc.

With the above premises, cataloguing methods need to be rethought. The traditional level of cataloguing detail is insufficient to describe the information needed to find programme, extracts, etc. for different usages. Furthermore, the document must be described on its components, and/or their parts; the textual description must be harmonised with physical features representation.

The aim of this paper is to highlight which are the cataloguing needs raised by the new supporting technology for historical AV archives and to illustrate how the use of an appropriate cataloguing metadata model can contribute to the satisfaction of these needs.

The paper begins with a detailed analysis of the new needs brought by the different classes of historical AV archives users (Section 2). Then, it proposes a new metadata model, called VandA, (Video and Audio) that combines descriptive

features of traditional AV historical archives with features employed by advanced AV digital applications (Section 3). This model is illustrated through running examples that show to what extent it can support the new usages of the historical AV archives (Section 4). The paper ends by discussing the limitations of the model and how it could be extended to overcome them (Section 5).

2. Usage and Requirements

The digitalization of historical audio visual archives allows the application of Internet advanced technologies, coming from interdisciplinary research. The today possible integration of historical archives is a significant example of those applications and the keystone for new ways of content usage and distribution.

In order to understand how people used to traditional research can react to the capabilities provided by the integration of historical archives, we have analyzed the needs of three major classes of historical AV archive user communities [ECHOa]:

- **Educational institutions:** they are characterized by an high level of domain expertise, but often a low level of video management systems knowledge
- **Broadcasting companies:** they are the most involved in content management due to the need to produce new programs and reuse content in a competitive situation.
- **Content providers:** they are experts in video archive management systems and content, heavy users of existing systems and connoisseurs of articulated user needs.

In what follows we examine the usages of each of these groups in turn.

2.1 Educational environment: teachers, specialists, students, researchers

In the secondary education the audiovisual material is employed both in lectures and in experimental activities. Depending on the kind of courses, it can serve several purposes. It may be used to stimulate the observation: for the comparison of images to a written description; to promote a discussion on a topic; it is also the means for teaching how to compose a video from fragments. In a linguistic laboratory, it allows to study and compare the spoken language in newsreels about the same subject, at the same time, in different countries. In all these cases the interest is intended to explore and widely diffuse the content.

In an educational laboratory, reusing audiovisual resources to produce new videos is usually intended as a test-bed and it is not covered by copyrights. Similarly, when the audiovisual material is collected in archives maintained by educational institutions, the driving force is not profit but rather the desire to support a diffusion within the educational institutions [FIATa].

Cultural organizations maintain audiovisual thematic resource collections as scholarly instruments aids. This way of reusing materials, so often adopted, is the most elementary way to distribute and add value to the archived content. Browsing collections is an excellent activity to refresh the memory and discover unexpected events. Students can autonomously browse significant periods of history, enlarging their personal knowledge. Teachers can be asked for interpretative concepts of the audiovisual features.

A collection, as a mediate way to present archive content, may inspire specialists to get some more information about the original document; going back from the transcript to the original audio, or from the shots selected in the collection to the entire document. Students will learn more going from the editor's observations back to the living voice of the persons playing in the film ("You may study the written words of the speeches of Sir Winston Churchill, but I think you get a better understanding of the speech by listening to the voice and seeing the man in action") [Nilsson2000]

Researchers, even historians as sociologists, appreciate the great opportunity provided by exploring historical archives of different countries with common access codes. They prefigure comparative researches on "propaganda" and "the language of the regime"; the possibility to analyse the occurrences of events and persons within the documents and verify the importance they had in a specific period in different countries; the ability to go in depth in behavioural researches on particular aspects of the daily life expressed in a visual language.

Cinema makers, on the contrary, deal with content and its expressive forms: they are mainly interested in tools analytically supporting the film process. In particular, they are attracted by the possibility to bring back a style, and set up a comparison between styles. For example, they often compare films in terms of visual expressive language. This implies a characterisation of the film in such terms as the framing typology, the framing occurrence frequency, the accelerated/decelerated camera movements, the cutting effects, fades, etc.

