Access to Archives of Performing Arts Multimedia

In the framework of IBBT, a Ghent based promotor of interdisciplinary research into the scientific and the business challenges of the information society, a collaborative research project (2007-2009) was set up: PokuMOn confronted the problems of online distribution and archiving of multimedia of performance and concerts (classical music, opera, theatre, dance etc). Recent scientific knowledge about copyrights, metadata and audio and video compression were linked so as to find pragmatic solutions for arts producers and venues and concert halls.

This publication groups some of the insights and lessons learnt during this project, ranging from sociology and media studies through management and law up to IT subjects like semantic web and multimedia compression and storage techniques.

www.vti.be
www.ibbt.be

VLAAMS THEATER INSTITUUT

VLAAMS THEATER INSTITUUT

IBBT
exploring the information society

Access to Archives of Performing Arts Multimedia

Tom Evens & Dries Moreels (eds.)

IBBT (Interdisciplinary Institute for Broadband Technology)
Stimulating ICT innovation

VTi (Vlaams Theater Instituut)
Supporting the performing arts

2009

Table of contents

Introduction

In late 2006, a group of researchers and performing arts professionals met to discuss the issues of managing collections of multimedia related to the performing arts. The wide range of archived materials (from photographs and audio or video recordings of live performances to dance films and promotional shorts), the lack of an agreed set of standards and procedures suitable for performing arts and the technological aspects of archiving this multimedia securely, immediately surfaced as key components of the problem.

Within the framework of IBBT, a Ghent-based promoter of interdisciplinary research into the scientific and business challenges of the information society, a collaborative research project (2007-2009) was set up: PokuMOn (http://projects.ibbt.be/pokumon).

A consortium of research groups at different universities, IT companies and cultural institutions carried out the research:

- IBBT- ICRI-KULeuven (Prof. Jos Dumortier), IBBT-MMLab-UGent (Prof. Rik Van de Walle), IBBT-MICT-UGent (Prof. Lieven De Marez), IBBT-ETRO-VUB (Prof. Peter Schelkens), IBBT-SMIT-VUB (Prof. Caroline Pauwels)
- Comsof, Telenet, Videohouse
- Koninklijk Ballet Van Vlaanderen, Muziekcentrum De Bijloke, DeFilharmonie, deSingel, Rosas, Jan Fabre Troubleyn, Ultima Vez, Vlaamse Opera, FARO, Muziek-centrum Vlaanderen and VTi

PokuMOn confronted the problems of online distribution and the archiving of performance and concert (classical music, opera,

theatre, dance, etc.) multimedia. Recent scientific knowledge on copyright, metadata and audio and video compression were linked in order to find pragmatic solutions for arts producers, venues and concert halls. Multiple objectives were therefore outlined for the PokuMOn project:

- Simplifying the distribution and archiving of performing arts multimedia by formulating standards adapted to the sector and by developing tools for these standards.
- Exploring different modes of digital participation of performing arts (online, at school, through digital television, video on demand, etc.).
- Clarifying the multimedia copyrights typically found in cultural institutions and proposing tools for producers and managers to clear all authors' and performers' rights.

This publication groups together some of the insights and lessons learnt during this project, ranging from sociology and media studies, management and law, to IT subjects such as semantic web and multimedia compression and storage techniques.

The first chapter, by *Laurence Hauttekeete and Tom Evens*, provides a good understanding of the process of safeguarding and preserving audiovisual collections within Flemish performing arts institutions. Based on several interviews with representatives, the authors provide a brief overview of the state of the art regarding preservation and access. This environmental scan deals with four keywords that are often seen as central in developing strategies for heritage collections in the digital media ecosystem: digitisation, metadata, intellectual property rights management and search & discovery. All these keywords will be discussed in depth further on in this booklet since these four issues are considered as major challenges for establishing broad access to audiovisual collections.

At the core is the notion that the digitisation process not only poses technological challenges, but also requires an organisational shift towards a digital workflow. However, this reconfiguration of practices and routines demands a great deal of investment, which performing arts institutions often cannot afford. Although a shared metadata model should optimise the accessibility of collections, this access is often restricted by copyright issues, which may hamper the disclosure of digital collections despite the abundance of new distribution channels.

In the following chapter, *Gert Nulens* outlines how these new media channels have been implemented for the distribution of digital cultural content. These interactive technologies enable cultural institutions to reach a wide audience and should lower thresholds for access and participation amongst individual users. Research has repeatedly demonstrated the large potential audience for digital cultural content. Evidently, digital culture offerings will be complimentary to the traditional cultural experiences. Educational applications should be seen as one major opportunity for digital culture. Supported by the government, institutions all over the world are launching innovative media platforms featuring thousands of hours of digital content selected especially for educational purposes. However, as questions are raised about the substitution effect of virtual culture, many cultural institutions still seem reluctant to explore the opportunities of e-culture. Moreover, an analysis of a number of best practices in cultural distribution shows that exploitation of content platforms is costly and the search for a viable business model is still on.

As *Tom Evens* demonstrates in his contribution, establishing consumer markets for purchasing cultural heritage video

downloads remains a tough challenge. Aiming to explore the interest in new forms of digital cultural participation, this chapter reflects on a pilot study using the Telenet (the main digital television operator in Flanders) video-on-demand platform for the wide-scale delivery of performing arts videos. Adoption potential proved to be surprisingly high, especially amongst frequent cultural participants. As a consequence, the study finds few differences between traditional and virtual audiences and suggests that traditional participation divides are simply extended into the virtual world although digital culture is widely assumed to democratise access. Moreover, as revenues were far below the operational costs of the Telenet platform, the commercial sustainability of such a supply is questionable. However, as this pilot study exemplifies, establishing content platforms for extracting commercial and even educational value from audiovisual archives requires a high degree of integration in a value network, with all actors involved obtaining value from the platform.

In his chapter, *Tim Raats* provides an overview of the main obstacles for developing such platforms: the lack of skills and competences within cultural institutions, the complexity of authorship, the financial investments and the issues of appropriate context and audience guidance. As access to content proved to be a major bottleneck in the pilot study, the following question arises: which factors restrict potential content stored in cultural institutions' archives from becoming real, actionable digital content ready for distribution? Despite the cost-effectiveness of many digital distribution technologies, the financial resources needed upfront are the main barrier for digital distribution. The intricacies of rights clearance appeared as too cost-intensive for performing arts institutions in Flanders. This issue has been dominating the agenda of many cultural organisations aiming to distribute audiovisual footage.

table of contents

However, rights clearance of performing arts involves a complex web of actors who should give permission and ought to be remunerated when exploiting live performance recordings in a responsible manner. This implies negotiations with royalty collection services and authors' guilds, which represent a large number of stakeholders. As in many cases, the details of right holders have been lost, and the process is complicated by a search for lists of people. The complexity of copyright regulations is further exemplified as *Tim Robrechts* and *Robin Kerremans* argue that the re-use of live performance recordings heavily depends on the qualification of the recordings as an audiovisual work or not. Since there is a shift from amateur to professional filming, it is likely that recordings will more often be qualified as audiovisual works. In this case, an automatic cession of rights from individuals to the producer is applicable, although this clause is still subject to discussion amongst experts.

Confronted with the multiplication of distribution channels such as digital television or the internet, and the explosion of digital audio and video formats, advice is needed about the appropriate compression techniques, container formats and conversion strategies. In their text, *Stijn Notebaert, Jan De Cock, Sam Coppens, Erik Mannens, Rik Van de Walle, Marc Jacobs, Joeri Barbarien* and *Peter Schelkens* provide a comprehensive overview of formats suitable for both the offline and online archiving and distribution of performing arts multimedia. The authors do not aim to select one common format for images, audio and video files, since the widespread use of performing arts multimedia does not simply depend on the selection of a standard format, but rather on the exchange model for metadata. This model should allow cultural institutions to annotate productions in order to maximise access for a broad public. Nevertheless, results from controlled lab tests on the performance of different compression and conversion techniques

using real-life examples are provided.

In the final chapter, *Sam Coppens, Erik Mannens* and *Rik Van de Walle* explore how performing arts multimedia can be archived, bundled and disseminated using semantic web technologies. The authors tested the open source BRICKS architecture to configure, extend and manage digital collections, since this platform is easy to use, robust and flexible. The metadata scheme, which relies on Dublin Core metadata as a basic layer, is enriched semantically following the Linked Open Data principle.

As a result of the PokuMOn research project, scientific articles were published and many master classes, conference talks and project presentations were given in different settings, allowing the optimum dissemination of the findings. Moreover, VTi is now undertaking a major overhaul of its databases, integrating the existing data and structure with new layers of metadata, optimised for the 'semantic web', and with the archived multimedia.

Tom Evens and Dries Moreels

A guided tour through the archives of performing arts institutions

Laurence Hauttekeete and Tom Evens (IBBT-MICT-UGent)

Many experts consider Flanders, the northern region of Belgium, as a *Walhalla of culture*, reflected by a large number of cultural organisations. The broad array of performing arts institutions annually produces a relatively large amount of valuable cultural material. Consequently, various authors have stressed the need for an adequate archiving and preservation policy for this type of material, given its historical, juridical, cultural, social and economic value.

Unfortunately, this material does not always receive the attention it deserves. For some organisations, a structured archiving policy for recorded or taped performances is part of their daily operation, whereas others lack the resources required to do so. Keywords nowadays in the whole process of safeguarding and preserving this audio-visual material are digitisation, metadata, rights management and disclosure. A thorough knowledge of these four aspects can considerably prolong the lifetime of these sources, even granting them a second life in a different setting.

On the basis of qualitative interviews with people entrusted with archiving in performing arts institutions (including dance, music, theatre and ballet companies), this chapter will consider the current situation in this sector when it comes to archiving, digitisation, metadata, rights management and disclosure, and will offer a number of guidelines for a more systematic archiving policy by means of an environmental scan.

table of contents

FROM AMATEUR TAKES TO PROFESSIONAL FILMING

The performing arts institutions in our study sometimes make recordings of their own performances, suited for different purposes, or store the material they have collected or received from others. Most of the organisations record the rehearsals or the performances as some kind of *documents de mémoire*, which are a perfect record of the history of the organisation, as a working document for the dancers, actors, directors, etc., or as promotional material. In this case, the filming primarily takes place in a straightforward manner, with one camera position and little effort, and the result is mainly used for internal purposes.

To reach a broader public, the performing arts institutions cooperate with professional external production companies to record the performances. The one most often-mentioned is Alfacam with its EXQI channel. Indeed, many cultural organisations are partners of EXQI Culture, which broadcasts the performances on a digital-only *culture channel*. Once the performances have been professionally recorded, there are many possible ways to distribute the material: television, online, DVD, etc. One interviewee mentions how they organised various *large-screen events*, whereby an opera production was recorded and projected onto a large screen in squares and cinemas, for a big audience. These events proved to be successful but were however too cost-intensive. Another option for more professional filming is the use of automated cameras, which can be controlled remotely. This way, the cameras are not that visible during the performance and neither the performers nor the public are disturbed. Lastly, we should not neglect the role of VRT and Klara for the broadcasting of performing arts, since they too have signed a number of agreements with several cultural centres.

To conclude, we must acknowledge that many of the performing arts institutions recently made investments to record or film their artistic performances. Negotiations are underway with other external partners and more sophisticated equipment is being bought, based on the idea of reaching a wider audience with the cultural material they produce.

TOO LITTLE PRIORITY GIVEN TO A STRUCTURED ARCHIVING POLICY

As mentioned in the previous paragraph, many performing arts institutions create audio or video recordings of their performances, in an analogue or digital format, for different purposes. In an ideal scenario, these recordings should be stored in *long-term archives*, to ensure this valuable cultural material is properly preserved. Photographs, posters or other promotional objects should also be safeguarded. Nonetheless, this is not necessarily so in reality. Only a few performing arts institutions spend a lot of time on the development of a well-run archive, mainly intended for the management and organisation of their audio-visual productions, their iconographic assets and a diverse set of promotional material.

The size of the archives differs greatly, depending on different aspects: the start date of the organisation, the amount of recorded items, the awareness of preserving cultural assets, etc. In general, we noticed that the audio-visual collections are not that extensive and mainly consist of play rehearsals. Many of the interviewees even had to admit that much of the material had not been safeguarded properly in the past and that some cultural items had probably been lost.

The character of the archive is determined by the type of material and again, we observed a great deal of variety: (analogue) pictures, brochures, newspaper articles, clothing, posters, scenic artefacts, video shoots, audio recordings of introductory speeches or the concert itself, and other materials. The abundance and

diversity of material is a clear reflection of the varying origins of the organisations.

Normally, archive material should be stored in air-conditioned rooms or at least in good environmental circumstances. However, given the cost, this is not the case. In most of the organisations, the archive collections are kept in cupboards or piled up in boxes. Nevertheless, some organisations do make an effort to carefully handle the material they possess, especially when it comes to video and audio material or *photographs*. The collection is kept under lock and key, and copies are preserved outside the building, as protection against fire or theft.

THE ANALOGUE AND DIGITAL JUNGLE

Most of the archives in the performing art institutions possess a jumble of material, which hampers efficient preservation and distribution. As many archives tend to store both old (analogue) and new material (of digital origin), there is often a lack of *playback infrastructure* for certain types of media such as old celluloid films, magnetic tapes or optical discs. The interviewees in the performing arts institutions did indeed say that they still possessed a great deal of material that can no longer be viewed or played. *U-Matic* tapes for example demand specific playback infrastructure. Moreover, the transformation of this old analogue material (which might be seriously endangered) into new standards demands a continuous effort at various levels. At the moment, most of the organisations give priority to the oldest material for digitisation, together with the material that can be used for a particular occasion.

Current difficulties such as the deterioration of existing information media, the lack of storage space, and insufficient access to archive material have led to a focus on the digitisation of audio-visual material. Nowadays, many performing arts institutions are convinced that this digitisation of material or the careful storage of content (of digital origin) is essential. However, the question is how to achieve this?

The digitisation of audio-visual material creates an environment without video tapes: the desired audio-visual material is saved on a server or tape robot as a computer file. This digital archiving offers many advantages: there is no (or very little) quality loss when copying the file and the material can be used on computers and robot systems. Furthermore, digital archiving reduces the need for quality control, enables an easy association with metadata and creates possibilities for exchanging the essence in a network environment. In order to steer the archiving of electronic assets in the right direction, the well-known *DAVID decision model* (www.expertisecentrumdavid.be/davidproject/) is often applied. In this tool, four questions need to be answered. What needs to be archived? Who will do the archiving? When will the archiving take place? And how will it work in practice? These questions and their solutions are undeniably interrelated. One must also be aware of a superficial and technological-deterministic thinking when considering this matter. After all, the current evolution towards digitisation demands a lot of financial effort and has clear implications at an organisational level (infrastructure, workflow, staff, etc.). Many interviewees explained that a small to medium-sized server to store digital data is available in the organisation, but that update and maintenance still demands a lot of investment. Furthermore, different issues need to be addressed. Is the preservation of original media appropriate? What are the costs? Which technology is the most suitable? Etc... One also has to bear in mind that digitisation will unfortunately not be the ultimate solution, since it is assumed that even digital media has a limited life span. In this respect, there is no such thing as *permanent or*

eternal media. The digitisation of an archive thus raises many questions and requires a continuous focus on new methods and practices to record digital content.

WHO HAS ACCESS TO THE ARCHIVE MATERIAL?

An audio-visual archive should not only guarantee the permanent preservation of the audio-visual data, it also has to ensure that this material is easily accessible to different kinds of users. In this context, any archive has to go through different steps, which include the processing of the material, making the necessary selections, ensuring good environmental circumstances, making the material available in a reliable way and making it available to a wide array of potential users.

As already described, most of the archive material in performing arts institutions remains in-house, used as a subject for (self-)study or prospecting. After rehearsals or an opening performance, the video material can be watched and slight imperfections can be corrected. Once in a while, foreign performing arts institutions wish to consult the material and viewing is allowed under certain conditions: sometimes for free, sometimes for payment, on tape or DVD. Another important target group is the education sector and libraries, which increasingly approach performing arts institutions for the study of cultural history or certain cultural documents/performances.

Nevertheless, as previously noted, there is a growing awareness that the material might also have a more explicit commercial value, through distribution on television, DVD or online. Therefore, recording or filming with professional equipment is necessary in order to reach a broader public. From this point of view, negotiations concerning intellectual property rights are of extreme importance.

The distribution of cultural performances via the internet is quite a popular way to distribute this content to a wider audience. Many interviewees stressed the relevance of this kind of distribution and foresee this in the (near) future or are already experimenting with this new form of cultural experience.

CONTENT IS KING, METADATA IS QUEEN

When reflecting on the use of websites or archiving and distribution in general, one should pay careful attention to the accessibility of the material. Indeed, in view of the accessibility of the audio-visual performance material, it should be carefully described in terms of metadata. This metadata need to be univocal and precise in order to guarantee the correct identification of the material (e.g. archive number, title, producer, origin or synopsis). Good metadata is a replacement of the *living memory*, to ensure that the information about the cultural item does not disappear when this memory can no longer be addressed.

Unfortunately, the interviews revealed that some organisations possess little or no information about their recordings or films, which is equal to a clear lack or absence of metadata. Three organisations observed a serious shortage of metadata because of the brief description that is applied, ranging from labels on boxes to a few descriptive terms on a tape label. The descriptions are not stored in any kind of database and are thus not easily accessible. One organisation mentions how hundreds of photographs are only characterised by a single number, which means that in a not too distant future, any information about the content of the photograph will be lost.

Other institutions employ their own custom-made system to achieve as much consistency as possible in the description of the audio-visual asset. In this respect, respondents from various

sectors refer to *'a Google-like search and archiving system'*, *'a customised software application that was developed at the beginning'*, or even just *'some description data filed on paper'*, etc. A comparison of these metadata sets reveals a big difference between institutions, tuned to the needs of each company. These *custom-made (software) systems* do indeed have their own metadata system and there is a strong variation in the amount of metadata (ranging from approximately five to more than fifteen fields) and in extra search functionalities (specific search or full-text search). Despite the effort to consistently use certain metadata within institutions, many interviewees notice that they are often confronted with a significant problem of inconsistency, owing to several factors: the lack of time to fill in all the metadata, different opinions among people within the organisation, users changing needs, etc.

Only three of the investigated organisations have made a significant effort when it comes to the development or implementation of a metadata model. Two of them use their own self-made system, wherein the relation between the physical information media and the digital counterpart is made possible by means of a unique numbering system. One organisation uses an international metadata standard, which is extremely valuable for cooperation or exchange with other institutions who apply the same standard.

BRINGING CULTURE ONLINE

After studying all the organisations' websites, we mostly observed website applications such as information searches and online ticketing. Indeed, studies show that, in general, the Internet presence of cultural organisations is far from interactive. They provide practical information, but in terms of community-building, interactivity and multimedia, they only use a fraction of the range of possibilities that can be explored with current information technologies.

