

The DEEP FILM Access Project: Ontology and Metadata Design for Digital Film Production Assets

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Abstract—The Deep Film Access Project (DFAP) aims to unlock latent opportunities that exist within the big and complex data sets generated by industrial digital film production. The project is developing a methodology for the integration of the data and metadata generated through film production, by capturing, archiving and making accessible the diverse range and levels of expertise which exist within filmmaking. As a proof-of-principle, the project uses the entire corpus of Sally Potter’s 2012 film, *Ginger & Rosa*, providing an emblematic example of an industrial digital feature film production in contemporary Britain which features the work of a number of renowned and prolific practitioners in the UK and international film industry. Our initial focus is on a case-study of materials associated with a single scene from the film.

Keywords-digital filmmaking; film archiving; ontological design; film metadata; digital asset management

I. INTRODUCTION

The Deep Film Access Project is a Big Data, Digital Transformations themed project funded by the UK Arts and Humanities Research Council (AHRC). The project aims to unlock latent opportunities that exist within the big and complex data sets generated by industrial digital film production. This paper presents the initial stages of the research as it moves towards its aim to advance a methodology for the integration of the data and metadata that is generated in the production process. By sequentially combining automatically-captured film production data with the qualitative, descriptive, contextual and expert knowledge generated by film professionals, the project will evolve new ways that these currently disparate sources can be integrated within the primary digital film asset, allowing them to be re-explored in the future. Through the improvement and evolution of new discovery and research methods, the project aims to stimulate film production data being used in new ways, across academic disciplines, industry professions and beyond.

II. CONTEXT

The film industry, academy and film archival institutions currently face a significant challenge in evolving long-term preservation methods for digital film. Big film data is a

daunting object for preservation, analysis and exploitation, with entire data sets of individual feature film titles typically measuring tens of terabytes. Filmmaking as a process has recently reached a scale and complexity where a new on-set ‘data wrangling’ role has emerged to manage the data generated by the camera(s) alone. Reducing costs mean that even small independent film productions can film on multiple cameras, increasing linearly the volume of raw material and exponentially the inter-relations between data items. As film completes its transition from photo-chemical to digital, and the use of advanced techniques such as Computer Generated Imagery (CGI) and shooting in Stereoscopic 3D increase, new archival methods and processes are needed to cope with the data. The searchability of digital film datasets is currently limited, and much of the content of their assets are invisible to search engine algorithms, in part because metadata standards are not uniform. Improved asset management could reveal many untapped opportunities, drawing on the potential for novel in-depth analysis of the filmmaking process and results.

This project aims to advance the methodology for the collection and management of data and metadata by developing working methods to integrate automatically generated metadata from the recording equipment with the manually recorded documentation of the production process and decisions in the digital film production workflow. The juxtaposition of these data sets opens up new possibilities for the analysis of film materials in a unified and holistic contextualisation.

In the longer term, this project has the potential to facilitate more effective communication within the film production workflow: enabling knowledge exchange and resource efficiencies, in both production and archiving processes, redeeming missed opportunities within film research and scholarship hitherto impinged by restricted and shallow access. By bringing together film scholars and computer scientists with film industry and film archival professionals, DFAP will develop an integrated framework which will transform the big, dispersed and complex materials generated by industrial digital film production.



Figure 1. On the set of *Ginger & Rosa*: the digital assets include extensive ‘behind-the-scenes’ material as well as the film itself.

III. CURRENT RESEARCH

There is a groundswell in the emergence of scholarly work exploring the affordances and impacts of digital technologies upon film studies, film analysis and the film industry, and an evolution of new digital research methods and approaches (including [1]–[4]). The impact of the digital on film archival research is highlighted in both the British Film Institute’s Future Development plan [5] and the Department for Culture Media and Sport report [6], which both call for widening and expanded access to film and audiovisual media. The development of digital technologies and open source software provides a unique opportunity to semantically gather and present these materials to audiences in new and open ways.