Often, a film contains sequences extracted from other existing audio-visual resources. In these cases it might be interesting to know both the origin of the video sequence and the other contexts where the same video sequence appears. Exploring these relationships between films often allows the discovery of unexpected information: for instance an high altitude bomber's shot (inventory material) broadcast in a particular newsreel has actually been used for documenting different situations, i.e. bombing in different towns.

In a film-education environment, it is also worth paying attention to the filmmakers and film critics' demands. In the laboratories students become aware of the complexity of each single medium and learn how to handle the complex relations among media, such as relationships between film and music. Students experiment the film editing, the mixing of sounds, or the combination of both in

order to produce audio-visual sequences. The efficiency of the appropriate “linking” mechanisms to synchronise these media mostly depends on highly qualified descriptors for each medium.

2.2 Broadcasting companies: documentary makers, news editors/journalists, program researchers

The archive users that work in a broadcasting company are mostly concerned with the reuse of audiovisual materials. Let us consider, journalists and documentary makers. Not only concerned with news chronicles, they often reconstruct retrospective stories about places, people, events, etc. Fragments of AV. resources are searched and then extracted and composed in such a way that they create a meaningful and significant story. During this editorial phase the journalist/documentary makers need means to retrieve information to answer to questions like: Whose? What? Where? When? and, possibly, Why?

As an editor the journalist/documentary maker also needs a descriptive space where to annotate the driving ideas and the main elements of the story: examining these notes the editor will be able to build a coherence among the different parts of the story [Davenport95].

The reuse of audiovisual material is fundamental in the broadcasting activity and, with the advent of the digitalization process, program researchers will be the principal players. They are the most heavily concerned with the broadcasters need to launch different channels in order to satisfy the increasing and differentiate demand of materials to explore; they have to plan new manners of displaying archives, to organize the content in different views; they are looking for new original ways of using archives reusing program; they must quickly change the document fashion to prevent the requests [Malden98].

Adaptation is also a kind of reuse: revision or extension of a reportage whose cuts were not used in the original production. Or, in re-proposing the program, the document is the same but the graphic presentation has been changed.

As the demand to use the archived materials is increasing, quite often the time in which it must be searched, found, and made available are shortening.

Consequently researchers need to easily manage and store the abstracts, to repackage the archives by scheduling them in a innovative way by enhancing the full exploitation and reuse of their content. The film researchers want to be able to find all the footage's and start to investigate the copyright issues [FIATb].

2.3 Large Audio Visual Archives: archivists, researchers, marketing and sales managers

Traditionally the archivist, as well as the documentarist / librarian in the role of indexer, is supposed to know better than everyone else the consistency of the holding and the more suited strategies to find content information. In the role of cataloguer and archive manager, she/he is the intermediary par excellence

between documents and end-users.

What is changing in this figure when archives are requested to sustain a more articulated exploitation of their content? What modification could affect the role of archivist when archives will be networked and inter operable, the users' access will be direct, and researchers will invoke more autonomy and control over their search?

Archive and library community have quite well understood that collaboration and cooperation on the Internet are dependent on standards-based communication. First of all they need classification schemes vs. standard [FIAF], [IASA], [SMPTE] by which to describe all the aspects of an AV. document: in the whole, in its decomposition into components (audio, video, transcript), in its segmentation (sequence, shot, frame), in its physical structures (features), and then its movement (migration), preservation (refreshing), etc. Each single part or state requires a specific description.

The archivist should be able to answer to any complex query posed by the users: for example, to know all documents where a "face" similar to... appears, the occurrences number per document, if cut material was employed and to which production it was belonging.

Nevertheless, the traditional role of an intermediary is leading to the role of finding aids providers (inventories, registers, indexes, and guide) to help the researchers to determine the relevance of items in a collection, to select carefully material to provide subject matter that will encourage new ways of searching, manipulating, and understanding digital information, without the costly mediation of reference staff [AMHER].

Another preminent figure inside the large historical archives is the researcher. He shares the same needs of the documentary makers, the programme researcher and the historian; he is less urged by the need to quickly deliver programmes with new content; he is rather engaged to improve the archive holding and to provide quality products. The holding analysis and any information or service that could fit this aim (summaries, key-words, visual abstracts, story-board, thematic repackages, collections) may supply new impulse for further research directions and production.