The websites mainly have two target groups: cultural visitors (the audience) and journalists. In most cases, users are able to navigate in the website in a rather goal-oriented way, for instance, to make a query about a certain performance, etc. Furthermore, users can buy the remaining tickets of a performance by making their preferred selections. Most interviewees mentioned that the websites are visited by a broad array of age categories, and national as well as international visitors. Some institutions provide journalists with a separate password for the website to gain access to specific documentation. This *press corner* gives information about important dates, investments, the actors, dancers or musicians, etc., and a lot of audio-visual material such as photographs or small media fragments. In some cases, these media fragments (pictures, recordings or films) are downloadable in low resolution or high resolution, depending on the intellectual property arrangements. Nevertheless, one organisation mentioned that many journalists still prefer receiving these media fragments on CD or DVD because technical vehicles (such as a press organisation's small broadband capacity) hinder the easy delivery of these large content data packages. Performing arts institutions who do not offer the press audio-visual material on their website blame it on the shortage of time to arrange this. Specific innovative audio-visual projects on websites, which occur once in a while, are contracted to specialised firms.

The opportunities for an organisation to bring culture online largely depends on the way the material has been described in the past or – for new material – will be described in the future. Thorough and clear *metadata is a prerequisite* to make audio-visual information on a website searchable for the audience.

The interviews confirm these ideas. The three aforementioned organisations that describe their cultural assets by means of consistent metadata, are the organisations that offer different types of people (students, journalists, artists, etc.) plenty of opportunities to consult different kinds of content on their website. The information is accessible via a cataloguing system and the relations between the different items in the database allow a very narrow search. The linking of metadata leads to a relational database, which makes internal and external distribution practical. Each of the three organisations also considers cross-media opportunities by referring for example to Amazon, iTunes or YouTube. And lastly, Web 2.0 challenges – which refer, among other things, to a shift from passive users towards more interactive participants – are being considered. Website visitors are, or should be able to comment, tag or rate the performances, possibly leading to a community of engaged visitors.

ONE PERFORMANCE, MANY RIGHTS OWNERS

The initiative of bringing audio-visual material about the performances to a wider public (online, television, DVD, etc.) should be loudly applauded. After all, the distribution of the performances via different channels also has a societal role, since new forms of *accessibility* and a greater amount of available digitised cultural heritage content can result in greater benefits to the public. An introduction, virtual or otherwise, to such content not only leads to a stronger interest on the part of users, but also to improved accessibility for people who are, for one reason or another, physically unable to consult the diverse array of art and cultural collections that are stored or performed in a variety of institutions.

However, cultural performances can only be distributed when those participants who possess any kind of rights give permission. And this is where the problem lies. *Rights clearance* is a slow and difficult process. Nowadays, when performing arts institutions make an appeal to external production companies to record or film a performance, the rights are defined in advance. Who has which task and which rights? When should the cultural asset be broadcast? Is a distribution on DVD possible? Who negotiates with the rights owners? In brief, all the aspects of commercialisation are clearly stipulated. An organisation must consider all the possible outcomes in order to ensure that a wide array of aspects is included in various clauses. Unfortunately, when examining the contracts for the internal operation and management of the performing arts institutions, we observed that many of these aspects are not mentioned. For example, one clause describes distribution via the internet, but does not take into account video-on-demand or digital television. Or in the employees' employment contracts, nothing is mentioned about their legal rights and no arrangements have been made in advance, etc. In other words, rights clearance is a tricky business and this is reflected in the need for legal experts in performing arts organisations. This way, a contract can be drawn up to meet the needs of a specific person, including specialised clauses for further distribution. For these experts, negotiation with different parties for rights clearance is high on the agenda.

Moreover, since a large number of recordings or films date from the pre-internet era, most contracts leave no opportunities for online (re-)use and distribution. As a result, further promotion of these recordings or films is hampered despite their cultural value. For the cultural material stored in the archives, the question thus arises how this matter can be solved retrospectively.

OPENING UP THE ARCHIVE

With the exception of some performing arts institutions, this analysis demonstrates that the archiving policy in these cultural centres is very rudimentary and in its infancy. Moreover, making the archives available still demands a lot of investment from various types of parties. This is also the case in other countries, where many projects have been (or are being) conducted to stimulate the digitisation and distribution of performing arts.

The audio-visual collections in Flemish performing arts institutions mainly consist of recordings or films of rehearsals or public performances, used for (self-)study or promotion, and are therefore mainly available for educational and cultural purposes. In general, the majority of the material remains somewhat invisible to a greater and broader public, and risks falling prey to deterioration, with the destruction of many valuable artistic objects. Unless the archiving policy in these organisations changes, this process will be irreversible.

As a consequence, *digitisation* is high on the agenda. It offers a structural solution to prevent the deterioration of existing media (to a certain extent), the lack of storage space and poor access to archive material. It forces institutions to make choices given that the digitisation of the total collection is not advisable and financially unfeasible. They will be obliged to formulate well-considered selection criteria, based on their business models for each of their target groups (cultural, academic, educational, press, etc.). And with this new reasoning, organisations face a great many challenges.

In today's network environment, archives are no longer separate entities but are connected to each other in an intelligent way. The digital collections of different organisations are combined and cooperation beyond the traditional boundaries is encouraged. Moreover, this cross-border and multidisciplinary cooperation will greatly foster the e-culture evolution.

For this reason, digital collections must be complemented with rich metadata, and if desired, with the participation of third parties (users, other cultural organisations, etc.). The current fragmentation when it comes to metadata (models) should be overcome and could lead to a shared standardised metadata model that meets everyone's expectations and the various needs, possibly inspired by international best practices. Such a shared minimum metadata set also offers more opportunities for a closer cooperation between institutions, concretised in the easy exchange of materials. Again, this fosters a greater visibility of the valuable collections leading to a better representation within the educational and socio-cultural field.

A prerequisite for the distribution of the archive is the fair treatment of the intellectual property rights. The high-speed technological evolutions incite the organisations to constantly revise their contracts and clauses, in order to ensure distribution on different distribution platforms. However, the question of what to do with the older archive material remains: will there be some kind of general amnesty for these productions?

Related to this is the growing awareness in performing arts institutions that professional recordings or films (in-house or via external production companies) of the performing arts might also have a commercial value, as well as their educational and cultural one. The *proliferation of alternative distribution platforms* (online, video-on-demand) offers the opportunity to reach a new public, and the successful distribution of DVDs and videos prove that performing arts can generate extra revenue.

Changing to a process of digitisation in an organisation is clearly not obvious. The production and archiving department must be geared towards one another and work routines must be altered and adapted to the new situation. Above all, there is a price tag on the migration of all the audio-visual material.

In addition, there are the technological requirements for the archive in terms of file formats, search engine, retrieval system, transformation procedures, rights clearance, the creation of unique identifiers, and so on. After the technical requirements, a digital workflow also demands a willingness to cooperate, both with cultural partners and the cultural participant. The traditional one-way communication should be replaced by open communities (cf. Web 2.0) that offer more chances with regard to information, interactivity and personalisation. Furthermore, one should also consider the management and structure of the archive. Combining different collections has a clear surplus value and a centralised, platform-independent distribution system could be an interesting solution to lower the costs. In this case, the maintenance and safeguarding of the archive is decentralised and distribution occurs through a central distribution system. What is also important – but often overlooked in the shift towards digitisation – is the opinion of the different types of users of the audio-visual material. In this respect, it is noted that users are often involved or consulted too late in digitisation discussions. Therefore, given the diversity of users, a whole range of expectations needs to be investigated.

To conclude, performing arts institutions still face many challenges when it comes to archiving and distributing their content. The interviews and visits revealed that there is a high degree of uncertainty and a strong need for guidance. Only some organisations risked engaging in innovative projects, which did however prove to be successful. So who's next?

Distribution channels for digital cultural content

Gert Nulens (IBBT-SMIT-VUB)

The advent and use of new media has been profoundly changing the domain of arts and culture in the last few decades. New media have been increasingly introduced in the creation, management and consumption of cultural content. Today the creation of music and cinema is characterised by digital workflows and technologically sophisticated production. Some cultural content is of digital origin and analogue content is increasingly being digitised. This offers additional opportunities to preserve cultural content in a sustainable way. Indeed some content will be lost forever if it were not transferred to more sustainable types of media. Thousands of movies and old music recordings are quickly deteriorating, and old books and pictures are degenerating. The digitisation of this content can preserve our cultural heritage for future generations. New media will not only be used to preserve existing content, they can also be instruments for a sustainable storage of new cultural expressions — e.g. digital recordings of concerts, theatre and dance performances.

Digital cultural content can also be presented, promoted and distributed in an innovative way. As well as the traditional means and media for cultural distribution – such as theatres, television, radio or books – cultural products can be distributed on a wide range of new instruments and applications: websites, digital television, digital cinema, podcasts, mobile television, MP3 files, etc. Moreover, digital content can be interlinked beyond the traditional borders of disciplines and organisations. This creates

opportunities for the advent of a *virtual cultural space* in which all artists, cultural creations, cultural organisations and cultural agendas are connected. It would be a cultural information and knowledge base from which unexpected relations, new symbolic meanings and innovative insights could emerge. However, this promising cultural space is strongly dependent on several conditions, including available metadata (data describing the digital content), organisational willingness to cooperate, technological investments (servers, broadband services), and agreements on standards.

As well as innovations in the way cultural content is created, preserved and offered to an audience, this audience is also changing its cultural practices and habits. While audiences used to consume predefined cultural products or packages, they are increasingly looking for very individual experiences in the vast cultural offer. People are using new media to construct a very personal selection of cultural content, to listen or watch cultural content where and whenever they please, to get cultural guidance from peers (instead of cultural experts), to prepare a cultural visit, to archive their own cultural experiences, and to communicate about it.

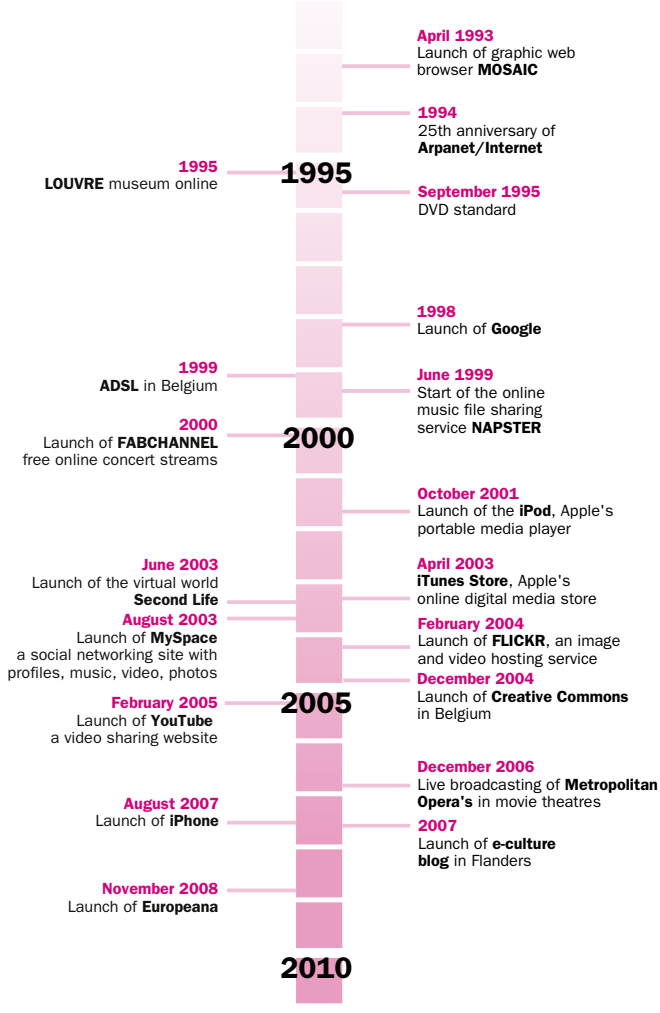
These evolutions do change the cultural domain. They can have a deep and intense impact on cultural production, cultural intermediation between artists and cultural participants, and the cultural experiences of the audience. However these evolutions will not substitute most existing cultural practices but will offer *additional ways to create and experience* cultural content and arts.

In this chapter, a variety of possible distribution channels for digital cultural content are explored. First we shall elaborate on the advantages of digital distribution. Why should digital cultural content be distributed and what is the added value compared to the analogue situation? Secondly, we shall reflect on recent cultural participation data. Is there an audience for digital cultural content and are there differences between online and offline audiences? Thirdly, we shall structure the field of digital distribution by classifying potential channels, goals and opportunities. Lastly, a number of best practices in digital distribution both in the broad cultural domain and in the field of performing arts are presented.

DIGITAL DISTRIBUTION

The distribution of digital content is not that new. Since the introduction of graphic web browsers in the early 1990s, artists and cultural institutions have been distributing digital cultural content. In these early stages of digital distribution, the content predominantly looked like a type of digital information brochure or descriptive data about arts and cultural objects. In following years, we experienced a range of new services and applications (see Figure 1). Some of them were successful for a short period (e.g. Napster), some have been rather disruptive (e.g. iTunes), and some have been hugely successful and then abandoned (e.g. Second Life). Moreover, some of the listed applications may be completely pushed out of the scene by competing applications. Nevertheless, some listed applications will have a lasting impact on how we think cultural content can be distributed. In other words, their value lies in their position as referents.

Figure 1: Highlights in digital cultural distribution



Why are these applications relevant for the cultural domain and why are artists and cultural institutions increasingly using them in their daily routines? There are various reasons. First of all, these new distribution instruments may be relevant tools for reaching the audience in a different way. Today, there are more than 1.5 billion internet users worldwide. More than 4 billion people have a mobile phone and almost 350 million of them have a mobile broadband connection. This connection allows the subscribers to create and consume multimedia. Thus, new media have become a means to reach a very large part of society, especially in the developed world. By using new media one hopes to better serve the existing audiences and to attract new ones. It is argued that thresholds for cultural participation, which can be practical (e.g. accessibility or opening hours), financial, social and cultural, can be overcome by using these new media.

After the audience argument, the second argument for the digital distribution of cultural content is related to the internal needs of the cultural sector itself. The preservation and distribution of digital cultural content can be an important source for the professional, i.e. inspiration, creation or education. Indeed an online cultural distribution platform can be a very accessible way to find cultural references and thus offers creators a rich and dynamic source of inspiration. Secondly, distributed content can be re-used in new creations. And lastly, digital content can be used by professionals for training and educational purposes.

The potential of going beyond the content as such and connecting content in ways which are impossible or difficult in the analogue or offline world, is seen as an additional advantage of digital distribution of cultural content. As such, cultural content can be *contextualised and enriched*.

However actual practices in cultural participation and in content distribution show that there still is quite a gap between the desirable and the feasible. Virtual cultural participation

seems to be determined by the same factors as in 'real' cultural participation. Research results in Flanders show the enormous impact of age and education on participation levels. Moreover, there is still a digital divide in society. And this divide threatens to amplify the existing cultural participation gap.

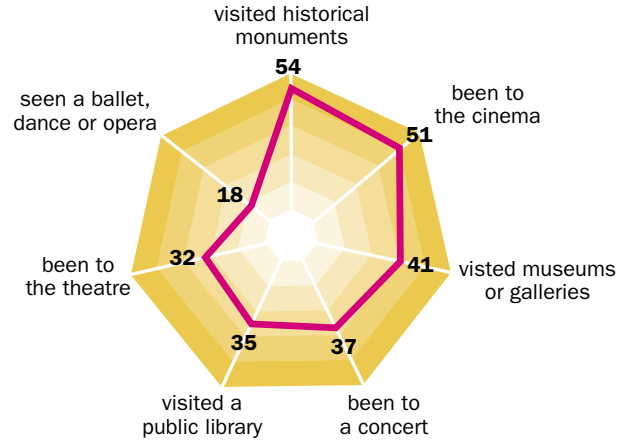
Practices and experiments in the domain of cultural content distribution also illustrate the complexity of recent evolutions. Indeed it is technologically possible to digitise and connect cultural content coming from a wide range of actors. But the road to an interconnected cultural space is full of obstacles, ranging from financial barriers (for digitisation, creation of metadata, etc.) and organisational problems (standards, formats, etc.) to policy challenges (willingness to cooperate, competing interests, etc.).

VIRTUAL CULTURAL PARTICIPATION

Does it make sense to distribute digital cultural content in order to broaden and deepen cultural participation? In other words, is there really an audience for digital cultural content? First of all, data regarding cultural participation in general will be presented. This data will then be compared with findings concerning participation in digital culture.

When taking a look at general cultural participation data in Europe, we observed that the only activities practised by more than 50% of the population are 'visiting historical monuments' and 'going to the cinema'. In the domain of performing arts, we observed that 37% have been to a music concert, 32% have been to the theatre and 18% have been to a ballet, a dance performance or an opera.

Figure 2: Cultural participation (at least once in the last 12 months) in EU-27 in percentages



It is rather difficult, if not impossible, to present a similar figure regarding virtual cultural participation. First of all, available data are scarce. We know of very little data about virtual participation in the domain of performing arts in Europe. Secondly, due to different ways of selecting respondents, different survey questions and different research periods, it is not an easy task to compare the available data. Therefore, in the following reflections on virtual cultural participation, we shall focus on only two regions/countries, namely Flanders (the northern part of Belgium) and the Netherlands.

In 2005, a research consortium presented an analysis of cultural participation in Flanders based on research into a representative survey. More than two thirds of the respondents belonged to the

group of people attending cultural activities. This data regarding virtual cultural participation in Flanders showed, not surprisingly, lower percentages. The 'virtual cultural participation' category was defined as the sum of 'looking for cultural information on the internet', 'purchasing cultural products on the internet' and 'experiencing online culture'. Approximately one third of the Flemish respondents could be called virtual cultural participants. When focusing on theatre/dance and the differences between 'real' and 'virtual' participation, one can see that the data concerning virtual participation is much lower. While 23% of the Flemish respondents attend theatre or dance performances, only 5.5% of the respondents have looked for online information about theatre/dance and only 0.3% have used the internet to experience theatre/dance (for example by watching online dance movies). These differences can be partially explained by the relative absence of digital content about theatre and dance on the internet.

A Dutch analysis of visitors to cultural websites reveals more detailed information about what the presence of performing arts on the internet means and about how the information is used and appreciated. The authors argue that almost all theatres in the Netherlands have a website nowadays, but that these websites are dominated by practical information about upcoming performances. Dutch theatres are increasingly making digital records of performances. Nevertheless only a few are distributing this content online. Visitors of theatre websites in the Netherlands are mostly women (73%), in the 35-49 age bracket (39%), with higher education (49%) and employed (69%). Half of the virtual visitors would like to see short theatre movies on these websites.

CHANNELS, GOALS AND OPPORTUNITIES

Digital distribution of cultural content can come in many shapes and forms. Indeed there are many channels to distribute digital cultural content. Among them are channels that are very close to traditional media usages such as digital television and internet radio. More experimental or innovative channels/applications include virtual worlds, game consoles and smartphones.