Multiple interrelated streams of data are generated during the filmmaking process. These are currently stored separately, and their initial rich interrelations and links are lost. This project seeks to advance the integration of these dispersed materials to meet four imperatives: reducing the duplication of archival processes, improving the integrity of data, making the content of digital assets visible to search engines, and facilitating the mining of embedded or hidden data through deep searches.

Currently, the archiving of the complex assemblage of digital film materials is duplicated by archival professionals: they re-generate descriptions of assets based on their own subjective interpretations of the materials, while descriptions are already created at source by the film professionals. For example, when a scene is shot the accompanying data includes automated data generated by the camera(s); the time code, make, model, lens, date, time (these can now be added and customised by the camera operator). In addition there would be a camera log kept (sometimes by hand, increasingly by digital means) which would detail the shot and take number, scene number, descriptions of the shot, the characters involved, director’s notations evaluating the quality of the shot. The scene would also carry with it an

information layer pertaining to the logistics and organisation of the shot, (normally captured within a document called a ‘call-sheet’) such as the location, timings, crew and cast members involved, local amenities, formal permissions and local authority information. A scene could also generate props information, costume, make-up and special effects data. This project aims to develop a system and a workflow where this data could be captured and integrated at source (as opposed to being archived separately), so that the implicit links between the materials would be preserved, duplication of labour saved, and the risk of misinterpretation and inaccuracy at the archival stage reduced.

A tacitly agreed terminology and phraseology exists in the international film sector, as evidenced in numerous publications. DFAP seeks to initiate a uniform and universally applicable method of automating metadata generation, using established film industry conventions. In addition, the code of search engine algorithms does not separate the content of assets from their form, so that mining embedded data is difficult. For instance, an archival user is currently unable to extract specific information from frames of digital film: the original description that it was given, the date, time, location of its generation, the personnel that were involved, the camera and lighting that was deployed, the props and costumes that were used, where they were purchased, what the cost was for a particular scene, who the crew were, are all elements of existing but ‘hidden’ information.

Many of these ancillary materials are now the standard constituent elements of a film’s release package across cinema, on-line, on-demand, DVD and Blu-ray (and in very recent examples have been released simultaneously with the main feature film). Barbara Klinger talks of these materials (which up until now have been packaged as DVD extras): “As a kind of film school in a box, DVD represents a mainstreaming of the educational imperative” [7]. Jonathan Gray commented that the *Lord of the Rings: The Two Towers* extra features “teach a significant amount of production literacy, familiarizing audiences with the vocabulary of pickups, Foley work, mime passes, second units, matte painting, and key frames” [8]. The DFAP will work towards enabling easy access to these primary materials so that they can be properly cited, as film and video gain further prominence as academic sources.

The DFAP benefits from full access to the entire corpus of Sally Potter’s *Ginger & Rosa*, which will be used as a proof-of-principle for this project. A British film released in October 2012, this period feature was shot entirely on location in the UK, with a 3.5 million pound budget and a crew of over 155 members; it provides an emblematic example of an industrial digital feature film production in contemporary Britain. It is a location-based feature film, set and filmed in London, and is (almost) entirely digital in all aspects of its production and output. The film includes the work of a number of renowned and prolific practitioners in

the UK and international film industry.

The project team is working directly with a number of formal project partners: Adventure Pictures, The British Film Institute (BFI), the National Media Museum, BBC Archive Development, Screen Archive South East and the University of Southern California. The work builds upon an established partnership with Adventure Pictures and SP-ARK, Sally Potter's online archive (www.sp-ark.co.uk). In addition to the materials generated by the filmmaking process itself, Adventure Pictures also enabled the filmed interview with every person who was involved in the making at the time of the production and these videos now form an integral part of the dataset (see Figure 1). The Adventure Pictures team and associated personnel are also providing expert advice on film production taxonomies, film industry-specific terminologies, process and protocols, as well as continuing to facilitate new partnerships with film industry specialists and professionals.