For example, a careful analysis of the banners and placards of the student protest movement of '68, may reveal the connection between student and feminist movements.

Reusing AV material, history researchers, like programme researchers and documentary makers, need to quickly find all information about the "rights" concerning the selected extracts and cost calculation, etc.; any obstacle to obtain this kind of documentation is a barrier to an effective archives reuse.

Strictly interwoven with this problem is the role played by the sale managers, who have traditionally managed the reuse rights of AV document inside the administrative departments. In a situation where digitalization offers the opportunity to reuse AV material to increasing groups of users, it is essential to understand what degree of detail of right description an information system should supply and how: by incorporating in the conceptual pattern the whole possible information, or by activating a systematic flux with other management

systems, like a rights management system.

3. The VandA model

The new form of usages of historical AV archives reviewed above impose a re-thinking on the way of cataloguing documents. The traditional descriptive models turn out to be insufficient for supporting the emerging applications enabled by the new technology. The VandA model presented in this section was designed to satisfy this need for a more complete cataloguing description.

VandA is an enlarged and revised version of the model designed within the European Chronicles On Line (ECHO) project¹ [Savino2000], [ECHO_b], (<http://pc-erato2.iei.pi.cnr.it/echo/>). The model is intended as a support for information discovery and as a descriptive surrogate of the AV resources disseminated to the users. It provides a necessary ground for supporting both the *traditional archive access services* - based on the descriptive fields about the content or the physical copy of the resource (e.g. access by name of the producer, by title of the series, by the tape collocation) - and a set of *advanced access services* - based on information automatically acquired through the manipulation of digital video (e.g. access by keyframe, by video abstracting, by words in the transcript, etc.).

The more authoritative reference metadata models for audio-visual resources [ABC], [DC], [MPEG] focus on specific aspects of the audio-visual resource description, as such they fail to provide the wide coverage required to support the innovative AV historical archive organisation and usages. The VandA was designed to cover this lack.

VandA is an extension of a general metadata model proposed by the International Federation of Library Associations (IFLA) [IFLA]. The extension allow to describe audio visual documents and to cope with the requirements discussed above. IFLA suggests to describe resources using four different entities: (1) *Work* entity to describe the abstract idea of a resource, (2) *Expression* entity to describe different versions of the same work, (3) *Manifestation* entity to describe different physical supports where an expression can be embodied, (4) *Item* entity to describe different copies of the same manifestation.

VandA, depicted graphically in Figure 1, extends IFLA with a set of sub entities and fields that are specifically tailored for describing historical audio visual documents. The entities are implicitly distributed on four description levels: each level corresponding to an IFLA base entity. The entities *Work*, *Expression*, *Manifestation* and *Item* are considered as the most general entity of the corresponding level. At the *Work* Level the entity *AVDocument* and its subentities *Newsreel*, *Documentary*, *Cut*, and *Reportage* are introduced for modelling an abstract AV historical work. *AVDocument* is a generic entity representing an intellectual or artistic work, while its subentities represent the different genres of

¹ ECHO - Project number I1994. Information Societies Technology (IST) Programme, funded by the European Commission. It aims to build a digital library of audio/visual historical documentary films. The first release contains selected materials from Institut National de l'Audiovisuel (INA), Netherlands Audiovisual Archive (NAA), Istituto Luce (IL) and Memoriav.

historical audio-video documentary films.

The subentities Newsreel, Documentary, Cut, and Reportage model different kinds of works. These subentities turn out to be sufficient for our experimentation. However, other entities may be added at this level to represent other types of audio-visual resources (as fiction, entertainment, etc.) that require a specialist management. The important point here is that any extension of this type does not invalidate the descriptions made according to the previous model.

A newsreel may be composed by a sequence of reportages that correspond to various parts of the whole audio-video document itself. This situation is modelled by the relationship *ComposedOf*. This relation permits to describe independently the whole document and its individual parts. The elements in AVDocument may be related to the cuts from which are extrapolated through the relationship *CutFrom*.