Public broadcasters all over the world have a long but also difficult tradition concerning the distribution of cultural content. Broadcasters have been criticised by the cultural sector and the general public. Either the content was too elitist or it was too popular. Nowadays, several public broadcasters are offering their cultural content via digital-only channels – *'behind the red button'*. Again, this evokes criticism with regard to the limited democratising potential of this approach. Recently, new actors have entered the domain of cultural broadcasting. In Flanders the private broadcaster EXQI started in October 2006. EXQI offers cultural programmes with a focus on music (pop, rock, classical, opera). Smaller initiatives, often from within the cultural sector, have popped up everywhere. For instance, there is Fabchannel (Amsterdam) and ABtv (Brussels). Both initiatives concern the online streaming of concerts. These and other cultural actors are gradually broadening their scope, from offering cultural activities linked to a certain time and space to a cultural programme which is always available by means of new media.

Cultural institutions and artists have also been exploring other web applications. Theatres have institutional websites on which they can promote their activities and distribute recorded or connected content. Virtual worlds such as Second Life once were, before being overwhelmed by a passive crowd, a playground

for artists like architects, designers and musicians. One of the existing instruments with a very high distribution potential is a digital archive. In several countries digital cultural archives are being constructed. A well-known example is Europeana, a European digital library for cultural heritage. However, *content distribution* from such an archive cannot be taken for granted. Several challenges have to be addressed, including copyright issues, standardisation, metadata, etc. The future internet will be a mobile internet. People are increasingly using smart handheld media which allows them to be connected with multimedia content anywhere, anytime.

Audiences can use these distribution channels for several purposes. The main motivation may be closely linked to a physical visit to cultural activities. People want to see virtually what they are going to see in reality. One could call this a kind of pre-visit. On the other hand, people also like to relive their recent experiences in a kind of virtual post-visit.

In contradiction with the above-mentioned virtual derivatives of the 'real' thing, digital culture itself can also be the experience. Indeed a virtual experience can be a kind of new user experience. First of all, a digital collection can be contextualised in many ways. Digital content can be situated in a vast collection of related objects extending the boundaries in which physical collections are usually situated. Objects from one institution can be linked with data from a research centre or with information from a related artist. Secondly, digital content invites people to guide each other through the content. Well-known web 2.0 applications such as Last.fm or Amazon are using the *wisdom of the crowds* to enrich the information about the digital objects. In other words, people are learning from each other's online experiences and comments.

table of contents

However, all these opportunities are closely linked with the availability of digital cultural content. In the next section, some cases in which the construction of a digital archive and the distribution from the archived content have been successfully realised are briefly described.

BEST PRACTICES IN CULTURAL DISTRIBUTION

There are lots of small-scale examples of digital cultural content distribution, be it linked to a certain organisation, company or artist. However, more large-scale cases, in which content from a wide range of cultural actors and/or cultural domains are brought together in a kind of centralised distribution platform, are much scarcer. The Scottish SCRAN and the Dutch Sound & Vision are examples of these larger initiatives.

The Scottish Cultural Resources Access Network (SCRAN, www.scran.ac.uk) is an initiative aiming at the preservation and distribution of photos, images and sound. SCRAN offers more than 347,000 objects from museums, galleries, archives, private collections and the media. The collection is characterised by its historic value and is primarily directed at the educational sector, libraries and research centres. In order to serve more than 4000 institutions with the collection, SCRAN cooperates with 300 cultural organisations.

SCRAN was launched in 1996 by The National Museums Scotland, The Royal Commission on the Ancient and Historical Monuments of Scotland, The Scottish Museums Council, and The Scottish Consultative Council. The digitisation of the collections has been paid for through subsidies and service contracts. Collection owners distribute their digital content through SCRAN by means of a specific licensing system. They still own the digital

content but deliver the content via a license. SCRAN users can be divided into different groups. Everybody can look in the database for free after being registered. However, a free user can only obtain thumbnail information. Tariffs for full content delivery are linked to the institutions to which the users belong. There are special prices for schools, universities and libraries.

SCRAN is an excellent example of a large cooperative project in which hundreds of cultural institutions add content to the central digital collection. But not only the organisational structure and the collection are worth mentioning. Indeed SCRAN is offering more than digital information. There are, for example, podcast services, *educational packages*, virtual exhibitions, and virtual communities. Users can create a personal webpage within SCRAN where they can archive their pictures, slides, notes, creations, etc.

One of the best known initiatives regarding distribution of digital content comes from the Dutch Institute for Sound & Vision (www.beeldengeluid.nl). This institute brings together large audiovisual collections from the Netherlands. More than 700,000 hours of radio, television, film and music are archived in the institute's building. Part of the collection has been digitised and is available online.

One of the most important target groups of the Dutch institute is the educational sector. Among the services for education are Teleblik and Academia. These are websites that collect thousands of hours of digital content selected especially for primary education and high schools (Teleblik) and universities (Academia). The websites contain content closely linked to educational programmes, in an accessible low-res format and free from copyright issues (the content is licensed).

Recently, the Dutch Institute for Sound & Vision launched an innovative educational media platform in which new services are included. The platform combines three applications: a one-stop search in different databases, an online platform to create presentations with digital video, and a database for online lessons. In short, the platform wants to bring the contextualisation of content one step further by inviting users to share their experiences and knowledge.

The archive is also frequented by professional customers and individual users. Professional users, mainly from the *creative industries*, can search in the archive and view the results. Very often the Dutch institute does not own the copyrights of the digital content. However, it will act as an intermediary facilitator between the potential professional user and the content owner.

As well as these large-scale distribution projects, two specific cases from the domains of the performing arts and music should be highlighted. 'Metropolitan Opera Live in HD' is an initiative of the Metropolitan Opera in New York, one of the biggest opera houses in the world (www.metoperafamily.org/metopera). It concerns the transmission of live performances in high definition in movie theatres in North America, Europe and Japan. The Met wants to broaden its audience through this new way of opera distribution.

Some of the broadcasted operas are now part of an online database which is accessible via pay-per-view or a subscription. Content is distributed by the Met player, a new streaming video player. The Met player allows the user to choose a favourite opera in high-definition video, standard-definition video and audio. Moreover, users can obtain additional related information such as synopses, articles, background information, etc. In Flanders, Kinepolis brought some of these operas into their movie theatres. The Belgian Concert Hall Ancienne Belgique (AB) started up ABtv in 2006, an online service offering users a wide range of live and on-demand concert streams (www.abconcerts.be). First of all, the AB wants to increase its audience via this new service. Concerts

are very often sold out. The online service is an additional tool to reach more music fans. Secondly, ABtv is a kind of online promotion channel for Belgian artists. And lastly, ABtv could be the start of a digital archive of Belgian artists. Based on the belief that people do not want to pay for online content, ABtv offers the content for free.

Nevertheless, the exploitation of a content platform is costly. The AB has to invest in the digital recording of the concerts, production, broadband costs, etc. This situation, whereby there is no revenue from users and copyright holders (artists or companies in the creative industries) are not always happy to deliver the content for free, may not be very sustainable. The latter is painfully illustrated by the end of the famous concert streaming service Fabchannel in March 2009 (www.fabchannel.com). Fabchannel had been very successfully streaming live and on-demand concerts from the Amsterdam concert halls Paradiso and Melkweg. The founder of Fabchannel, Justin Kniest, explained in an online message that the added value in the promotion and sales of the online distribution of concerts could no longer convince the labels (the copyright owners) to cooperate.

In other words, artists, the creative industry and cultural organisations are looking for alternative business models in the new digital landscape. Within a context in which traditional content actors are increasingly threatened by new online actors (e.g. iTunes, Amazon, citizen journalism, etc.), decreasing revenues (lower sales and lower revenues from advertisements), and a new generation used to free content, the distribution of digital cultural content will not follow a straight and easy path. For the time being, in an era of *contestable business models*, the production and distribution of digital content is rarely profitable.

However the opportunities and added value (in a cultural and social context) are too promising to give up. Audiences are increasingly looking for online cultural experiences. And some cultural organisations are proving how innovative distribution channels can create a cultural enrichment. The growing audience for digital culture and the actual evolutions towards rich cultural content by means of digital distribution channels are challenging cultural policymakers.

Opportunities and audiences for the performing arts in digital television

TEST RESULTS FROM A PILOT STUDY

Tom Evens (IBBT-MICT-UGent)

In Western Europe, the transmission of cultural programmes was traditionally seen as a major argument to legitimise the establishment of public service broadcasting (PSB). Indeed, within its cultural-educational mission, PSB has contributed to the creation and development of national identities by supplying highbrow culture in order to enlighten citizens. However, this enthusiastic spirit surrounding the medium was soon replaced by a more industrial-economic approach. Commercial networks, aiming to capture the greatest number of viewers for advertisers, began to limit arts programming for its unprofitable small audiences. This illustrates that profit-making and audience rating concerns seriously complicate *televised arts programming*.

As a result of the increasing competition from commercial channels due to the liberalisation of audio-visual markets since the 80's, the cultural mission of PSB in Europe has resulted in highbrow culture such as theatre, opera and dance being increasingly superseded by popular culture. This evolution towards more competition for viewers is likely to cause less programme diversity with television content among broadcasters becoming almost alike. However, according to the European Commission, new information and communication technologies (ICT) might be a strong driver *'for reinforcing Europe's cultural diversity by*

making our heritage and our cultural creations available to a wider number of citizens'. By benefiting from digital television services, which transform distribution scarcity into an abundance of choice, the *power of the 'long tail' (Chris Anderson)* enhances greater media pluralism and cultural diversity. By embracing all kinds of niche content, the so-called "long tail" is assumed to aggregate dispersed audiences and maximise their share. This is certainly the case for niche content genres that are banned from the traditional screen because of their small and therefore unprofitable audience sizes.

As the share of culture in total television programming has diminished over the last two decades, this decreasing spiral is hard to transcend in the analogue linear broadcast world. However, new emerging technologies, such as digital television, could prove to be alternative gateways to deliver culture to a wider audience and to revive televised arts. As culture evolves to become digitally consumed, these technologies present opportunities for the cheap and easy delivery of cultural content. Nevertheless, television is still seen as the most appropriate medium for the wide-scale distribution of cultural experiences. Experts claim that digital television services are currently starting from pole position to distribute high-quality and full-length cultural heritage videos with mass appeal. This chapter reports on *a pilot study* based on the existing video-on-demand (VOD) platform of Flanders' main digital television (cable) operator (i.e. Telenet), aiming for wide-scale delivery of performing arts videos and investigating the economic potential of this venture. In addition, we have drawn up a profile of the so-called innovators of this pilot study. Since little is known about the actual demand side of audio-visual cultural heritage over VOD and its users, this paper endeavours to fill this gap.

METHODOLOGY

Based on the established VOD platform of the digital television operator Telenet, a pilot study was set up for the large-scale delivery of performing arts videos. A pilot study often involves testing by end-users to gather marketing data before planning the entry into the *commercial market*. Owing to tough copyright negotiations, the pilot only ran from May until August 2008 and started with 10 items including musical, dance, and classical and jazz music recordings; in August 2008, the PokuMOn library was updated with five additional videos. These items were democratically priced, ranging from EUR 0.50 to EUR 2.00, except for one short teaser that was offered free of charge. Due to the pilot's experimental and short term character, no specific promotion campaign was established except for a single press release.

Prior to the pilot, we conducted an electronic survey amongst all digital cable television viewers in Flanders, i.e. almost 30% of all households with a television. By gauging their expectations concerning this kind of archival material, we were able to investigate the economic potential of this material in the VOD platform and to accurately profile these users and non-users. In the end, we obtained representative sample data from 678 households on which statistical analyses were performed. By using the Product Specific Adoption Potential (PSAP) methodology, we were able to avoid the traditional overestimations of an innovation's potential that arise when using one-question-intention questionnaires. This PSAP methodology has been applied successfully to a diversity of ICT innovations such as digital TV, 3G, mobile TV and mobile internet.

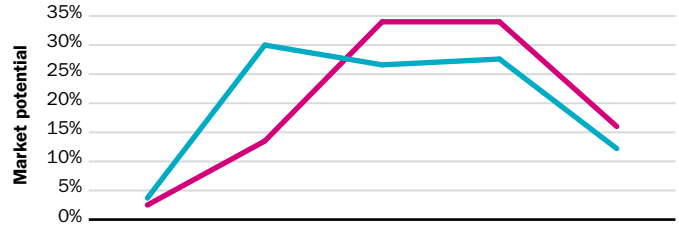
As the PSAP methodology relies heavily on forecasting techniques, we combined these results with more in-depth findings resulting from the pilot itself. By means of exclusive data provided by Telenet, the telecom operator involved in this

research project, we revealed some basic but nevertheless interesting customer facts and figures concerning the use of the performing arts VOD service. Finally, in order to draw up a profile of the users and to gauge their satisfaction, we addressed all households with digital television who had ordered videos from the PokuMOn library. In the end, 121 customers filled out the internet questionnaire. This allowed us to provide a general snapshot of the socio-demographics and cultural consumption patterns of the pilot users. By combining the market adoption forecast with more in-depth usage analysis, we aim to provide a more holistic view on both the sustainability of interactive digital television services for the supply of cultural programming and the actual take-up of such services among households with digital television.

MARKET ADOPTION FORECAST

By applying the PSAP segmentation forecast method to the stated intentions of 678 respondents, we obtained a reliable view on the size and nature of the various adopter segments for this interactive service (PAD). Whereas the blue curve indicates the predicted market demand for cultural niche content (see Figure 1), the red line represents the theoretically assumed distribution pattern of Rogers' diffusion of innovations, according to which the diffusion of an innovation in a social system always follows a bell-shaped distribution, with a successive distinction between innovators (2.5%), early adopters (12.5%), early majority (34%), late majority (34%) and laggards (16%). This segmentation forecast governs the potential market for such a pay-per-view supply and indicates a realistic *partial market potential* among one third of the digital cable television households in Flanders in 2008. Not only were 3.7% of the respondents revealed as innovators, or as a segment that would immediately subscribe to such a service as soon as it became available, but another 30% was detected as an early adopter, a large segment that would probably not be among the very first to adopt, but with a need, an interest and a willingness to pay that is significant enough to expect them to adopt shortly after the innovators.

Figure 1: Segmentation forecast (general)



	innovators	early adopters	early majority	late majority	laggards
PAD	3.7%	30.0%	26.6%	27.6%	12.2%
Rogers	2.5%	13.5%	34.0%	34.0%	16.0%

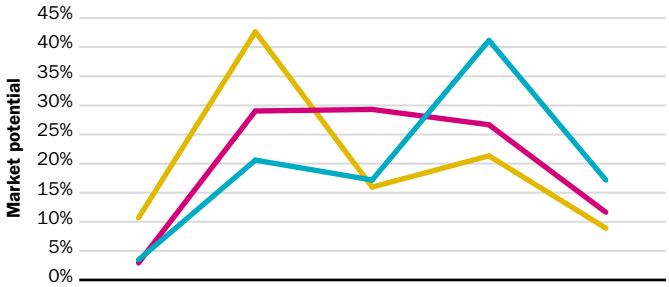
However, these figures need to be put into perspective since the sample only represents the more innovative part of Flanders that has already adopted digital television. The survey was conducted in the first part of 2008, a time when digital television was in the transition stage between early adopters and early majority, with approximately 800,000 households having access to digital TV services, of which about 500,000 over cable at the date of the pilot. In other words, these figures are only representative for the more innovative part of the Flemish television households that had already adopted digital TV. As digital television continues to move into households with more technology-averse people going digital in the future, this short-term potential of innovators and early

adopters is likely to drop. Nevertheless, this potential estimation reveals a substantial short-term partial market potential for on-demand cultural content and feeds hopes of a cultural programming revival as a result of digital television's affordances. Indeed, we identified a very interested and quite innovative front part of the market for cultural content in terms of two segments that are likely to take up the service rapidly because of practical, social, economic or other reasons.

As we discovered, there is a possibility of an even bigger market potential, although it would be risky to build a sustainable business model on this. In the social process of the diffusion of new technologies, innovators and early adopters are seen as trendsetters whose behaviour is copied by less innovative segments, such as the early and late majority segments in ideal situations. In order to reach the mass market, a crucial moment in the adoption process is considered to be the transition or copy behaviour of early adopters towards critical mass, starting with the early majority, which is a vital segment for applying a full market approach. Therefore, it is necessary to keep the majority's expectations in mind from the early introduction of the innovation, and to propose the technology in such a way that it can leverage added value for all the proposed segments. When a technology does not proceed to convince less innovative segments or does not succeed in crossing the *chasm* between early adopters and early majority, the market remains limited to the innovative segments as was the case with a lot of innovations such as WAP (Wireless Application Protocol, an open standard for wireless internet via mobile devices) and the Nokia N-Gage (a mobile gaming device). If these segments in front of the chasm are quite small-sized, innovations end up failing, which may have serious commercial and financial implications. When these segments are of a substantial size, a business model can be developed to reach full market.

In this case, we notice a certain decrease in potential when comparing early adopters (30%) with the early majority (26.6%) and a substantial lower interest and willingness to pay among the early majority. Therefore, some kind of chasm can be expected when launching the service. Assuming the totality of digital cable television households is the potential target market for this supply, this implies that full market acceptance may not be that self-evident. Because of the rather innovative foreground of the market, transition from these segments towards the majority of the market is doubtful. Clearly, we must imagine difficulties in order to persuade culture-averse people to try new technologies. Other people may have financial or even technological reasons for not using new technologies. As we have concluded from our research, 20.3% of the respondents indicated that they were unaware of digital TV's interactive VOD features while almost 45% of the respondents never use VOD services. However, the actual size of the market will depend on the applied introduction strategy and future competition from other providers (via digital television but also via alternative distribution channels such as the internet). As the name of the method suggests, the product specific adoption potential only forecasts the adoption potential of a new technology and not its future sales. The extent to which providers can realise this forecasted potential will thus heavily depend on marketing decisions such as price, content and communication efforts.

Figure 2: Segmentation forecast (cultural consumption)



	innovators	early adopters	early majority	late majority	laggards
non-participants	3.45%	20.68%	17.24%	41.37%	17.24%
sporadic participants	2.91%	29.17%	29.44%	26.79%	11.67%
frequent participants	10.71%	42.85%	16.02%	21.42%	8.92%

Without going into too much detail about the particular profiles of the various (non-)user segments, we closely analysed to what extent cultural participation plays a decisive role for consumers to try and enjoy this cultural content-on-demand service. By cultural participation, we mean the overall degree to which people inform themselves about cultural products or events, purchase cultural goods (e.g. books, discs, concert tickets, etc.), watch audio-visual cultural content (on television or the internet) and participate in cultural events. Based on these four variables, we computed a new variable classifying all respondents into a limited set of cultural consumption profiles. We eventually drew up three distinctive categories clustering people with similar cultural consumption patterns. Depending upon the frequency with which people enjoyed forms of culture during the last six months, three types of cultural participants were identified:

- non-participants (NP) with almost no participation at all;
- sporadic participants (SP) with participation limited to maximum two instances of participation, and
- frequent participants (FP) having enjoyed culture at least on a bi-monthly basis.

As Figure 2 shows, adoption potential for this interactive cultural content is undoubtedly the highest among frequent participants, who can be considered as culture-lovers. While considering the early adopter segment in particular, and given the largest proportion within the innovator segment, frequent participants are most likely to take up the innovation or at least try it immediately. The opposite is certainly true for non-participants, the so-called culture-averse people, who seem barely attracted by the culture-on-demand supply. This is exemplified by the fact that only one quarter of this category belongs to the most innovative segments. Last but not least, sporadic participants, who make up some 80% of our survey sample, remain rather inconclusive about the content although the proportion of its early adopters is still considerably high (nearly 30%).