Curators and archival professionals from the BFI are supporting the DFAP through the sharing of their practices and procedures of processing current data sets in their own film, scripts, documents and ephemera collections, which includes the recently acquired Ken Loach archive. This specialist knowledge includes how they apply current archival and metadata standards in their implementation of a specialist archival software system.

The National Media Museum (NMM) in Bradford are specialists in the archiving of production technologies and processes. The Museum staff are providing the DFAP with access to samples of archival assets and metadata across their library (books), archive (documentation) and collection (physical objects). In turn the DFAP are sharing their knowledge with NMM of potential new ontologies which will enable novel access to the museums holdings that move beyond their traditional chronological arrangements.

BBC Archival Development are brokering partnerships between the DFAP team and key archival personnel and specialists across the BBC in order to facilitate mutually beneficial knowledge exchange activities relating to the data management and production workflows of audiovisual content. These partnerships will include BBC R&D Projects, News, Sports, Information & Archives, the Natural History Unit and Television Production.

Digital archival specialists from Screen Archive South East (SASE) are providing assistance and advice to the DFAP team based on the development of their current film archival data bases and are contributing knowledge and experience about how they link these data sets for researchers, historians, film-makers and other users. SASE have also facilitated links with the Presto4U Project and their Film Collections and Filmmakers Community of Practice (CoP) who are also exchanging resources and knowledge with DFAP.

The University of Southern California's School of Cinematic Arts are providing the assistance of their Large Scale

Video Analytics (LSVA) Project Medici system [9]. They will be assisting DFAP in the establishment of protocols for working with the vast range of media assets that are created in the process of making a feature length film, which have yet to be sufficiently organized, managed and made accessible to be useful for both industry and academic constituencies. In addition, the ingestion and integration of the DFAP dataset into the LSVA-Medici system affords an invaluable opportunity to test and extend their work into data preparation and indexing systems for tagging.

IV. CURRENT ACTIVITY

The project team is currently working with Adventure Pictures to gather, consolidate, manage and prepare the entire dataset in readiness for the modelling. The data, which, at the start of the project was located within numerous computer storage facilities across different geographical sites is currently being consolidated into a single storage solution. The team will be carrying out initial modelling on one particular use case (see Figure 2) which draws all of the materials and metadata from one scene of the film, generated on a single day during the production cycle. Although no single scene can cover all aspects of the production, the particular scene chosen was one of the most complex in the film, involving all the production departments in its execution. Data is also being gathered from the other project partners which pertain to archival practice and process and film metadata standards, to ensure the project's future scalability and applicability to national and international film industry organisations and archival institutions. A critical interrogation of on-set practices which involve the generation, management and transference of data, both between systems and members of the production crew, is also currently being undertaken alongside this work through observation and interviews with Digital Imaging Technicians ('Data Wranglers') who are working on current productions.

A second line of activity is the reviewing of existing proposals of digital film assets and metadata enhancement. One line of research tries to enrich multimedia information objects (e.g. MPEG-7 files) through core ontologies, i.e. pre-compiled, often logically defined knowledge structures about the core concepts of film production and narrative development. One example is the *Loculus* system [10], an ontology-based information management system which takes a perspective-based approach to modelling two industry timelines: the Production Cycle Timeline (which comprises the same basic structure as SP-ARK) and the Life Stage Timeline (which includes entities that are specific to operations on the available filming material after post-production, e.g. repurposing). The *Loculus* terminology will provide some support to DFAP's modelling effort, and the system also includes interesting rule-based relatedness metrics between the parts of the ontology. A second example is the *Core Ontology for Multimedia Annotation* (COMM)