Each document, belonging to the entities of the Work Level, may have one or more versions. For instance, an element of *Version* can be the audio realisation of a newsreel, another the audio-video realisation of the same newsreel. This is expressed by the relationship *ExpressedBy* between AVDocument and Expression. The entity Version is specialised by the subentities *Video*, *Audio*, *Audio/Video* and *Transcript*. These subentities represent, respectively, the following possible realisations of a work: audio only realisation, video only realisation, audio/video realisation, and transcription of spoken words. As the whole document and its parts share the same set of descriptive fields, the same entity is used for modelling both concepts. A relationship *PartOf* permits to associate a component of a document to the corresponding whole document; whereas the relationship *FollowedBy* express the temporal succession of the document parts and the type of transition between a part and the following one (cut, fading, etc.). The relationship *HasChannels*, defined on audio and audio-visual documents, models the different audio channels that an audio document may have. The relationships *HasAudio* and *HasVideo* create a link between an audio-visual documents and its audio and video components when these exist as separate resources. The relationship *HasTranscript* links the video document to the transcript of its audio (in the case that the audio document of that video document is missing) or links the audio document to its transcript.

At the Manifestation Level, the entity *Media*, with its specialisation *Analog* and *Digital*, represents different kinds of analog and digital supports that can be used to maintain audio visual document versions. Each version of the Expression Level can be stored on one or more Manifestation as described by the relationship *ManifestedBy*. The synchronisation among different elements of Media are modelled by the relationship *SynchronisedWith*. The entities Analog and Digital, that represent the entire document, are specialised in the entities *Analog-Seg* and *Digital-Seg*, that represent segments. The relationship *PartOf* permits to associate the part to its whole document.

At last level, the entity *Storage* describes general information about the individual copies of the documents. Specific information about on-line and off-line document copies are modelled by the *On-Line* and *Off-Line* sub-entities. This partition permits, for instance, to represent a situation in which the same MPEG1 file may be stored on different servers, or in which several copies of the same CD-

ROM or of the same VHS tape have different quality of preservation. The relationship *AvailableAs* links a manifestation to its items.

A set of specific descriptive fields are associated with each entity. They model the characteristic properties of each entity, i.e. they represent a description of the AV documents as perceived when looking at the AV document at a certain abstraction level. For example, a Version, which models a conceptual realisation of a work, is characterised by fields like: Title of the Version, Edition, Themes, Working Notes, Copyrights owners, etc. A Video, which is a particular Expression, is characterised by fields like: Subtitle Language, Video Abstract, Keyframe, Camera Movements, etc; whereas a Digital entity, which is physical embodiment of an expression, is described by fields like: Support Type, Format, BitRate, etc. The complete list of the descriptive fields can be found in [ECHO].