LESSONS LEARNT FROM THE PILOT

Research data provided by Telenet enabled us to gain insight into the actual market demand during the pilot. Due to privacy concerns, no information about the socio-demographic profile of these users could be tracked so that only data on a macro level were obtained. Figure 3 provides an overview of the actual purchase of each library item. As said, the pilot started with ten performances with the seven-minute *Body, body on the wall* offered for free. Despite the lack of publicity, this short teaser was requested nearly 900 times during the first month while the other productions performed by Ultima Vez also drew attention. In August, the library was extended with some other performances from the Ultima Vez trademark.

It thus seems that well-known performers are somehow necessary to drive the consultation of content services. This is especially crucial when targeting a wider public than just culturally-minded, well-educated and high-earning people, who are often associated with participation in culture. For this reason, we also included the popular musical *Cyrano de Bergerac*, which was one of the most popular items in the video library. Besides this, we cannot ignore the fact that few users were willing to pay since the majority of ordered items were retrieved free of charge. Another major conclusion we can draw from these results is the declining interest in the items during the trial. While there were more than 1000 consultations in the first few months, this amount had nearly halved by August. Nevertheless, the increasing demand in August compared to July demonstrates that more content possibly leads to more demand. Therefore, providers have to manage their portfolio in such a way that the supply is gradually extended in order to continue leveraging added value for returning customers. Above all, this demonstrates that continuity acts as one of the key factors in the success of VOD platforms in Flanders.

Figure 3: Number of performance consultations

Performance - Performer(s)	May	June	July	August	Total
Blush - Ultima Vez	55	22	18	21	116
Roseland - Ultima Vez	25	17	10	6	58
Body, body on the wall - Wim Vandekeybus	889	578	426	355	2248
Cyrano de Bergerac - Various artists	17	16	13	17	63
Flemish Jazz Meeting 1 - Various artists	5	8	7	1	21
Flemish Jazz Meeting 2 - Various artists	1	7	1	1	10
Et ecce terrae motus (Brumel) - Huelgas Ensemble	3	5	1	1	10
Harmoniemesse (Haydn) - La Petite Bande	4	4	4	3	15
Lecture Curating the Library - Sidi Larbi Cherkaoui	0	1	1	1	3
Lecture Curating the Library - Josse De Pauw	6	4	2	2	14
Silver - Ultima Vez				19	19
In spite of wishing and wanting - Ultima Vez				30	30
La Mentira - Ultima Vez				31	31
Dust - Ultima Vez				14	14
Symphony n° 41 (Mozart) - Anima Eterna				11	11
Total	**1005**	**662**	**483**	**513**	**2663**

Although at first sight these results could be seen as disappointing, we believe they support our rather optimistic market forecast. We should mention that only a limited, specific and even avant-garde trial supply was involved in this pilot, which nevertheless proves that there is a wide and diverse public interested in watching and even paying for performing arts on television under certain conditions. Out of a total of about 500,000 households with digital cable in Flanders, a considerable proportion of the forecasted innovators was reached, although we cannot expect the market potential to be realised within only four months. This is especially the case when running the pilot study during summer months when audience viewing figures have been proved to be considerably lower compared than other months. We also need to consider the potential competition from the Olympic Games that may have lured attention away from the VOD platforms. In other words, the timing of the product launch is essential for reaching a high market penetration.

Furthermore, neither the telecom operator nor the cultural institutions involved significantly promoted the cultural content service because of its temporary character. After all, the impact of marketing, advertising and *promotional strategies* should not be underestimated when launching new consumer goods wherein both content aggregators and cultural institutions have to fulfil an important role. As well as close cooperation, content aggregators and cultural institutions can raise product awareness among their target audience (subscribers, customers, etc.) through efficient and attractive communication about the supply. Therefore, the extensive profiling of users through segmentation forecasting provides communication experts with valuable input to set up microsegment targeting and marketing campaigns to reach target audience(s) more efficiently.

Despite the large amount of cultural institutions in Flanders, only a limited amount of 15 recordings were collected. Furthermore, the supply was not that representative due to the absence of theatre and the dominance of dance performances. The major conclusion is that *very little arts performance footage is ready for multimedia distribution*. This has much but not exclusively to do with copyright issues. Indeed, uncertainty exists about the copyright status of recorded performances. In the past, some of these rights were not or insufficiently registered, which has reduced the opportunities to (re)distribute this content. Therefore, cultural institutions have become risk-averse and prefer to avoid prosecution by not distributing this content.

Technical factors are undoubtedly another explanation for this clear lack of distribution-ready content. It seems hard for these institutions to stay up-to-date on fast-changing technological developments, especially in the field of data transcoding and video formatting. After all, interviews have revealed that the creative sector is rather sceptical about transforming potential content into distribution-ready footage and exploiting limited resources (time, people, money, etc.) to lower these legal and technological thresholds, especially when widespread success is not guaranteed. Perhaps this is due to the fact that the cost structure of subsidised cultural institutions is suffering from these overheads and that there is little optimism about new exploitation practices for audiovisual footage (DVD, internet, iDTV, etc.) in an economic sense.

A final lesson is that such a service implies high initial costs. Within the scope of this pilot study, only existing productions and recordings were applied. In other words, no new exclusive content was produced for this purpose only, which has of course drastically reduced production costs. In our opinion, such a platform should provide added value and therefore exclusive content. This is especially true given the tight competition from other entertainment resources. However, we have strong doubts about the economic viability of a platform providing exclusive cultural content. When catering the niches "in the long tail," costs should be kept

to a minimum. Secondly, as tough negotiations for content clearly illustrate, the time needed to bring all the content together onto the platform increases management costs. In particular, the lack of knowledge about copyright issues has increased these costs, which are likely to inflate if service providers have to clear rights. Lastly, profit margins are limited by storage and transaction costs, which are inherent to VOD. This may eventually affect (split) revenues of both service providers and cultural institutions.

PROFILING USERS

In order to become acquainted with the customers of this cultural content service, we contacted all households that had ordered at least one video during the pilot study. In the end, 121 households with digital TV filled out our questionnaire. This enabled us to draw up a socio-demographic profile of the users. Since research has revealed that cultural consumption is characterised by a rigid participation divide, it begs the question whether new forms of virtual consumption (e.g. via digital TV) can overcome these barriers in terms of age, sex, education or income level. Our data below enables us to shed some new light on this issue and should qualify this technological optimism.

As Figure 4 clearly shows, men in particular tried out this interactive content. This supports earlier findings that men would be more likely to use and purchase new technological services than women. However, these figures should be set in a wider context. As they are often responsible for the purchase of ICT within households, it was especially men who filled out the questionnaire. This does not automatically imply that only men watched the videos they ordered; it is very likely that their partner also enjoyed the performing arts videos. The traditional assumptions on cultural participation are further confirmed as the content was relatively more consulted by a somewhat older segment of the population. Almost 80% of all viewers were older than 35, and half of the audience was at least 45. This leads to the rapid conclusion that televised performing arts simply fail to attract youngsters and young families. Thirdly, we found that users were more likely to be highly educated. Undertaking further studies should thus be considered an important driver for cultural consumption. This is also the case for income level: higher income levels tend to stimulate cultural participation. Our data suggest that the traditional participation divide is simply extended into the virtual world although digital culture is often assumed to be more accessible and to democratise access.

Figure 4: User socio-demographics

Variable	Items	Frequency	Percentage
Gender	Male	93	80.9
	Female	22	19.1
Age	<34	22	19.1
	35-54	66	57.4
	>54	27	23.5
Education	Primary	20	17.4
	Secondary	28	24.3
	College	40	34.8
	University	27	23.5
Income	<1000 €	1	1.3
	1000-1500 €	26	32.9
	1500-2000 €	30	38.0
	>2000 €	22	27.8

Surprisingly, sporadic participants in particular watched this content the most frequently, while we expected frequent participants to be overrepresented within our pilot study. This suggests that the cultural content supply was perceived as less elitist than was originally feared. This inspires hope that digital television services have made culture more accessible to sporadic and even non-participants. This increased exposure can stimulate these segments to go to cultural venues more often. Within this context, the pilot study and even a future commercial deployment *can also be considered as an educational experiment* to push interested people softly towards theatres and cultural venues.

Although this hope could be somewhat naive, we believe that this kind of service undoubtedly presents an opportunity to deepen, widen and renew the concept of cultural consumption. As the cultural sector is characterised by deep participation divides whereby non-participating strata of the population are hard to target, the recent digitisation of media and cultural industries enable new consumption practices, which go beyond traditional and physical access to cultural content. Thanks to the fact that the adoption of digital TV is going at a much faster pace than broadband internet penetration, and that most people are much more familiar with their television set, we believe that television holds greater opportunities for the distribution of culture in our society. Within this context, we make a strong plea to take TV more serious when debating on the democratisation of culture, which has mainly focused on the use of the World Wide Web up until now.

Limitations for performing arts in an online environment

Tim Raats (IBBT-SMIT-VUB)

The so-called digital era has provided us with great possibilities for content creation, distribution and reaching new audiences. Cost-effectiveness, new platforms, and ever-larger scales and markets are being put forward as potential for online distribution. And although various actors have been lagging behind for a number of years, remaining quite reluctant to integrate *e* with *culture*, they now seem to recognise the potential of the online environment and digital technologies. The need to preserve cultural heritage and the acknowledgment of the potential of online distribution has brought about a wide array of digitisation and distribution projects in recent years. Cultural institutions often possess large and valuable collections of audiovisual material, not in the least in the sector of the performing arts. Video recordings of rehearsals, large-scale recordings for broadcasting purposes, or material for commercial use, all offer a potential for distribution. Moreover, various cultural institutions today are engaged in filming performing arts (from opera, to musicals, concerts and theatre). Indeed, not only has the recording of live events with high quality equipment become more cost-efficient, the software necessary to digitise, catalogue and distribute the recorded and archived content has become more widespread and in some cases, even free. Lastly, the skills required for integrating these new technologies have become widespread as well.

Although the World Wide Web provides an enormous potential for the distribution of performing arts and although various institutions possess archived content suitable for web distribution, this does not mean that this content will easily translate itself into the online domain. In this chapter, we address the specific restrictions for cultural content – and more specifically audio-visual content on performing arts – in an online environment. When distributing digitised cultural material, cultural institutions engage in an intricate web of actors and factors, deciding together whether specific content will be *successful*. This chapter provides an overview of the main obstacles preventing online distribution, and although restrictions might occur at all levels of the process, specific focus in this chapter lies on (1) skills and competences; (2) the complexity and obscurity of online authorship; (3) financing of digitisation and distribution initiatives; and (4) the specificity of the cultural content itself, which requires various forms of contextualisation. Furthermore, a number of lessons from a case study analysis will be presented.

A CASE FOR COMPLEXITY

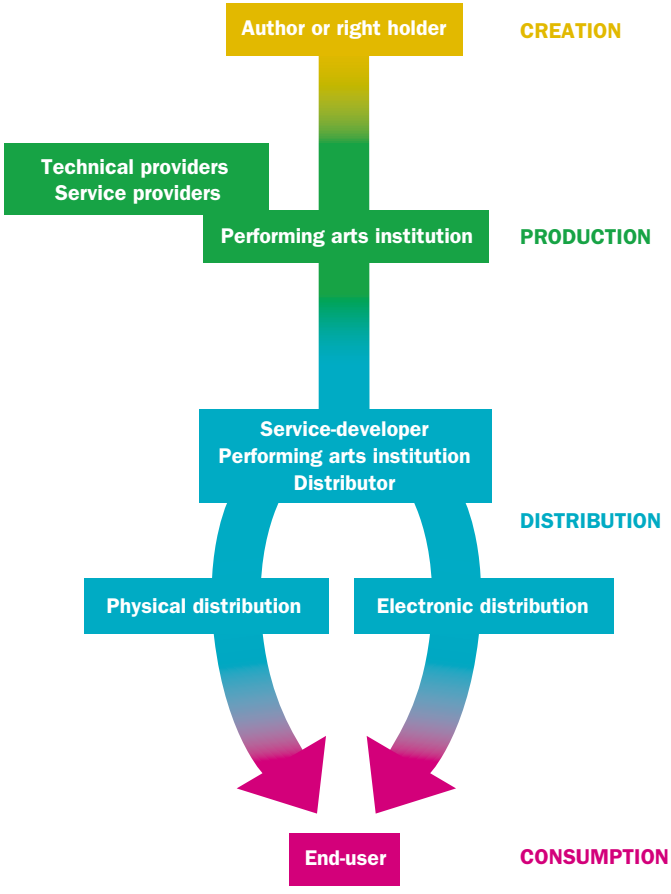
For the purpose of the project, a series of business models were conceived beforehand. However, the researchers and cultural partners involved immediately stumbled upon a number of thresholds, preventing the content from being distributed on the various platforms. This led to the question of why *potential content* does not translate itself into *real content*. Therefore, this research focused on mapping the different bottlenecks at all levels of the digitisation and distributive process.

The process, beginning with the filming of the cultural event, storing and archiving the content, clearing intellectual property rights and distributing it on platforms aimed at reaching specified target groups, was conceived as a cyclical rather than a linear process, which is common in most research. When observing the distribution of cultural content, and more specifically audio-visual content on performing arts, as a complex process of intertwined factors and interdependent actors all connected in a complex networked reality, it immediately becomes clear that the different limitations we have identified are also interlinked and subject to one another. For example, the difficulties with clearing authorship and other rights not only stem from obscure legislation or reluctance from collective rights associations, but in most cases, also a lack of skilled and experienced personnel, which, in turn, is partly derived from a structural lack of financial resources and strategic choices involving other priorities for the cultural organisation.

The diagram below describes the value chain for the distribution of audio-visual content on performing arts. The lines represent the connection between the different actors. They should be perceived as revenue flows and service provision flows.

In the remainder of this chapter, we shall successively discuss the impact of competences, intellectual property, financing and cultural specificity as bottlenecks for distribution.

Figure 1: value chain of performing arts audiovisual distribution



SKILLS AND COMPETENCES

Personnel and the acquiring of skills and expertise at all levels of the distribution process, has indeed become one of the key pillars for succeeding in opening and distributing cultural archives. The availability of adequate information and expertise in research is not the problem. The various reports commissioned on a European level are just one example. In some cases, the large amount of reports and research on the same topic has paradoxically generated some sort of saturation and even overkill of information.

Furthermore, cultural institutions often possess the competences and skills. The main obstacle, however, is that (1) these skills are strongly connected to specific people within the institution, which implies that when this person is no longer part of the network, all acquired expertise and skills are cut off as well; and that (2) the available information does not flow to all the levels involving performing arts and archiving. To reduce *fragmentation of knowledge* and to generate circulation of competences and expertise, cultural and audiovisual actors often participate in consortia and large-scale digitisation initiatives. The latter not only generate scale advantages and cost-efficiency, but also form a platform for the mutual exchange of information. Up until now, these cooperation models mostly remain limited to large audio-visual collections and archives. Of note are the platforms based on knowledge sharing, such as the Dutch CulturePlayer initiative (www.cultureplayer.nl). This platform specifically aims at providing the tools, knowledge and skills to cultural institutions (including the Dutch Opera House DNO) for creating and distributing online applications and audio-visual material.

In most cases, the process of digitisation and distribution is partly executed in *cooperation* with third parties. These third parties provide the professional know-how and competences,

and possess the required technical infrastructure. Cooperation with facility companies and production houses for filming and editing is the most common. Cultural actors also work together with external IT professionals for streaming or downloading infrastructure, content storage, and web and metadata design. Other external partners include structural sponsors and right holders' representatives. Freelancers are often integrated temporarily in an organisation for the duration of the project.

CLEARING OF RIGHTS

Within the context of online business models, the issue of clearing intellectual property rights appears as one crucial bottleneck. Rights clearance refers to the agreement between a content provider (in this case the cultural institutions) and the author (in this case the artists) to re-use or distribute content with the author's permission, mostly in return for a fair fee. Although authors of audio-visual works lose their intellectual property protection after 70 years, nearly all archived audio-visual material in the cultural institutions was created after 1940. This means that various authors still possess various rights on these works. This explains why the issue of clearing rights has dominated the agenda of many cultural organisations engaged in the distribution of audio-visual material.

The clearing of rights in the area of performing arts, however, involves a complex web of regulations and actors. Firstly, complexity is caused by the *large number of authors involved*. Although some of them are represented through collective rights organisations and guilds, all of these authors need to provide permission in return for remuneration, from composers to stage builders and freelance choir singers. For some of the audio-visual works, the names and details of these authors have become unclear over the years, so cost and time-intensive research is necessary in order to locate them. Cultural institutions often lack the legal background necessary for negotiations with larger players. Furthermore, these organisations have to cope with the reluctance of larger players to engage in distributing their content. Territorial restrictions and cost-intensive Digital Rights Management (DRM) systems are deemed necessary to convince the reluctant corporations into an agreement.

Secondly, the legislative obscurity for intellectual property in multimedia surroundings contributes to its complexity. Even now, it is still unclear when remuneration, negotiations and licenses are necessary in an online environment. The problem is that the strict rules applied to intellectual property often contrast with the flexibility, scale and cross-media nature of the web. New types of license agreements and initiatives such as the *Creative Commons License* indicate the difficulties of remunerating authors in an online environment and mark a shift towards open licensing.

FINANCING

As pointed out in the introduction, part of the optimism on the potential of the online realm is the cost-effectiveness of digital technologies. Financial leeway has enabled organisations to launch platforms on a large scale, visible to ever-larger audiences. In practice, however, the lack of financial resources, affecting all other aspects of the process, forms a major barrier for audiovisual distribution. And although digital content has decreased reproduction costs, the costs for starting up digitisation initiatives and developing platforms for target audiences remain cost-intensive. Authors and cultural professionals also repeatedly point to the various underlying costs connected to digitisation and distribution projects, from project management to energy

resources, maintenance costs and administrative activities, which are often referred to as *hidden costs*. What is problematic is that it is difficult to map the various costs, since they are heavily dependent on contextual circumstances. Existing inventories and models mainly focus on digitisation and preservation costs (see for example the models presented by the Research Libraries Group and the Arts and Humanities Data Service). The costs for clearing authorship, personnel and management, and designing interfaces are often overlooked in these models. However, authors' rights and personnel capacity in particular have proved to be the most cost-intensive for cultural organisations.

Introducing performing arts in the online environment also entails introducing this content in an environment where huge amounts of information, be it written or audiovisual, are already freely available. Platforms such as YouTube, Garage TV and Joost.tv and the widespread illegal downloading of music and films have contributed to the conception that the web is, or at least should be, *free* from a users' perspective. On the other hand, a trend towards having to pay for valuable information on the web has gained support over recent years as well.