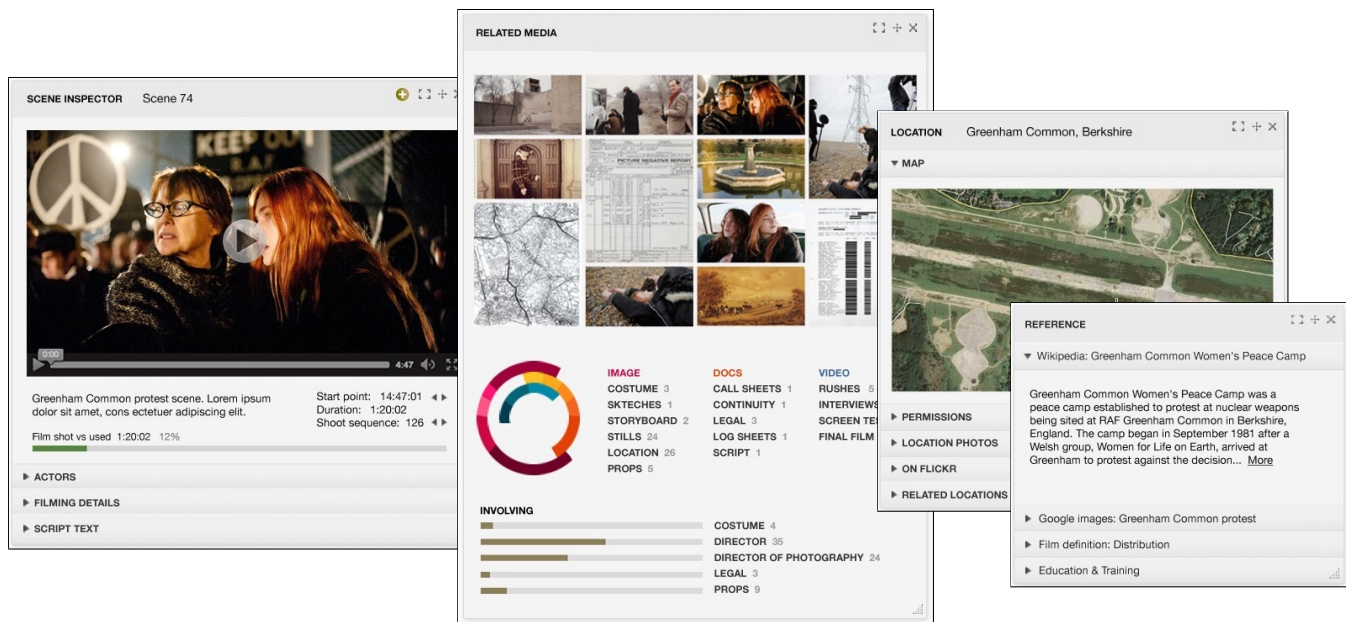


Figure 2. Use case illustration: a mock-up of the kind of additional functionality DFAP aims to support for visual browsing tools such as SP-ARK. Semantic metadata supports deep semantic linking between film assets and to related external resources.

[11], which represents the structure of multimedia objects by means of a foundational ontology. Wrapping an ontology of multimedia in a foundational ontology is necessary to, among other things, model the distinctions and the relationships between the various aspects of a multimedia representation (what is represented, the representation itself, the physical realization of a representation etc.). COMM could support the modelling of DFAP's use case, although the philosophical and terminological overload of the chosen foundational ontology (DOLCE) introduces additional complexity for the modeller. Also, despite providing a structured hierarchy, COMM's definitions are currently quite shallow.

V. CONCLUSION

The DFAP project recognizes an urgent need to establish comprehensive protocols and sound practices for indexing and accessing filmic media and metadata for the purposes of research and learning. The development of a new approach to searchable metadata will enable the interrogation of the vast array of disparate data, generated in every step of the film production process. Metadata can never capture the full richness of the data itself, but our cross-disciplinary and multi-partner approach aims to ensure the integrity of the primary dataset is preserved and enhanced through a systematic and comprehensive approach to modelling.

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