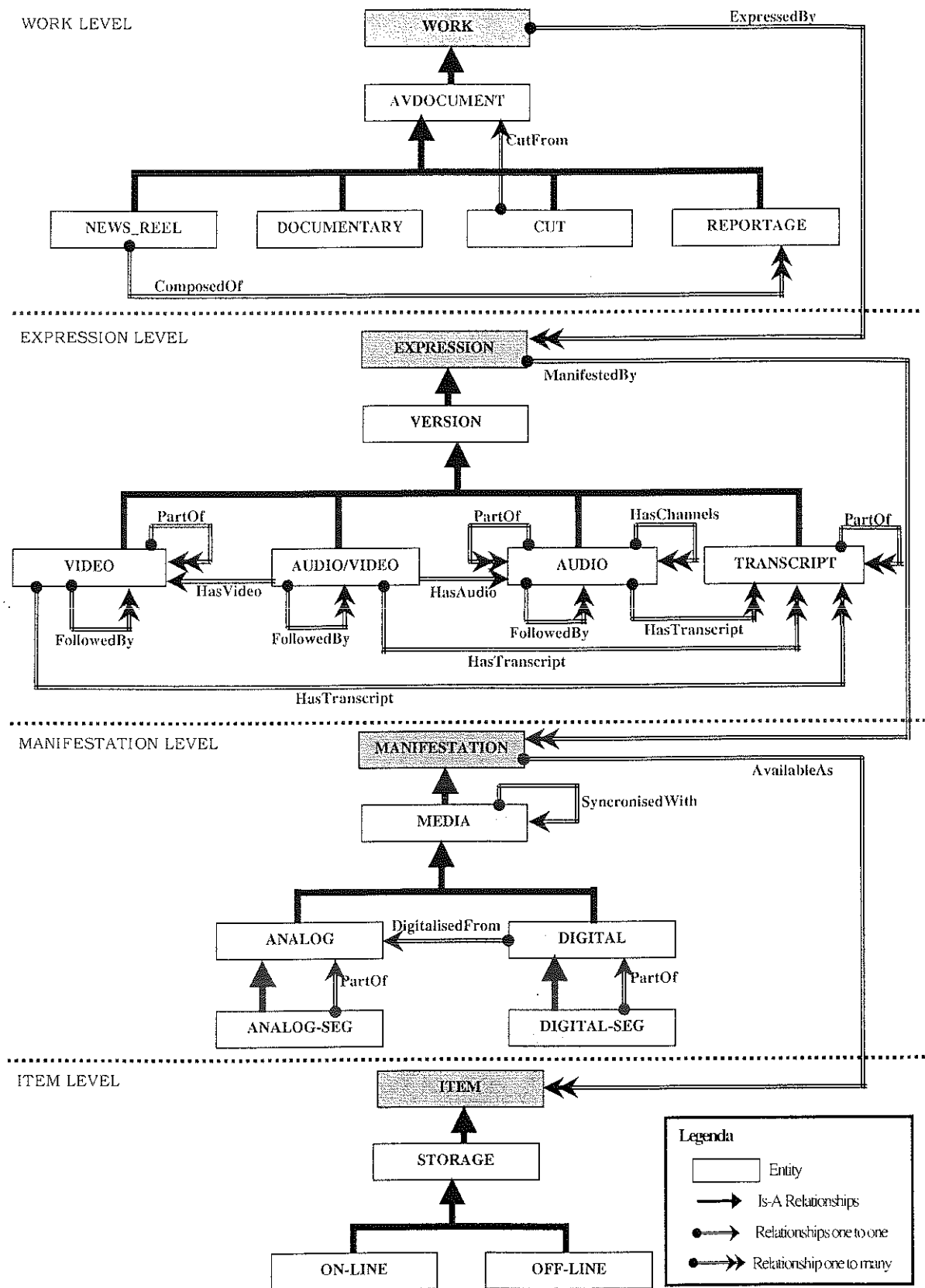


Figure 1: The VandA model

4. Running example

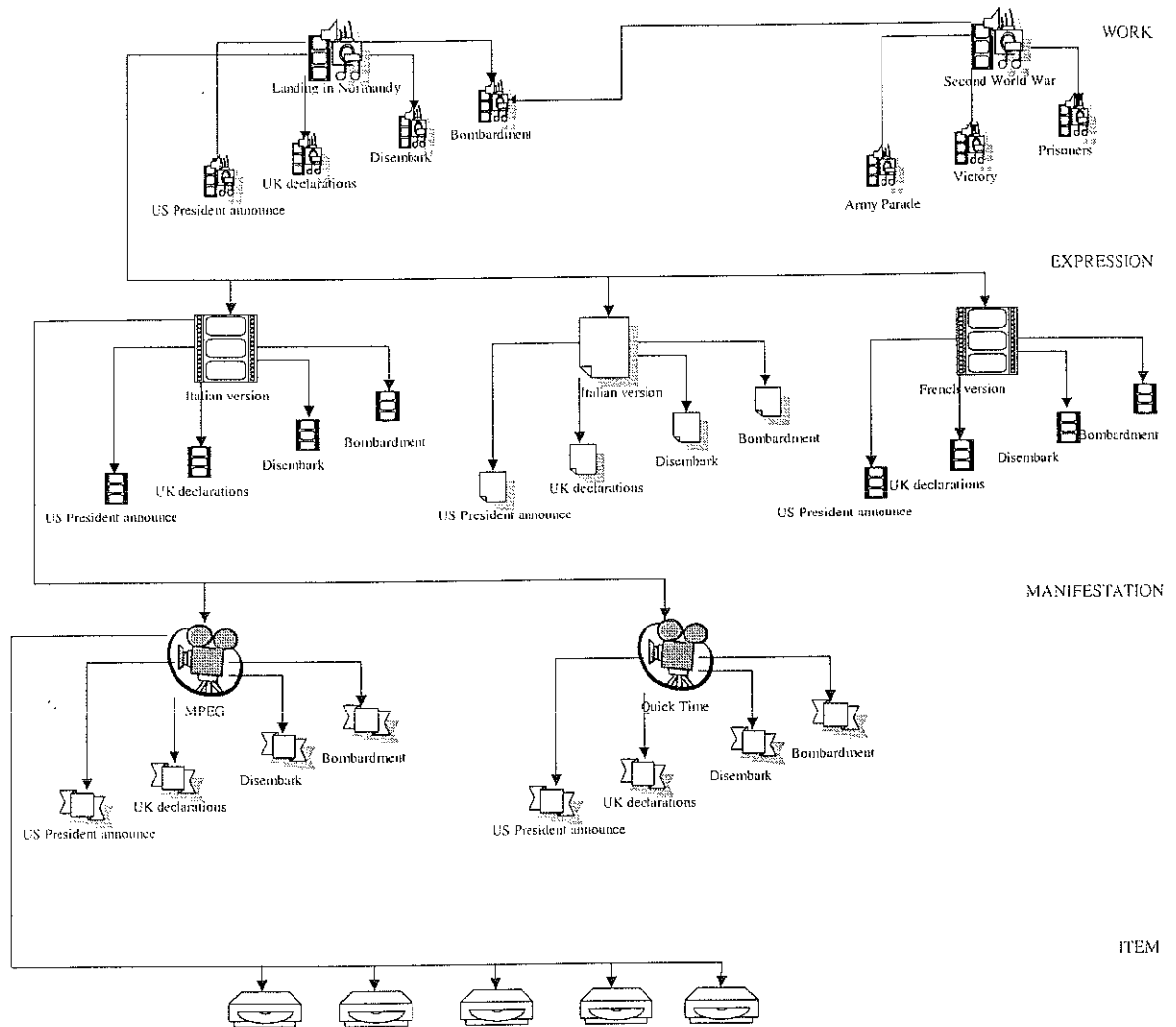


Figure 2: Running example

Work level

Let us suppose that we have a newsreel about the Landing of the allied forces in Normandy. This is represented by an instance of the Newsreel entity. The "Landing in Normandy" newsreel is composed of several reportages. For instance one where the US president announces the attack; one where the UK prime minister read an official declaration; one showing the soldier disembarking during the attack; one where aerial bombardments are shown. These are represented by instances of the Reportage entity.

We also suppose that we have another newsreel regarding the Second World War. This is again represented by an instance of the Newsreel entity. This newsreel is also composed of several reportages. One of these reportages, the one about bombardments, is the same used in the Landing in Normandy newsreel. In this case, the works corresponding to the landing in Normandy and the Second World War share the work corresponding to the bombardment. It is important to point

out that this only means that the description (metadata) is shared. Indeed since the reportage is the same there is not reason to replicate this information. However, it could happen, and in most case it will really happen, that the files containing the two entire newsreels have the same reportage replicated. The result is that the data corresponding to the audio/video stream is replicated, while we have only one description of the reportage.

The existence of an explicit relationship between reportages and newsreels allows users to retrieve and have access to all contexts in which A/V documents or portions of them have been used. This kind of organisation allows a researcher to retrieve and maintain all contexts in which A/V documents or portions of them have been used. This feature, as previously stated, is one emerging type of usage of video material.