In practice, however, a whole series of revenue mechanisms, from advertising to pay-per-download models can be applied for distribution of cultural content. Indeed, digital technologies enable cultural actors to generate income through creative models. Revenue models are categorised in direct and indirect models. Indirect implies that revenue is generated through advertising, sponsoring or subsidising. Direct models involve an immediate contact with the user. Various mechanisms have been introduced over the years, from zero-payment systems to subscription models, pay-per-item, etc. Within these models, again a whole variety of options exist: for example, subscription models can be based on a fixed fee, or can be estimated in accordance with the target audience and purpose (for example, lower costs for educational use or charges corresponding with the number of students using the service). Pay-per-item systems can be divided into pay-per-stream, pay-per-download and pay-to-own models. Apart from these, a number of other mechanisms are applied as well. The top-up model, for example, consists of a free basic service but requires a payment for additional services (for example: viewing is free, but in order to view high-quality images, extra payment is required). Although these revenue streams might compensate for a small percentage of production costs, practice shows that initiatives remain heavily dependent on government subsidies.

THE SPECIFICITY OF CULTURAL CONTENT

A fourth limitation we signalled stems from the specificity of the cultural content itself. Translating audio-visual content implies taking into account the specific nature of the audio-visual medium: unpredictability of demand, high investments versus a relatively low return and other factors. Both cultural and audio-visual products are 'experience' goods, which means they have to be consumed (in this case viewed) in order to appreciate their value. Moreover, culture has gained a specific status because of its intrinsic nature, its societal and intellectual value, and consequently, positive spill-over effects or externalities. Many authors, however, point to the fact that culture is hard to appreciate and some forms of competences are required in order to appreciate it. Hence, some form of guidance education is required. For public policy, this has been the main driver to subsidise the cultural sector. When translating culture into an online environment, where the available information and content of all sorts is abundant and attention has become scarce, the cultural specificity needs to be consolidated.

Contextualisation has become quite a common term when preserving the essence of specific content. While contextualisation is a commonly-used term for metadata and the technical structure of a network, it also refers to concerns of the so-called frontend of the infrastructure, i.e. the user interface or, quite simply, the screens. Content can be contextualised in various ways, from enriching the existing content with additional information, generating interaction between users and content through discussion forums, feedback mechanisms, different forms of tagging or by integrating it into existing Web 2.0 applications, such as YouTube and Flickr.

However, rather than simply making the content more attractive and relevant, one has to keep in mind the different needs of specific users. Therefore, content needs to be packaged in such a way that it meets the expectations, requirements and interests of target audiences. Specific platforms for educational use are the most common. In the case of performing arts content, content can be packaged for educational or professional use, or for broadcasters, on-demand and the broader public. Contextualisation of content itself does not pose a limitation, but limited capacity, both in content and competences, does. Analysing the specific needs of user groups often involves research, while designing platforms implies cost-intensive programming and developing. Contextualisation of content also involves the need to include contextual factors throughout the digitisation and distribution process. Various elements, ranging from the nature of the content, to the length and size of the content file, the technical quality, the origin, the relevance, the way it is filmed, etc., determine the potential for distribution.

LESSONS LEARNT FROM THE CASE STUDY ANALYSIS

Since examples in the performing arts sector are rare, we focused on distribution projects showing relative resemblances with (a) the performing arts sector and/or (b) the way content is distributed. The projects investigated included VRT's Klara platform, The Dutch Opera (DNO), Fabchannel, Digileen, Kinepolis (Opera in the Cinema) and Ancienne Belgique's ABTV. All these initiatives were complements to the already-existing activities of the organisation, except for the Fabchannel platform that was established for online viewing only. Analysis of these different cases revealed that the same bottlenecks occur more or less in all the cases. Although the cases differ in magnitude, goals and resources, some key indicators can be deduced from all the cases determining the success of their initiatives:

(1) All cases start from a consistent, coherent and clear point of view on intellectual property and right-holder remuneration. In some cases, *ex ante* clearing of rights forms a decisive factor when starting up the initiative.

(2) All the initiatives were launched from an already existing platform or initiative. They were created out of certain needs within the organisation and as an additional service to better meet consumers'/visitors'/users' expectations. The organisations can therefore integrate the initiative into the already-existing work process, skills and personnel, often complemented with coordinators or external project managers, providing additional specialised competences. Most activities are also based on the existing infrastructure.

(3) Technology follows content, not the other way around. The aim of the initiatives defines how content is best

distributed to achieve the target. Technology and tools are chosen to enable this content.

(4) The organisations supporting the various initiatives are characterised by a high degree of interconnectedness. All initiatives are integrated in a network of actors, based on *sharing of knowledge and expertise*, and cooperation with specialised third-party partners. Other required competences are obtained through cooperation with freelancers, outsourcing or sponsorships.

(5) Distribution of content is organised according to a clearly defined goal and a well-defined target group. The initiatives take into account the various requirements, expectations and needs of these target groups. The latter also becomes a key criterion to distribute content in an online environment.

(6) All the cases are characterised by a clear point of view on the digital media environment and the role of the organisations within the new media constellation. This perspective often coincides with a strong awareness of the technological innovations and media uses outside the walls of the institution. Moreover, they are characterised by a high *degree of courage and experimentation* on the one hand, and flexibility and relativism on the other.

CONCLUSIONS

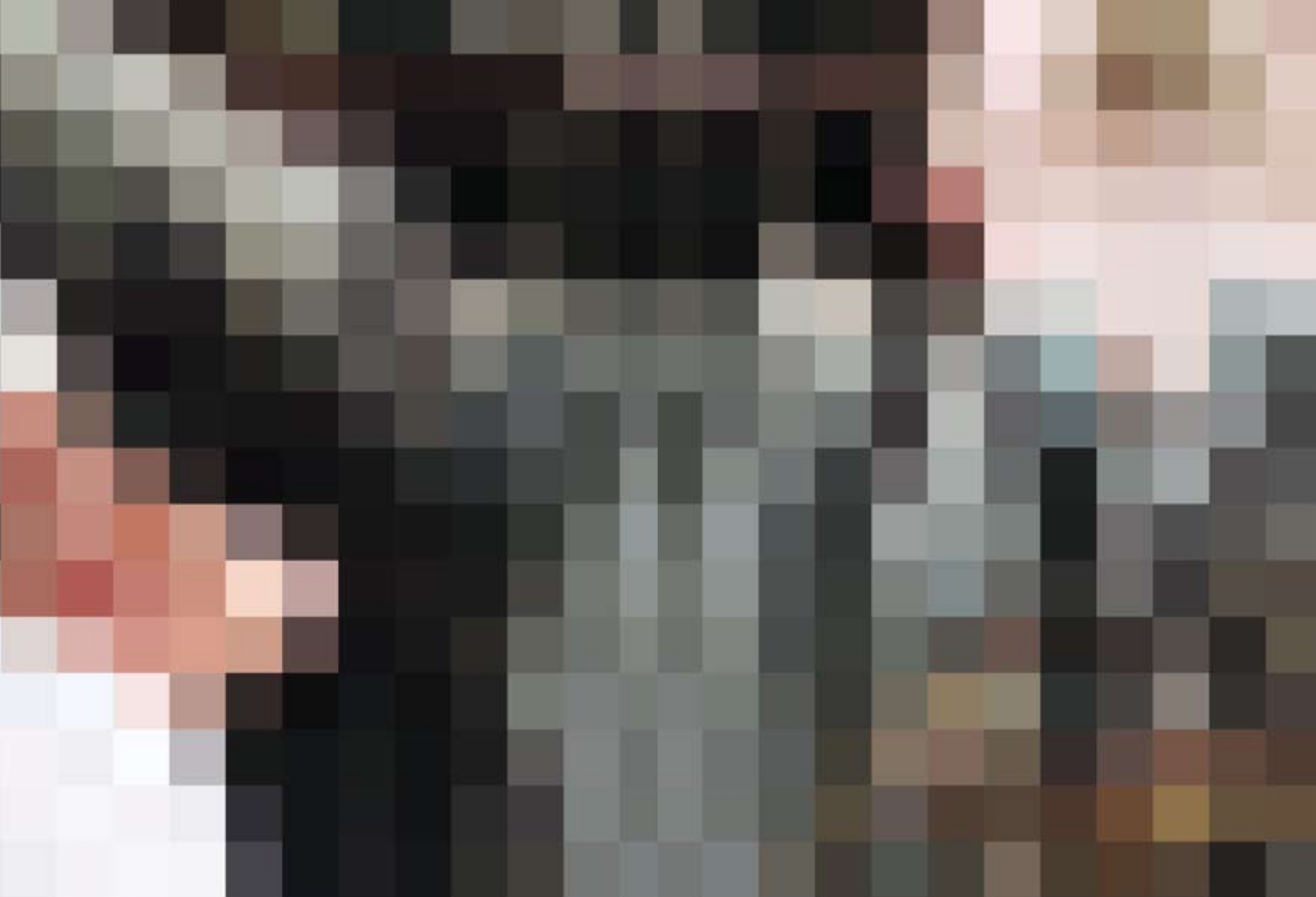
In their reports, the European Broadcasting Union (EBU) confirms the potential of audiovisual archives again and again. Five characteristics were put forward to describe the audiovisual archives in today's networked society:

- Archives have become more valuable than ever before. However, if they do not adapt to current media ecology and the abundance of information, they tend to disappear into complete obscurity;
- Archives tend to evolve from physical, product-based repositories towards file- and stream-based online services;
- There is an increasing need to develop additional services to generate added value;
- The use of archives is no longer based on business-to-business cooperation models, nor on business-to-consumer models, but both;
- Costs increase, but providing new services also entails the possibility of generating new revenue.

These characteristics correspond with the findings described in this chapter. The chapter addressed the different limitations of distributing audio-visual content on performing arts. Thereby, we nuanced the notion that the digital sky is the limit. Instead, a series of bottlenecks were signalled, all of them intertwined and all of them connected to various actors and factors. By emphasising these bottlenecks, we do not want to enhance the pessimism still lingering in some institutions. Instead, we wanted to tackle the widespread optimism when discussing the potential of online distribution. Nor do we stress that the bottlenecks signalled in this chapter are the only ones to occur; they are, however, common in most digitisation projects, and to a greater or lesser extent, present within all investigated cases. In this chapter, we have presented some key elements determining the success of the project; success being understood in intellectual rather than in economic terms.

The main obstacles for the distribution of cultural content, and more specifically audio-visual material on performing arts, were, first of all, financing, i.e. the financial dependency of subsidised institutions, the difficulties in generating revenue from the distribution of performing arts and the cost connected to the required resources (competences, experience, personnel). The lack of these skills, know-how and personnel capacity is the second threshold. A third bottleneck arises from the complexity of intellectual property: not only the complexity of legislation, but also the difficulties in obtaining agreements with the various actors, the territorial restrictions, the reluctance of large players to engage in online distribution, and the time and cost-intensive operation of localising different rights holders. These are critical bottlenecks for distribution. Furthermore, the issue of contextualisation was discussed, a necessary tool to maintain the distinct nature of the cultural good, not only when designing the interface, but throughout the whole digitisation and distribution process. In the end, contextualisation does not guarantee any success, but it involves a reflex which should be taken into account throughout the whole process. Therefore, digitisation and distribution can never be seen as a means in itself, but instead a function as a means towards an end.

Up until now, there has been no roadmap or one-business-model-fits-all for the cultural sector, let alone for the performing arts. But by taking into account the possible obstacles, and by anticipating the outcome when they do occur, the distribution of performing arts in an online environment is only limited by the creativity of its professionals.



How to contract with right holders? A legal analysis

Tim Robrechts and Robin Kerremans (IBBT-ICRI-KUL)

For some time now the digital revolution has been raging through our technological landscape. It is hard to predict how much longer and at what pace developments in this area will continue, but we can already say that the market has now matured insofar as quality has risen and prices have started to fall. Never before has the public had such a wide range of technological tools at its disposal to record, edit, sample, share or distribute. In the cultural sector, this creates new opportunities. The democratization of recording and distribution infrastructure enables cultural players, who traditionally rely significantly on subsidies, to produce and disseminate high quality recordings of live performances in theatre, music, musicals and dance. Without a doubt, the technical means for an unlimited circulation of cultural material are available.

Copyright laws, on the other hand, grant (exclusive) rights to the people who create and enact these live performances. *Copyright sensu stricto* (for authors of original works) and related rights (for performing artists) require the prior consent of the right holder for any kind of exploitation (reproduction or communication to the public) of his work/performance. Producers of these recordings of live performances need to obtain this prior consent by way of an agreement, i.e. a contract. In principle, the Belgian Copyright Act (hereinafter: 'BCA') formulates stringent rules to contract with original right holders. However, exceptions to these strict rules

exist in respect of employees, public servants and free-lancers. In the area of audio-visual works yet another system is applied, the so-called *implied cession of rights*. Exceptions were also made to this system to protect or to favour certain categories (e.g. musical works and 'cultural works').

This brings us to the focal point of this chapter. As stated above, the BCA contains several regimes to contract with right holders. These regimes impose very different requirements, ranging from highly formal and detailed to next to none. It is of crucial importance that producers of this type of material know which contractual regime is applicable to their specific situation, in order to obtain legal certainty on how to acquire all the desired exploitation rights. However, selecting the correct regime is not as obvious as it seems ...

In this chapter we will describe (a) how and where copyright and related rights originate and (b) how they can be transferred according to four different contractual regimes relevant to the recording of live performances. Furthermore, (c) we will try to identify the regime most likely to suit our purpose as well as the elements that complicate this identification. Finally, (d) the practical consequences of this selection are discussed.

ORIGINAL RIGHT HOLDERS: THE START OF THE CHAIN ...

Article 6 BCA stipulates that an individual who produces a work through creative activity, is normally regarded as the initial beneficiary of the work's copyright. Only a natural person can be the initial beneficiary of copyright protection. Legal persons can merely obtain rights by assignment. In the context of performing arts, this results in the fact that first of all, the director of a musical and/or theatrical piece and the choreographer of a dance performance can possibly obtain protection by copyright. Besides this initial group of authors, there are many other persons who contributed to the work, in one way or another, and can thus also claim copyright protection (e.g. set designers, costumers, lighting technicians). Where two or more authors collaborate in producing a work, a situation of co-authorship exists. A distinction can be made between indivisible or 'joint' works and divisible or 'collective' works.

A joint work is a piece of work prepared by two or more authors with the intention that their contributions be merged into inseparable or interdependent parts of a unitary whole. The contribution made by a co-author in a joint *creative effort* should be indispensable or essential, which means that without that contribution the end result would not have existed or would have been significantly different. Since the authors of a joint work are co-owners of the work's copyright, exploitation of the work should be a concerted action. Nevertheless, Article 4 BCA prescribes that co-authors of a joint work are free to arrange this exploitation by mutual agreement. Since live performances are usually joint works, these rules often apply. While locating the rights involved, it is important for future producers of a recording to keep in mind the possibility that previous arrangements have already been made between the right holders on how to arrange the exploitation.

By contrast, a collective work is a work in which a number of contributions, constituting separate and independent works in themselves, are assembled into a collective whole. Since the individual contributions of the different co-authors can be distinguished, the copyright for each separate contribution to a collective work is distinct from copyright for the collective work

as a whole and is initially vested in the author of the contribution. Thus Article 5 BCA stipulates that every co-author can exploit his own contribution separately, as long as there is no negative influence on the exploitation of the collective work as a whole.

In relation to a theatrical work, a musical or a dance performance, not only the work as a whole, but each separate aspect of the work (script, artwork, music, choreography) will have to be submitted to the following test: how many persons collaborated to create this work and is it possible to identify their individual contribution? Most means of exploitation, such as overall recording and distribution of the complete live show, will require the *prior consent* of every possible right holder, regardless of the separable or inseparable nature of the input. Only when the exploitation focuses on a specific part or a piece of the performance, which is completely separable and attributable to an individual person, can the prior consent be limited to this person (e.g. recording of a musical's songs only does not require the consent of the scriptwriter or the director).

For employees' works or commissioned works, the employer or the commissioner is not necessarily a co-author of the work that is realized on the basis of his instructions and/or suggestions. This situation can only result in co-authorship when the employer or the commissioner truly contributed in a creative way to the realization of the work. In general, the basic principle of Article 6 BCA indicates that the employee or the creator of the work on commission is the initial owner of the copyright of the work produced in the course of his employment or on commission. Nevertheless, the employer or the commissioner has the possibility to stipulate contractual provisions leading to a transfer of certain rights. In this case, the general rules on assignments concerning author's rights should be taken into account. As a final remark concerning the author's rights, it should be mentioned that the BCA provides for a special regulation with regard to the co-authorship of audio-visual works.

Furthermore, the BCA does not only protect authors, but also provides protection to other persons, namely by instituting so-called related rights. The protection offered by these related rights is largely similar to the protection provided for by author's rights, but is not entirely the same. The related rights can be defined as a 'light' version of the traditional author's rights, both with regard to the number of rights that can be claimed by the beneficiary and concerning the duration of protection.

The most important category of owners of related rights, regarding the recording of live performances, is that of the performers. The economic and moral rights of performers are exactly the same as those of an original author, but according to Article 34 BCA they only refer to their specific performance; or, in other words, to their personal interpretation of the original work and not to the original work as such. Actors, singers, musicians and dancers indisputably belong to this category. Purely technical performances (e.g. cameraman or sound technician) and informative performances (e.g. models) are not considered as performances susceptible to protection. Finally, Article 37 BCA stipulates that the use of a recording of a live performance from an ensemble can be approved, depending on the type of performance, by the soloists, the conductor, the director or the manager of the ensemble.

SHIFTING OF RIGHTS

The initial beneficiaries of copyright or related rights are not obliged to exercise their rights themselves. As a general rule, when someone wants to reproduce or disseminate a copyrighted

work, he will have to acquire the necessary rights through the prior consent of the original right holder. There are different systems that enable the shifting of rights to other natural or legal persons. First of all, right holders can dispose of their (economic) rights by contract. The BCA imposes certain contractual formalities concerning prior consent. In general, these rules are rather stringent. However, the rules of this contractual transfer have been eased in relation to certain other contractual relationships. Furthermore, the BCA has instituted the so-called implied cession of rights, specifically for audio-visual works, which in fact implies an inversion of the contractual rules. In addition, this system reveals an important exception regarding works from the *cultural sector*, which, as we shall see, will be important for our further analyses. We shall now describe the four relevant 'regimes' in detail.

Contractual assignment of rights: general rules

Since the regulation concerning the assignment of rights is more or less similar for both authors and the owners of related rights, the discussion that follows shall focus mainly on the traditional contracts with authors. Article 3 BCA regulates the assignment of author's rights. The fundamental idea of this provision is to protect the author as he is typically the weaker contracting party. When an author assigns or licenses some or all of his economic rights, the protective conditions stipulated by Article 3 BCA must be respected.

The first rule of protection can be found in Article 3, § 1, section 2 BCA. This provision namely stipulates that only written evidence can be used against an author to demonstrate the existence of a contract. A private deed or an instrument drawn up by a notary public is not required and moreover, the demonstration against any other person than the author does not require any written evidence at all.

Another substantial condition that should be fulfilled in an author's contract can be found in Article 3, § 1, section 4 BCA, which provides that for every single type of exploitation the specific scope of the assigned rights should be defined explicitly. This does not mean that every type of exploitation should be defined to the last detail. An enumeration that indicates the remuneration of the author, the geographical scope and the term of the assignment, is sufficient. Furthermore, Article 3, § 1, section 5 BCA imposes an obligation of exploitation, in accordance with the professional standards, on the person to whom the exercise of rights is confided.

Article 3, § 1, section 3 BCA prescribes that the interpretation of a contract with an author should be restrictive in case of a dispute or lack of clarity. In addition, according to Article 3, § 1, section 6 BCA, the contracting parties are not allowed to assign rights concerning types of exploitation that do not already exist at the moment of concluding the contract. Thus *catch-all clauses* like "*every new type of exploitation enabled by the development of modern technology*" are invalid.

The second paragraph of Article 3 BCA enables the transfer of economic rights in works that do not yet exist. Since such a transfer concerning *future works* is only allowed for a limited period, licensing their use is the only possibility. Moreover, this is only possible when the genre of the work at hand is specified. Whether the description of the genre and the delineation of the term of the transfer should be in writing and specified in a detailed manner or not is a topic of discussion in both jurisprudence and legal doctrine.

Contractual assignment of rights: the light version

In the case of employees' works or commissioned works, paragraph 3 of Article 3 BCA slightly attenuates the strict rules laid down in the first two paragraphs of this stipulation. The first section of paragraph 3 prescribes that the economic rights of the involved employee or the person who has created a work on commission can be assigned to the employer when this is explicitly stipulated and falls under the scope of the employment agreement. Thus, unlike that which is mentioned in Article 3, § 2 BCA, the transfer of rights in future works can indeed be permanent in some instances. In addition to this second paragraph, the second section of paragraph 3 of Article 3 BCA provides that the exploitation rights in commissioned works can be assigned to the person who commissioned the work, if this person's activity can be situated in the advertising sector or in the *non-cultural sector* and if the work is specifically intended for that activity. Furthermore, the assignment of rights should be stipulated explicitly.

The precise scope of the notion of the non-cultural sector is susceptible to interpretation, giving rise to discussions in legal doctrine and in jurisprudence and thus resulting in legal uncertainty. The majority of legal theorists say that 'non-cultural' is equal to 'industry' (based on the preparatory works which mention, in this respect, the IT industry, car industry, fashion industry, design industry, etc.). The assessment of the cultural or non-cultural character of the activity of the person who ordered the work, should be based on a work-by-work approach. For example, a publisher is operating in the cultural sector when he publishes literary works, but in the non-cultural sector when he publishes manuals for IT applications. Others argue that the deciding factor should be the global activity of the commissioning person. If this activity has a commercial character (profit-making), it falls within the scope of the 'non-cultural sector'. In any case, when the assignment of rights is included in some kind of employment agreement, the rules from the second paragraph of Article 3 BCA and from the following sections of the first paragraph of that stipulation, do not apply.

Article 35, § 2 BCA regulates the assignment of performers' related rights in more or less the same way. An important difference lies in the fact that performers in an employment relationship do not dispose of the legally guaranteed right to receive a certain percentage of the potential profit realized by types of exploitation that did not already exist at the moment of concluding the contract, whereas Article 3, § 3, section 4 prescribes that authors can claim this right.

Special regime for audio-visual works: implied cession of rights

Audio-visual works are subject to a separate section of the BCA. This section contains rules concerning the transfer of rights that differ significantly from the general rules of Article 3 BCA. In fact, the special rule for audio-visual works is to a certain extent completely the opposite. According to Article 18 and Article 36 BCA, contracts between producers and (co-)authors of audio-visual works, imply assignment of the exclusive exploitation rights of the audio-visual work to the producers. In other words, the producer of an audio-visual work is presumed to be the holder of the exploitation rights of that work. The first ground for this implied cession of rights, is to make the plurality of authors and performers and the resulting plurality of rights that occur in the process of creating an audio-visual work manageable. Besides the director as a self-evident author, Article 14 BCA enumerates

several other persons who are presumed to be co-authors of the audio-visual work. The contributions of the screenwriter, the scriptwriter, the writer, the graphic designer or the author of a musical composition that has been specially created for the audio-visual work can be substantial to such an extent that these persons should be considered as co-authors. Furthermore, when an audio-visual work is based on another work, the author of the initial work is placed on the same level as the author of the newly-created work. In addition to the fact that this provision attempts to simplify the exploitation of audio-visual works by centralising the rights of the jumble of potential right holders, another ground for the implied cession of rights is to enable the party who bears the economic risk of the production to exercise control over the exploitation of the audio-visual work.

There are mainly three complications that arise when applying the approach just outlined in practice. The first *bottleneck* relates to the fact that musical compositions that have not been specially created for a particular audio-visual work are excluded from the scope of the implied cession. Thus, the rights on those compositions have yet to be acquired by assignment.

The second problem is the definition of 'producer'. A two-fold criterion applies: the producer must invest money and must also be responsible for the result. As a consequence, a mere financial contribution does not suffice.

The third and main bottleneck of Article 18 BCA is the vague and general nature of the rights that are included in the transfer to the producer. Article 18 BCA stipulates namely that the implied cession of rights only refers to the exclusive right of audio-visual exploitation, including the rights that are indispensable for this exploitation. In search of a balance between the interests of the producers and those of the authors and the performers, only those rights that are strictly indispensable for the audio-visual exploitation of the concerned work, are presumed to be included in the transfer. Thus, the crucial question is in fact: which rights can be called 'strictly indispensable for the exploitation of an audio-visual work'?

The traditional classification of audio-visual exploitation rights falls into three categories.

The primary exploitation rights can be further divided into reproduction rights on the one hand (such as the reproduction right itself, the right to record and to distribute a work, and the right to provide for subtitles), and communication rights on the other hand (such as the presentation right, the right to show the work in cinemas or at festivals, or to communicate it to the public by way of television or satellite).

The secondary exploitation rights contain the possibility to show fragments, pictures and summaries from the work, as well as the graphic or literary adaptation thereof. Finally, the derivative exploitation rights refer to the use of elements of the work for merchandising. According to a restrictive interpretation, only the primary audio-visual exploitation rights are included in the implied cession. Others are of the opinion that the implied cession covers every possible means of exploitation, both the known and the unknown and this even without requiring an enumeration. This broad-minded definition of the notion of *audio-visual exploitation*, gives rise to dissension in jurisprudence concerning unknown exploitation forms and exploitation through the internet.

Finally, the so-called 'remuneration rights' of authors and performers should also be examined in this evaluation of the scope of the implied cession of rights. In certain instances an author cannot oppose the exploitation of his work and consequently his consent is not required. In exchange, the author or the performer is entitled to remuneration. Since these remuneration rights, such as the remuneration right for the private audio-visual copy, the

reproduction and/or communication of works or performances used to illustrate academic research or for the public rental of the work, are not an integral part of the audio-visual exploitation rights of Article 18 BCA; the author or the performer essentially remain the owner of these rights.

Just like the remuneration rights, moral rights also fall outside the scope of the implied cession of rights. The rules contained in Article 15 and Article 16 BCA slightly reduce the scope of moral rights in audio-visual works as a way of preventing co-authors from blocking the exploitation of this special category of works by the producer. Article 18 BCA explicitly prescribes that Article 16 BCA will not be harmed by the implied cession of rights.

To sum up, we can state that as a consequence of the implied cession of rights, the audio-visual exploitation rights of the respective (co-)authors are presumed to be transferred to the producer, unless otherwise stipulated. The (co-)author or the performer basically remains the owner of the following rights. First of all, the (co-)author shall remain the owner of the non-audio-visual exploitation rights. Secondly, he shall remain the owner of those 'separate uses of musical compositions' that are not created especially for the audio-visual work. In the third place, he shall retain the moral rights and finally, the different remuneration rights. The preceding analysis clearly indicates that as a matter of fact, the implied cession of rights is a very unreliable tool for producers to obtain rights. Due to the vague wording and the uncertain scope of this presumption, the exploitation of audio-visual works has not become any easier.

Not only has the scope of the implied cession of rights been under discussion, but the question of which cases this concept can be applied to has also not been univocally answered. The Court of Appeal in Brussels stated that concerning performing artists, the implied cession of rights can only fulfil its role when there is a production contract between the performing artist and the producer of the audio-visual work. According to the Brussels' Court, this contractual relation does not have to be enshrined in a written document but can be demonstrated by any form of legally admissible evidence. From the moment a *de facto* production relation concerning the recording exists between the performing artist on stage and the producer of the recording, two end-products emerge: a live performance and a recording usually produced by two different entities. Certain jurisprudence, however, has a different opinion concerning the applicability of the implied cession of rights doctrine. These authors adhere to the idea that the production agreement between the performing artist/author and the producer of an audio-visual work has to be part of a written contract. Under this approach, the implied cession of rights has to be seen as a completion of the general rules for contracts with authors or owners of related rights. Article 3 and Article 35 BCA clearly state that a written document is required to prove a contractual bond with an author or a performing artist. In order to invoke the implied cession, a producer has to present a contract that describes at least the production of the audiovisual work (e.g. employment contract, service agreement, etc.). This basic requirement does not undermine the eventual goal of the implied cession, since the production contract does not have to include an explicit transfer of copyright or related rights. It is noteworthy that the French Copyright Act explicitly states that the implied cession only applies in case of a written production contract between the author and the audio-visual producer. An employment contract is the most common way to fulfil this condition.

Special regime for audio-visual works: neutralisation of the implied cession in case of 'cultural works'

In addition to the above-mentioned uncertainties concerning the scope and applicability of the implied cession, another element has the potential to undermine the effectiveness of the implied cession of rights. Article 19 BCA states that authors creating works for the cultural sector ("*except for works belonging to the non-cultural or advertising sector*") preserve the right to a separate remuneration for each form of exploitation. The result of Article 19 BCA is a *de facto* re-introduction of the obligation to explicitly and precisely describe the ways of exploitation that are being transferred. The required level of detail is hard to determine. It is not clear whether it is sufficient to differentiate between primary and secondary forms of exploitation or whether it is necessary to address every single form in detail. Initially, the implied cession seemed to invert the rule of Article 3 BCA, which stipulates that vague contractual clauses should be interpreted in favour of the author. The implied cession establishes an interpretation in favour of the producer. However, Article 19 and 36 BCA neutralise this inversion.

Again, we see the notion of 'cultural sector' arise. As we explained, different opinions exist about the exact meaning of this notion. We can only observe that Article 19 BCA is consistent with Article 3, § 3 BCA. The latter introduces a light regime for commissioned work in the non-cultural sector/advertising sector (in other words, the stringent regime of Article 3, §§ 1-2 BCA remains applicable to the cultural sector), the former neutralises the effect of the implied cession of rights to the producer in the cultural sector, hence re-introducing a more stringent contractual regime. It remains unclear whether or not Article 19 should also be applied in case the transfer forms part of an employment contract (in the case of non-audio-visual works, employment contracts fall under the light regime, regardless of the cultural or non-cultural nature). Although logically Article 19 BCA should not be applicable in the case of an employment contract, the wordings of Article 19 BCA suggest a general application. Until a legal decision clears up this matter, it is safe to take Article 19 BCA into account at all times, also in employment contracts. The bottom line is that in the cultural sector, stringent contractual regimes with a more detailed enumeration of ways of exploitation and corresponding remuneration remain in place.

Unless otherwise stipulated, the amount of this *remuneration* must be based on the gross revenue related to the respective ways of exploitation. Article 36 BCA contains a similar provision for performing artists. It is recommended to clearly define this amount (lump sum, part of net revenue or mixed) for each means of exploitation in the contract. If this has not been done, the right holder can always turn to the default system, and claim a part of the gross revenues. In general, producers prefer to avoid this method of compensation.

WHICH 'CONTRACTUAL REGIME' IS APPLICABLE TO THE RECORDING OF A LIVE PERFORMANCE?

In order to determine which legal framework applies to the producers of this kind of material, it first needs to be determined whether or not this specific kind of recording qualifies as an 'audio-visual work' within the meaning of the BCA. Secondly, we will have to decide whether or not this kind of work qualifies as a cultural work.

Audio-visual work: yes or no?

The BCA does not provide a definition for *audio-visual work*, but the preparatory works of this law do offer some background to the concept. They define an audio-visual work as "*a creation consisting of moving images, with or without sound*". According to this description, any sequence of moving images qualifies as an audio-visual work. The requirement of 'moving images' should be understood as a succession of edited pictures, which in itself could be fixed. Therefore, a series of separate pictures or a slide show could also fall within the scope of this definition. As do video games and music videos. In conclusion, it can be said that both the Belgian legislator and the Belgian jurisprudence wish to give a broad interpretation to the notion of audio-visual work.

The consensus within Belgium relating to the broad interpretation of what constitutes an audio-visual work allows us to state that recordings of live performances and performing arts productions are also likely to fall within the scope of this definition. This means that the specific regimes of Article 18 or 19 BCA are applicable. Whether or not Article 19 should be observed, depends on the cultural or non-cultural nature of the work/sector.

Contrary to the above, it is possible to argue that the mere recording of a live performance does not qualify as an audio-visual work within the meaning of the BCA. On the contrary, it can be supposed that when the recording is in fact the result of a purely technical operation, it does not qualify as a separate, protectable audio-visual work. Nowadays, as a result of technological developments, it is possible to produce simple audio-visual works at a low cost and through means accessible to a wide public. The broad scope given to audio-visual works in the preparatory works should be seen as a desire not to exclude any audio-visual work *a priori*. On the other hand, the question arises whether all the audio-visual output that has been produced in recent years should consequently be included.

In order to answer this question properly, a more basic level in copyright theory should be examined. The mere recording of a live performance does not result in a new protectable work *per se*. In many cases, the recording will be a purely technical capturing of the live event. This is particularly true when the recording is made entirely from a fixed point. For audio-visual works, as for any work, copyright protection will only be granted if the concerned work is original. *Originality* is a basic requirement to apply copyright protection to any work and, consequently, apply the special regime for audio-visual works to any audio-visual output of an audio-visual device. When the recording lacks originality (for example original choices regarding direction, photography, lighting, editing, etc.), it will be a reproduction of copyrighted works (the play, the performances, art work, etc.), but there will be no additional copyright for the recording itself and hence no application of the special regime for audio-visual works.

In conclusion, it can be said that if the recording of a live performance does not qualify as an audio-visual work, the transfer of the rights of the author and of performing artists involved in the live performance to the producer of the recording can only be established by a contract in accordance with the rules of Article 3 BCA. These rather stringent regulations are attenuated by the third paragraph of this article, in case the transfer takes place within the framework of an employment contract, the civil service or a service agreement.

Cultural sector: yes or no?

As we explained above, two legal theories exist concerning the meaning of the non-cultural sector. One theory looks at the cultural or non-cultural nature of the work itself, while the other looks at the nature of the organisation that is involved in the production of the work. A strictly commercial company will not be labelled as part of the cultural sector. Regardless of which theory is followed, the object of our explanation will in most cases be identified as belonging to the cultural sector. The recording of a live theatre, music or dance performance will certainly result in a cultural work. In most cases, these recordings are produced by the producer of the live event (e.g. a theatre group, a dance group, etc.), or the hosting institution (e.g. a cultural centre, a music hall, etc.). In some cases, a purely commercial company could be involved, but this sector mostly consists of not-for-profit organizations, working with subsidies. In our opinion, it is more acceptable and also most cautious to situate the area of operations within the "cultural sector". Since the prevailing objective of the sector of performing arts is not to make profit, but rather the production of *cultural goods*, the persons who order works within the context of the cultural sector cannot enjoy the more flexible regulation contained within Article 3, § 3, section 2 BCA.

CONCLUSION: WHAT TO PAY ATTENTION TO IN PRACTICE

The previous theoretical outline shows that defining the character of a recording of a live stage performance is not a straightforward exercise. Nor is selecting the exact legal regime on which producers of this type of material should base their contractual relations with authors and performers of the piece. The numerous uncertainties in this legal area (e.g. regarding the scope of the notion of audio-visual work, the implied cession of rights and the notion of the cultural sector) should stimulate producers to eliminate these uncertainties by including the necessary clauses in their contracts with right holders. The following points should be observed when recording a live performance with the aim of further distribution/exploitation:

- Make sure that at least a production contract concerning the recording of the live performance exists with the team creating the live performance (live crew). Even if rights are not explicitly transferred in this contract, it is a minimum requirement to apply the implied cession of rights to producers of audio-visual works. Although this does not guarantee that the producer acquires all the rights of the production (e.g. music rights are not covered) it does at least document the prior consent of the live crew.
- If contracts are concluded with a legal person, they should guarantee indemnification for claims of natural persons/right holders under their control. After all, a legal person has to acquire all the rights in good order before he can transfer them further. The producer should prevent damages due to mistakes in a previous stage of contracting.
- Transferring rights should be done in the most detailed way possible, enumerating in detail every method of exploitation. The traditional division should be made between 'primary exploitation' (including the right to produce an original recording and the right to communicate the recording to the public by all means), 'secondary exploitation' (including the right to reproduce the recording on other audio-visual media) and 'derived exploitation' (including merchandising). We recommend using this

detailed approach also when the transfer of rights forms part of an employment contract between the producer of the recording and the live crew.

- Since the area of activity most probably qualifies as part of the 'cultural sector', separate remuneration for each method of exploitation should be stipulated in the contract. If no separate remuneration system has been set up, right holders might at any time invoke the legal default mechanism. This default mechanism grants a proportionate part of the gross revenue linked to a specific method of exploitation to the right holders. The producer may also be obliged to provide an annual overview of the gross revenue per way of exploitation. This clause is crucial in order to avoid unforeseen financial and administrative burdens in a later phase.
- Determine geographical scope and, if necessary, the duration of the transfer for each way of exploitation.
- Include future methods of exploitation in the contract. Although the legitimacy of this kind of clause is not completely guaranteed, we believe future or unknown ways of exploitation can be covered. In order to guarantee the applicability of such a clause, make sure two additional conditions are fulfilled: (1) if the transfer of future/unknown means of exploitation is done within the framework of an employment contract, part of the profit generated through that specific method of future/unknown exploitation should be granted to the right holder and; (2) insert a clause which secures the validity of the rest of the contract in case one clause turns out to be invalid.

table of contents

Digital recording of performing arts: formats and conversion

Stijn Notebaert, Jan De Cock, Sam Coppens, Erik Mannens, Rik Van de Walle (IBBT-MMLab-UGent)
Marc Jacobs, Joeri Barbarien, Peter Schelkens (IBBT-ETRO-VUB)

In today's digital era, the cultural sector is confronted with a growing demand for making digital recordings – audio, video and still images – of stage performances available over a multitude of channels, including digital television and the internet. Essentially, this can be accomplished in two different ways. A single entity can act as a content aggregator, collecting digital recordings from several cultural partners and making this content available to content distributors or each individual partner can distribute its own recordings via the internet. Both methods (content aggregation and individual internet distribution) imply a different set of requirements for audio-visual compression and container formats.

Content aggregation requires high-resolution, high-quality material, suitable for editing/post-processing and conversion to different audio-visual formats tailored to specific distribution channels. Compression and container formats must be chosen so that the content can be processed using (semi)professional production tools. This means that *interoperability* is essential, which implies the use of internationally standardized solutions. Since the material is typically transferred offline, storage and bandwidth limitations are of secondary importance. However, constantly increasing quality and resolution demands and the need for an efficient production chain prohibit the use of older, sub-optimal compression techniques.