Expression level

Let us concentrate on the Landing in Normandy newsreel. The model allows users to express that there are distinct versions of a work. These versions are implicitly related since they are conceptual realisations of the same work. In our example, let us suppose that it was produced in two different version. One version was produced to be broadcast in Italy, while the other to be broadcast in French. The language is Italian in one version and French in the other. However, it is also possible that the Italian version and French version do not differ only for the language, but, for some reasons, some parts may have been cut or modified in these two versions. This way is possible inspect not only to how different phrases were translated in different language, but also the differences in which the same episode was reported in different countries. This type of usage is promising for video material accessed by teachers and students, when observing different versions of documents from a conceptual/analytic point of view.

In correspondence of the two versions, we also have two audio/video expressions and of course the corresponding audio only, video only and transcript expressions. In the figure, for simplicity, only the transcript expression corresponding to the Italian version was reported.

Description contained at the expression level characterises a particular version of a work. Among the others, here we can find attributes that allows us to perform similarity retrieval as for instance visual features (colour histograms, motion vectors, textures, etc.) of the video documents. In addition, attributes that give information on the style used for a particular version are included. For instance, in case of a video expression, information on the camera movement in a shot are specified along with information on the type of transitions between scenes (e.g. fade in, fade out, etc.). Using this information is possible to enhance the way in which documents can be retrieved, using the concept of similarity retrieval. As previously stated, specialists and researcher may need to analyse A/V material by using this kind of information.

Manifestation level

At the manifestation level, information on the physical support, on which

expressions are available, is included. For instance, in our example, the Italian version of the Landing in Normandy newsreel is available in MPEG and QuickTime formats. This means that the “same” expression can be played using MPEG players and QuickTime players. The content is exactly the same, but is different the way in which it was encoded in the file. Different formats means also to favour different usages. If a document is requested for broadcasting maybe BETACAM is the right format.

Here also portions of the entire documents can be identified. For instance, the reportage corresponding to the bombardment can be precisely identified in the MPEG and QuickTime file.

The possibility to identify portions of A/V material also allows people (documentary makers, news editors journalists, etc.) to reuse these components by creating new documents that are created by extracting segments from other existing documents.

Item

At the item level different copies of the same manifestation are described. In our example we supposed that the MPEG file, corresponding to the Italian version of the Landing in Normandy news reel, is mirrored on five different sites. That is, the file or its physical support (CD, tape, etc.) can be found in five different locations. Notice that these different copies may have, for instance, different access speed, preservation quality, therefore different access prices, and different authorisation information associated with them.

5. Final remarks

In designing this metadata model great care was taken to render it extensible. This is a key feature of any metadata model since it permits a successive expansion to cover new emerging needs.

Expansion may regard an addition of a new genre of *Work* form (in our case a new genre of film), or to be an expansion by specification when a certain type of usage claims for more articulated description level of a metadata (metadata qualification), or to simply represent the incorporation into the model of some further concept (metadata).

Now, we are involved to inspect the coverage level allowed by the model in respect to the stated usages and to provide the extensions when needed. In our model, for example, the metadata and attributes with which cinema historians are heavily concerned are only the essential ones. We have in mind to expand the genre typology by introducing the new genre “cinema”.

Another aim in designing the model was the provision for interoperability. We are currently experimenting the mapping of this model into other metadata models to evaluate its interoperability level, starting with those belonging to the IFLA family.

About the reuse of AV material we will also remark that the current version of the model was designed taking into account the semantic approach rather the right

approach of reuse. In fact the organization of the model permits to represent quite well the history of the resource content (programme, extracts) along the reuse phases and their context; meanwhile the right requirements for the reuse weren't kept in consideration in our inspection intents.

The reason is that right information often encompasses intellectual property rights (IPR), copyright, and various property rights; and any right element will contain a rights management statement for the resource, or reference a service providing such information. Thus, if rights element is absent, no assumptions can be made about the status of these and other rights with respect to the resource.

To understand if a metadata model, directed to describe AV resources, should supply a rights specialization or an integration among models, applying each on a different aspect of the same domain (description of the resource and rights management), or furthermore assume the form of a e-commercial version [INDECS], is a matter to inquire. Usually, in a in-housing situation, all data pertaining to contracts, copyrights and royalties is collected and managed by legal departments. Much of it is of a confidential nature, which explains why they were designed as rights management systems and not to meet the requirements of asset management systems.

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