For internet distribution, the formats must be flexible enough to support a wide range of terminals (PC, personal media player, smartphone, etc.) and bandwidth-limited connections (xDSL, UMTS, etc.). This specifically implies the use of compression algorithms with a very good rate-distortion performance, (i.e. algorithms which require a minimal number of bits to obtain a given, suitable quality) over a large range of resolutions, frame rates, and quality levels. Additionally, it is of prime importance that the distribution formats are supported by popular playback software.

Establishing a standard set of suitable content aggregation and distribution formats necessitates efficient tools for the conversion of contributed and legacy content to the chosen formats. This conversion is often a time- and resource-consuming process. The efficiency of conversion tools can be improved by performing transcoding instead of re-encoding. Transcoding implies the use of information present in the compressed representation of the original material to facilitate low-complexity conversion to a different format.

In the project, the problems of compression and container format selection and that of efficient format conversion through transcoding have been investigated in great detail. In this chapter, the main conclusions of this work will be presented. A selection of compression formats for video, audio and still images will be discussed. The next section will elaborate on the choice of a proper container format. Finally, the work on transcoding will be summarized.

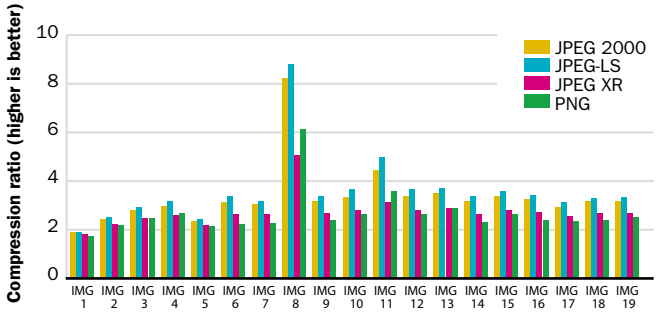
COMPRESSION FORMATS

Still image compression

As mentioned in the introduction, there is a difference in the requirements for the two scenarios, content aggregation and distribution via the internet. The first scenario puts the emphasis on quality, implying the use of lossless image compression, whereas the second scenario must take into account the limitations imposed by the internet connection bandwidth, implying the use of lossy image compression. For the first scenario, the following standardized image coding techniques, operated in lossless mode, were tested: JPEG-LS, JPEG 2000, JPEG XR (HD Photo) and PNG. The evaluation of the compression performance of these codecs is straightforward. The most efficient codec is the one that offers the highest compression ratio, i.e. the size of the uncompressed image divided by the size of the compressed image, for a set of representative test images. In our evaluation, the employed test material consisted of a set of high resolution images related to performing arts productions and exhibiting varying characteristics. The results of our experiments clearly show that PNG has the worst compression efficiency. JPEG XR performs significantly better than PNG but its efficiency is still considerably worse than that of JPEG-LS and JPEG 2000. For black and white images, the performance of JPEG-LS and JPEG 2000 is very similar but for colour images, JPEG-LS outperforms JPEG 2000.

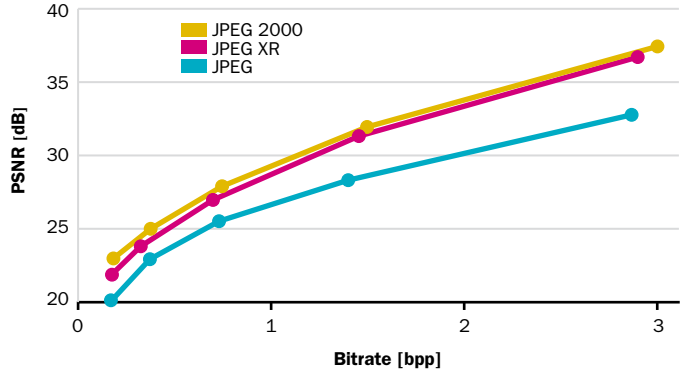
From the viewpoint of professional support, none of the compared compression formats should pose a problem for professional image processing and desktop publishing software. This leads us to conclude that JPEG-LS is the best choice for image compression in the content aggregation scenario.

Figure 1: Compression ratios for lossless still image compression (scenario 1)



For the second scenario, distribution via the internet, the following standardized lossy image coding techniques were tested: JPEG, JPEG 2000 and JPEG XR (HDPhoto). The images used were the same as for the first scenario but their resolution was uniformly reduced to obtain pictures with a maximum height of 768 pixels (typical height of a modern computer monitor). The test images were coded using different bit rates (ranging from 0.1875 to 3 bits per pixel). In each case, the quality of the decoded video material was measured using the peak signal-to-noise ratio (PSNR), which expresses the quality difference between the original and the compressed material. The test results for the second scenario clearly show that classical JPEG coding is no match for the other two image coding techniques. The results for JPEG 2000 and JPEG XR show that JPEG 2000 slightly outperforms JPEG XR. However, the performance difference is limited. Based on its performance, JPEG 2000 is the winner, closely followed by JPEG XR. However, the end-user support for JPEG 2000 is rather limited, whereas Microsoft is actively pushing support for JPEG XR, as shown by the fact that JPEG XR is natively supported in all versions of Windows Vista. As a conclusion, based on its performance and end-user support, JPEG XR is our recommended choice for the internet distribution scenario. Figure 2 presents a typical PSNR graph – showing PSNR values in function of corresponding bit rates – from our tests with lossy image compression.

Figure 2: Typical PSNR graph for lossy image compression (scenario 2)



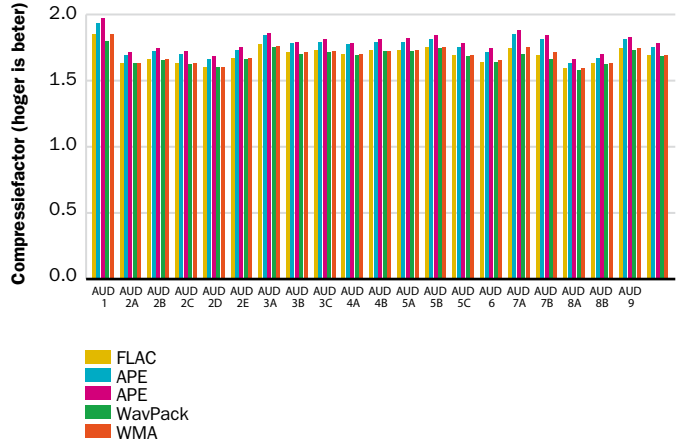
Audio compression

For the content aggregation scenario the following audio compression techniques were evaluated: MPEG-4 Audio Lossless Coding (ALS), Free Lossless Audio Codec (FLAC), Monkey's Audio (APE), Windows Media Audio (WMA) Lossless 9.2 and WAVPACK. Lossless audio compression techniques were selected, since they offer sufficient *size reduction* to be practically useful

in professional environments, while introducing no quality degradation. Apart from MPEG-4 ALS, these compression techniques are not officially standardized and WMA Lossless is even a closed-source audio compression technique. To evaluate the performance of the selected codecs, their compression ratio was compared on different representative audio fragments with varying characteristics. All fragments had two channels (stereo) and a sampling rate of 96 KHz with 24 bits per sample.

The experimental results, graphically presented in Figure 3, show that MPEG-4 ALS yields the best compression performance, closely followed by Monkey's Audio. The third place is shared by FLAC and WMA Lossless. WAVPACK shows the worst performance. Based on compression performance alone, MPEG-4 ALS is clearly the winner. However, the current generation of media applications seems to have only limited support for lossless audio compression in general and for MPEG-4 ALS and Monkey's Audio specifically. FLAC seems to be the most supported lossless audio compression technology, followed by WMA Lossless. Therefore the conclusion is that FLAC is the lossless audio compression technology of choice for the content aggregation scenario.

Figure 3: Compression ratios for lossless audio compression (scenario 1)



The second scenario, internet distribution, warrants the use of lossy audio compression techniques for *bandwidth efficiency* reasons. The following audio compression technologies are commonly used for distributing audio content via the internet: MPEG-2/MPEG-4 Advanced Audio Coding (HE-AAC v2), Microsoft Windows Media Audio (WMA 10 Pro), Ogg Vorbis (aoTuV), and MPEG-1/2 Layer-3 – commonly known as 'MP3'. Unfortunately, the performance evaluation of these techniques poses a significant problem. In the community of audio compression specialists there is no consensus concerning an adequate objective quality measurement tool for audio material. This implies that lossy audio compression techniques have to be evaluated with standardized subjective tests. However, these tests are very complex with very high demands on qualified expert listeners and very strict requirements for the testing

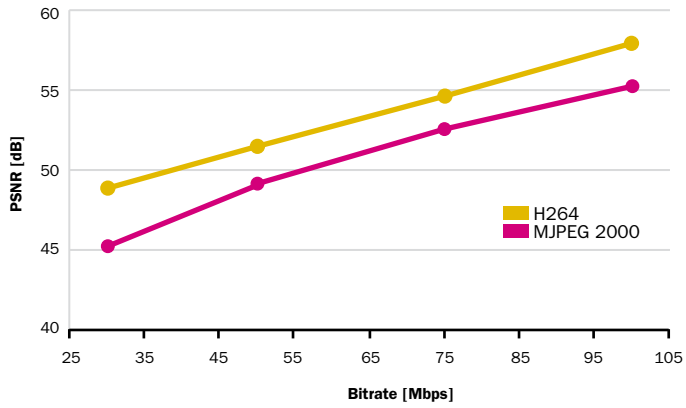
hardware and the testing environment. Because the necessary expert listeners were not available for the testing hardware and testing environment, the tests were replaced by a literature study encompassing test results from subjective tests performed by international organizations such as MPEG and EBU and by independent audio compression experts. Test results presented in the literature indicate that other compression techniques, which have been developed more recently, significantly outperformed the older MP3 codec. Among these newer techniques, there seem to be only small performance differences. On average, HE-AAC v2 seems to show the best performance. The best supported audio compression technology is still MP3, with HE-AAC v2 coming in second. Based on its performance and (end-user) support, HE-AAC v2 is the recommended choice for the internet distribution scenario.

Video compression

Given the requirements detailed in the introduction of this chapter, two video coding techniques, H.264/AVC Intra and MJPEG2000 were selected and compared for use in the content aggregation scenario. Both MJPEG2000 and H.264/AVC are international standards. In both techniques, each frame of the video sequence is coded independently, ensuring optimal edit-friendliness. While, for still images and audio material, lossless compression was advocated for use in the content aggregation scenario, this is not a practical solution for video since it implies unrealistic bandwidth and storage requirements. However, to ensure high quality results, lossy compression with visually imperceptible quality degradation is used, which significantly reduces the storage and bandwidth requirements in comparison to true lossless coding.

To evaluate the compression efficiency of the selected techniques, a performing arts event was captured in 720p HD resolution (1280x720, 50 frames per second), with 4:2:2 chroma subsampling and 10 bits per component, and selected fragments, with varying characteristics, were coded using different bit rates (ranging from 30 Mbps to 100 Mbps). In each case, the quality of the decoded video material was measured using the peak signal-to-noise ratio (PSNR). Figure 4 presents a typical PSNR graph for high resolution, high quality video compression.

Figure 4: Typical PSNR graph for high resolution, high quality video compression (scenario 1)

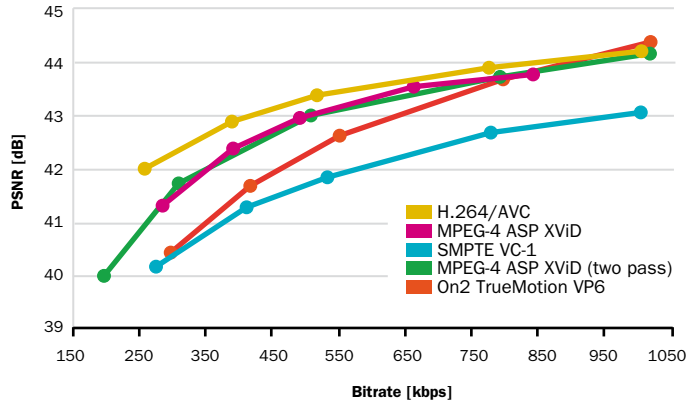


The results show that H.264/AVC Intra performs slightly better than MJPEG2000. However, the differences in objective quality at the same bit-rate are so small that they will not be visible in general. In terms of compatibility with existing and future professional production systems, the situation is not entirely clear yet. This is most certainly the case in broadcast environments.

However, considering its massive adoption in a multitude of other markets, H.264/AVC is likely to receive better hardware and software support. These reasons lead us to conclude that H.264/AVC Intra is the best choice in this scenario.

For the internet distribution scenario, the following coding techniques were evaluated: H.264/AVC, MPEG-4 ASP (XViD, DivX), VC1 (Windows Media 9 Advanced Profile) and Flash (On2 VP6). The first three codecs are open international standards, while the last one is a proprietary solution, which has become a de facto standard in the last few years. All codecs employ temporal prediction to obtain optimal rate-distortion performance. To evaluate the compression performance of these codecs, selected fragments from a recording of the opera *Dialogues des Carmélites* at the Vlaamse Opera in SD format were converted to QVGA format (320x240, 25 frames per second) using professional editing equipment and thereafter compressed at different bit rates ranging from 256 kbps to 1 Mbps. The resulting video quality was again measured using the PSNR (see Figure 5 for a typical PSNR graph). The results show that H.264/AVC generally achieves the best compression efficiency, while VC-1 typically yields the worst performance. The results for MPEG-4 ASP lie somewhere in the middle between those of the latter two codecs. The results for VP6 are harder to interpret. For some sequences, VP6 shows the worst performance, while for others it demonstrates the highest efficiency. The relative performance also seems to vary depending on the target bit-rate. In general, the performance of VP6 should be placed somewhere between that of MPEG-4 ASP and VC-1. The best performing codec, H.264/AVC, is still relatively new. Despite this fact, end-user support for this standard is rapidly growing. On one hand, mature open-source solutions are already available (ffmpeg). On the other hand, a H.264/AVC decoder has recently been added to Adobe's popular and freely available Flash Player 10, ensuring high-quality support for the broad end-user market. Additionally, Apple's popular iPhone and iPod Touch and several mobile phones from Nokia and other manufacturers also offer H.264/AVC support. As a conclusion, based on its performance and end-user support, H.264/AVC is our recommended choice for the internet distribution scenario.

Figure 5: Typical PSNR graph for video compression (scenario 2)



Conclusion compression formats

For the content aggregation scenario, the compression technologies of choice are the following: FLAC for audio content, JPEG-LS for still images and H.264/AVC Intra Only for video content. For the internet distribution scenario, the compression technologies of choice are the following: MPEG-2/MPEG-4 Advanced Audio Coding (HE-AAC v2) for audio content, JPEG XR for still images and H.264/AVC for video content.

CONTAINER FORMATS

While compression formats are designed to compress the multimedia data, container formats, also called wrapper formats, are meta-formats that specify how the (compressed) data is stored in a file or a stream in order to support functionalities such as multiplexing, synchronization, indexing and the addition of metadata. Container formats are typically tailored to a specific type of multimedia material, be it audio, still images, video or a combination of these. Some multimedia container formats, like AIFF, WAV and XMF are exclusively designed to contain audio data. Other containers, like FITS, JP2, JFIF, EXIF and TIFF, are exclusive to still images. Other containers are more flexible and can simultaneously hold many types of audio, video and other data, such as subtitles, metadata, tags, timeline information, and synchronisation information for the playback of the interleaved streams. The most commonly used are 3GP, ANIM, ASF, AVI, CDXL, DVR-MS, IFF, Matroska, MPEG-2 TS, MP4, MOV, Ogg, OGM and Realmedia.

The choice of a multimedia container format requires the thorough evaluation of different aspects of container formats: market support, overhead of the metadata, support for the (advanced) coding features of the intended compression format, support for multiplexing, synchronization and indexing, and finally, the support for streaming media – which requires the data to be stored in chunks inside the container. In the following subsections we elaborate on the choice of the proper container format for the compression formats selected in the previous section.

Still image containers

According to the previous section, the compression technology of choice is JPEG XR for the internet distribution scenario and JPEG-LS for the content aggregation scenario.

The JPEG XR standard defines a feature-complete container format organized as a table of Image File Directory (IFD) tags, similar to a TIFF 6.0 container. A standard JPEG XR file contains image data, an optional planar alpha channel, basic HD Photo metadata stored as IFD tags, optional descriptive metadata stored as IFD tags, optional Extensible Metadata Platform (XMP) metadata encoded in XML and stored as a single IFD tag with extended data, optional Exchangeable Image File Format (EXIF) metadata stored as a sub IFD table linked by an IFD tag, an optional ICC colour profile stored as an IFD tag with extended data. The image data is a monolithic self-contained, self-describing JPEG XR compressed data structure. The optional alpha channel, if present, is stored as separately compressed single channel image data, referenced by the appropriate IFD tags; enabling decoding of the image data independently of transparency data in applications which do not support transparency. In an effort to remain compatible with software designed to decode IFD table-based TIFF files, the largest possible HD Photo file is 4 GB in length. Even though this limit should not raise any concerns in real-life applications, it will be addressed in a future update. Taking all these elements into consideration, it can be concluded that JPEG XR coded images do not need an extra container format for the internet distribution scenario.

JPEG-LS uses a file format that is similar to the JPEG interchange format (JFIF), as it consists of frames, scans, and restart intervals. In fact, JPEG-LS uses the same markers as JPEG (except for a few that do not apply). Moreover, it adds new marker segments containing JPEG-LS specific information, namely specific start-of-frame and start-of-scan marker segments, and an LSE marker segment for preset parameters. In fact, unlike JPEG, parameters have default values that can be overridden by other marker segments. JPEG-LS supports single- and multi-

component scans; in this latter case, a single set of context counters is used throughout all components, whereas prediction and context determination are done independently on each component. The data in the component scan can be interleaved either by lines or by samples. Since JPEG-LS has its own file format, which can foresee most of the required functionality, it is unnecessary to use an additional container format.

Audio containers

Some containers are exclusively designed for audio. The most widespread audio-only container formats are FLAC, WAV, AIFF, and XMF, of which WAV is the most widely used. However, audio is also very often wrapped in multi-purpose multimedia containers, such as Ogg, MP4 or Matroska. This is usually also the case for the compression formats that were withheld before: FLAC for the content aggregation scenario and MPEG-2/MPEG-4 Advanced Audio Coding (HE-AAC v2) for internet distribution.

The open source FLAC development community proposes two alternative containers. The first, also called FLAC, is a very minimalistic audio container, designed to be very efficient at storing single audio streams. The second is the Ogg multimedia container, which enables the mixing of audio, video, metadata, etc. The overhead is slightly higher than that of the native FLAC container format. The FLAC community advises the use of FLAC if only archiving of compressed audio is required. For more advanced purposes it advises the Ogg container. Evidently, other containers also support FLAC. Sometimes, the open source, feature complete multimedia container Matroska is chosen for FLAC encoded audio.

MPEG-2/MPEG-4 Advanced Audio Coding (HE-AAC v2) is supported by many audio and multimedia containers such as 3GPP, Flash Video, Matroska, MP4, MPEG-2 TS, NUT, Ogg, Quicktime, and RMVB. The most interesting of these are the multimedia container MPEG-4 Part 14 (MP4), formerly known as ISO/IEC 14496-14:2003 and Matroska. Both container formats offer a wide variety of functionality and support for many different multimedia compression formats (see further).

Video containers

Video material is usually stored in combination with the corresponding audio tracks, subtitles and metadata in a single container format. Commonly used formats are AVI, MP4, Matroska (MKV/MKA), and MXF.

Audio Video Interleaved (AVI) is a multimedia container designed by Microsoft. AVI containers can store multiple audio and video streams. The format supports nearly all the audio and video formats supported by DirectX and Video for Windows. Subtitles and chapters can also be stored inside the container via modifications outside Microsoft. An AVI container consists of a header with information about the video, e.g., the frame rate, and the actual data.

MPEG-4 Part 14 (MP4) is a multimedia container format that is part of the MPEG-4 standard. MP4 can store multiple audio and video streams. It supports the standard video formats MPEG-1, MPEG-2, MPEG-4, and MPEG-4 AVC and the audio formats (HE-) AAC, MP3, MP2, MP1, CELP, TwinVQ, Vorbis, and Apple Lossless. Except for these audio and video compression formats, MP4 containers can also store private streams. These private streams can hold any kind of information. MP4 also supports storing images, hyperlinks, subtitles, and chapters.

Matroska is an open-source multimedia container format. It is based on EBML (Extensible Binary Meta Language). This is a binary byte-bonded format, based on the principles of XML. Matroska has two versions: MKV, that stores audio and video streams, and MKA,

that can only store audio streams. Matroska containers can hold an unlimited number of audio and video streams. It supports nearly all the current audio and video codecs. Besides audio and video streams it can also store images, subtitles, chapters, DVD-like menus, and even fonts for the subtitles. It also allows streaming.

Material eXchange Format (MXF) is a standard container format for professional audio and video. The format is specified by a set of SMPTE standards. It is an open file format especially designed for exchanging audiovisual material together with the associated data and metadata during the production process. Interoperability is the main goal of MXF. It can be used as a streaming format and as a transferring format. MXF supports nearly all the current audio and video codecs and also permits storing random files. This allows storing transcriptions, images, etc. The MXF container consists of a header, footer and body, which actually holds the data. The header of the container format stores timing parameters, synchronisation information, and metadata. The MXF metadata can store information about the file structure, the title and keywords, subtitles, reference numbers, annotations, version numbers, location, date, etc. To manage the complexity and all the degrees of freedom of the MXF container format, MXF offers some 'operational patterns', or templates.

In the previous section H.264/AVC Intra Only was chosen for the content aggregation scenario while H.264/AVC was the codec of choice for the internet distribution scenario. H.264/AVC Intra Only can be combined with any of the above-mentioned video containers but for maximum professional support this compression format should be combined with the MXF container format. H.264/AVC can also be combined with any of the above-mentioned video container formats. However, a combination with AVI or MXF is not ideal. AVI limits the coding options, e.g. B-frames cannot be supported in a straightforward manner, which results in suboptimal compression and support for MXF on the end-user market is limited. This limits the practical choice of a video container for H.264/AVC to MP4 and Matroska.

Conclusion container formats

FLAC, JPEG-LS and H.264/AVC Intra Only were advised as the compression formats for the content aggregation scenario for audio content, still images and video content respectively. For the internet distribution scenario, the compression technologies of choice are the following: MPEG-2/MPEG-4 Advanced Audio Coding (HE-AAC v2) for audio content, JPEG XR for still images and H.264/AVC for video content. The encoded data should be wrapped in container formats that are fully compatible with the compression formats and support the requirements of the different scenarios. The advised container formats for the chosen compression formats for the content aggregation scenario are:

- Ogg or Matroska for FLAC,
- JPEG-LS does not need an extra container format,
- MXF for H.264/AVC Intra Only.

The container formats of choice for the internet distribution scenario are:

- MP4 or Matroska for MPEG-2/MPEG-4 Advanced Audio Coding,
- JPEG XR does not need an extra container format,
- MP4 or Matroska for H.264/AVC.

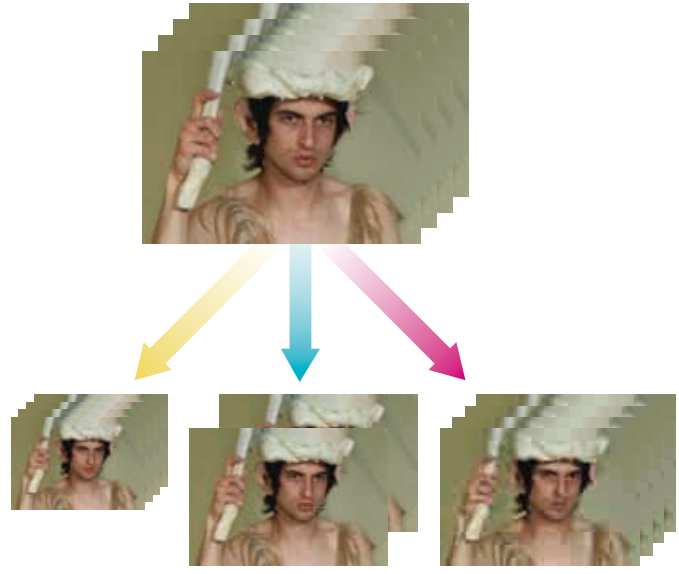
Video transcoding

In order to match the properties and constraints of transmission networks and terminal devices, video transcoding is necessary. Video transcoding can be regarded as the process for *efficient adaptation of video streams*. The information of the incoming video stream is efficiently reused while, at the same time, the quality loss due to the transcoding process is minimized. A number of properties and constraints can be the subject or reason for the transcoding process, such as bandwidth limitations, packet loss, bit rate variation, buffer constraints, display resolution, battery life, etc. The properties and constraints implied by the network or the device typically have an impact on the bit rate, the frame rate, or the spatial resolution. Other types of transcoding exist such as the insertion of new information, i.e. a company logo or a watermark.

A straightforward solution for transcoding is the concatenation of decoder and encoder. Since decoding and encoding is a computationally very demanding operation, this solution is very time-consuming. To overcome this problem, different alternative transcoding solutions have been introduced in the literature that try to 'shortcut' the transcoding process. Reducing the computational efficiency has been a major driving force behind the development of new transcoding solutions.

Efficient transcoding of video streams can be performed by re-using as much of the information as possible from the incoming video stream, and by only changing the required data in the video stream. This means for example, that the motion vectors will be re-used while changes will be made to the residual data (transform coefficients). Another way of reducing complexity is by avoiding algorithmic operations in the transcoding solution. An example

Figure 6: Spatial resolution, temporal resolution and bit rate reduction transcoding



is to work in the frequency domain instead of the pixel domain, hereby avoiding inverse and forward transform operations.

In order to obtain higher compression performance, standardization committees have pushed the limits of coding algorithms in order to identify spatial, temporal, and statistical dependencies in the video stream. As a result, the amount of dependencies in the video stream is severely increased. This means that by changing one syntax element of the video stream, several other elements

can be harmed. Because of the resulting mismatch between the transcoder and decoder, drift can arise in the video stream, and video quality can degrade. Because of this reason, a significant effort related to the development of transcoding algorithms was dedicated to assuring visual quality of the transcoded video streams. Ideally, the transcoded video stream should have the quality of a stream encoded directly with the required parameters. The *problem of drift* together with techniques to stop degradation has been extensively studied in literature.

In this project, we have been investigating bit rate reduction transcoding and temporal resolution reduction transcoding for H.264/AVC video streams.

Bit rate reduction transcoding

The objective of bit rate reduction transcoding is to reduce the bit rate of a video stream while maintaining low complexity and achieving the highest possible quality. Ideally, the quality of the transcoded video stream should have the quality of the video stream directly generated at the reduced bit rate.

There are two classes of techniques for bit rate reduction transcoding, namely requantization transcoding and dynamic rate shaping. Requantization transcoding uses a coarser quantizer while dynamic rate shaping discards high-frequency transform coefficients. In the scope of the project, we selected requantization transcoding for bit rate reduction transcoding.

Different transcoding techniques are proposed in the literature: open-loop requantization, requantization with compensation and the cascade of decoder and encoder. Problems of drift for MPEG-2 transcoding are extensively discussed in the literature. New coding tools in H.264/AVC cause extra problems for transcoding. An evaluation of different techniques for H.264/AVC transcoding is presented in the literature. The main transcoding techniques are briefly discussed and their strengths and weaknesses are indicated:

1) Open-loop requantization is a low-complexity transcoding technique that consists of the following operations: entropy decoding, requantization, and entropy encoding. A number of time-consuming operations are eliminated and fast transcoding becomes possible. The main disadvantage is that the requantization errors propagate and accumulate, which results in increased quality loss. Drift plays an important role in H.264/AVC transcoding and its effect on visual quality will become more severe. Open-loop requantization as such is practically not usable for transcoding.

2) Requantization with compensation is an extension of open-loop requantization. This single-loop architecture calculates the requantization errors and compensates with the requantization errors for both spatial and temporal prediction in order to restrain drift propagation and accumulation. As a result, more processing power and memory buffers are required compared to open-loop requantization; however, this transcoding technique is still faster compared to the cascade of decoder and encoder.

3) The cascade of decoder and encoder is the only drift-free solution for transcoding. This is the most straightforward solution since this is the concatenation of decoder and encoder. In most cases, this solution is not desirable due to the computational complexity as a result of the double-loop architecture. One way to reduce the computational complexity is to reuse the mode and motion data from the incoming video stream. This way, complex processes, such as mode decision and motion estimation, are avoided and significant savings can be made in complexity.

Since none of the transcoding techniques satisfied the requirements, we developed a hybrid architecture that combines different transcoding techniques depending on the picture and macroblock type. This provides a fast transcoding solution that minimizes quality loss due to transcoding. Transcoding tests on performing arts video content have shown that the performance of the hybrid architecture is close to the cascade of decoder and encoder with a significant reduction in transcoding complexity.

Temporal resolution reduction transcoding

The objective of temporal resolution reduction transcoding is to reduce the frame rate of a video stream. In the past, this was often achieved using motion vector mapping. The mapping operation introduces small propagating errors. More recently, other approaches have appeared. These approaches make an appropriate choice for the coding structure. The coding structure allows certain pictures to be dropped without causing errors in other pictures.

Before we explain how to compose these coding structures, we need to further elaborate on picture types. There are three types of pictures: I pictures, P pictures, and B pictures. The I pictures are coded independently and only exploit spatial correlation. These pictures require more bits compared to P or B pictures and are used as random access points in the video stream. The P and B pictures exploit both spatial and temporal correlation. The P pictures only refer to past reference pictures while the B pictures refer to both past and future reference pictures.

In the past, mainly IBBP coding structures were used. The P picture is coded before the two consecutive B pictures. As a result, there is a structural delay on the encoder side of two pictures. When the B pictures are not used as a reference, they can be discarded from the video stream. This leads to a temporal resolution reduction. More recently, hierarchical coding structures have been used. Pictures are organized in temporal layers. A temporal layer only depends on lower temporal layers. As a result, the highest temporal layer can be removed without harming the other pictures.

Conclusion transcoding

Transcoding of H.264/AVC has become more difficult due to new coding algorithms. The transcoding operation should be carefully designed in order to have an optimum trade-off between the computational complexity of the transcoding solution and the visual quality of the transcoded video streams. For bit rate reduction transcoding, a hybrid transcoding architecture is presented that combines different transcoding algorithms. These algorithms are selected based on the picture and macroblock type. This results in a fast transcoding solution that minimises quality loss. We found that the hybrid architecture performs well for performing arts video content. For temporal resolution reduction transcoding, the H.264/AVC specification allows flexibility in the selection of picture types. This way, different temporal resolution reductions can be obtained using different coding structures. This technique does not harm the other pictures in the video stream.

FUTURE WORK

Future work in the domain of digital recording of performing arts will probably be driven by the evolution in compression techniques. In the short term in particular, the evolution in video compression is likely to have a significant influence. More specifically, a lot of work is being put into the development of Scalable Video Coding (SVC) and Multiview Video Coding (MVC).

SVC is the efficient combination of the same video content with a different resolution, frame rate and/or quality into a single encoded video stream. Some of the applications of SVC include a scalable production format, offering both a high resolution, a high-quality editing format and a low resolution, a lower quality browsing format, and a scalable format for distribution over channels with different characteristics (bandwidth, error rate, etc.). MVC allows the efficient representation of multiple views of the same video content into a single encoded video stream. It offers interesting possibilities in applications, such as 3D video and immersive experiences where the spectator can virtually walk on stage during a performance. However, new techniques like SVC and MVC and their possible applications will pose new requirements on container formats and they will increase the need for efficient conversion – transcoding – to application and/or network specific content.

CONCLUSIONS

The goal of this project is a fluent digital dissemination of performing arts content. Two different scenarios were identified to realize this goal, a content aggregation scenario and an internet distribution scenario. This chapter tries to formulate recommendations concerning the optimal choice of compression and container formats for audio, video and still images in the context of these two scenarios. The following table presents the advised combinations of compression formats and container formats for the different scenarios.

Figure 7: Compression and container formats

Scenario	Multimedia files	Compression format	Container format
Content aggregation	Audio	FLAC	Ogg or Matroska
	Still Images	JPEG-LS	/
	Video	H.264/AVC Intra Only	MXF
Internet distribution	Audio	MPEG-2/MPEG-4 Advanced Audio Coding	MP4 or Matroska
	Still Images	JPEG XR	/
	Video	H.264/AVC	MP4 or Matroska

It should be noted that the optimum solutions for the two scenarios differ because the requirements of the scenarios are different. This implies that there is a need for conversion if aggregated content needs to be distributed. The most efficient method for this conversion is transcoding, optimized for specific compression formats and/or applications. In this chapter, a hybrid architecture for transcoding H.264/AVC encoded video with low quality loss was presented.

Semantic BRICKS for Performing Arts Archives and Dissemination

Sam Coppens, Erik Mannens, Rik Van de Walle (IBBT-MMlab-UGent)

Until recently, cultural institutions in Flanders had little strategy to archive and disseminate their productions. And yet, the local government wants the productions to be archived as cultural heritage, schools want teaching packs for educational purposes, and other (foreign) institutions want production clips for promotional or research aims. Therefore, the following issues need to be tackled: a) the institutions want an easy-to-use, robust, decentralized archive; b) the institutions want to bundle and exchange their assets; c) the institutions want to use a common metadata schema combined with their own schemas; and d) the institutions want their (meta)data enriched and interlinked.

In this project, the problems investigated concern how the data should be archived and disseminated and what (meta)data schemas and application frameworks should be used. In this chapter, the main conclusions of this research are presented. Before jumping to conclusions, it is discussed which problems have to be tackled when digital material has to be archived and disseminated and how a semantic, layered (meta)data model answers these issues. In the following section, a semantic layered (meta)data model is developed that corresponds to the known problems of the previous sections. Following this, the relevance of a distributed framework that uses this semantic layered (meta)data model taking into account the special requirements of the cultural sector is shown. Furthermore, we elaborate on how assets can be bundled for dissemination. The next section

describes how data can be opened up and made available to the masses, whereas the following section shows how one can use the wisdom of the crowd by using the *Open Linked Data* principle the other way around. Finally, best practices and conclusions are drawn in the final sections.

WHY GO LAYERED? A BRIEF LIST OF (META)DATA PROBLEMS

A digital repository offers numerous advantages besides archiving: spatial bordering blurs, mobility is no longer an obstacle, and searching through a vast number of files becomes much easier. But a digital repository is not invulnerable. Long-term preservation of digital multimedia data imposes specific requirements on the digital repository. First of all, the software and hardware of the digital repository must guarantee long-term access to the available information. Next, human intervention is still required both in the form of file descriptions, work processes and the use of standards to keep the information accessible and interpretable as long as possible for the user community.

Digital information is exposed to many threats. Some of these also endanger analogous documents, while others only target digital information:

- In digital form, information is a mere conceptual object. Digital multimedia can easily be copied and altered without immediate visible impact on the content therein. In comparison with analogue information, it is therefore difficult to guarantee the authenticity of digital information. Hence, one of the main concerns of long-term preservation is *permanently guaranteeing the authenticity* of data.
- Technological changes comprise another threat to digital data. Data formats and their inferred formats evolve rapidly. They can become obsolete or no longer interpretable in the future. The life span of storage techniques is also finite. To get rid of the discrepancy between the *short life span of digital technology* and the need for long-term preservation, either the old data format must be migrated to the new data format, or lasting emulation of the old data format must be foreseen. Moreover technical metadata must pass sufficient information onto the stored data to make fast interventions possible.
- In the long term, even the knowledge domain of the user community can change, data specialists come and go, or the institutions themselves can be modified or have a new task assigned. This possibly leads to interpretation problems. The stored data must therefore also contain *sufficient contextual metadata*, so new and future user groups can also still interpret the information.

When storing cultural heritage data from several different sectors digitally – i.e. broadcasters, libraries, the cultural sector or archival institutions – the digital repository will have to process a lot of descriptive metadata. Each specific scope stipulates which descriptive metadata are necessary. Digital images in a library can represent a scanned book, whereas images in the possession of a museum probably represent an artwork. Both images consequently demand other descriptive metadata fields. The digital repository must be able to search within these very divergent data sets. For this reason, a layered metadata system is necessary.

WHY GO SEMANTIC?
A BRIEF HISTORY OF KNOWLEDGE ON THE WEB

Nowadays, the web of hypertext is a fact. This web is actually a web of documents. These documents are described using Hypertext Mark Up Language (HTML). HTML is a language especially designed to describe web pages and the links between them. Such a web page usually consists of a body of text interspersed with multimedia objects, e.g., images, interactive forms, or movies. HTML provides a means to describe the structure of text-based information in a document. It is able to denote text as links, headings, tables, etc. This text is supplemented with embedded images, interactive forms and other objects. These HTML pages can be consulted using HTML browsers, e.g., Mozilla Firefox, which can present a web page in a human readable form.

```
<html>
    <body>
    <p>
    An image:
    <img src="http://www.vti.be/examples/Hamlet.pdf"
         width="144" height="50">
    </p>
    <p>
         Author: William Shakespeare
    </p>
    </body>
</html>
```

A lot of data presented by web pages comes from (relational) databases, spreadsheets, address books, etc. Unfortunately, HTML was not created to describe this kind of data. It can only describe a web page, which is a visual representation of that data. To describe the data itself, eXtensible Markup Language (XML) was designed. XML is a set of rules for representing and structuring data in a textual format. Just like HTML uses tags and attributes to describe a web page, XML uses tags to describe a piece of data. XML parsers use these tags to extract the right piece of data from an XML document. XML documents are well-formed, because these XML documents are validated against an XML schema. An XML schema thus describes the structure of an XML document. This schema can, for instance, say that the value of the "author" tag must be "a string".

```
<document href="http://www.vti.be/examples/Hamlet.pdf">
       <author>William Shakespeare</author>
</document>
```

The next evolution was the eXtensible HyperText Markup Language (XHTML). XHTML restricted the rules of HTML to those of XML. It is actually a reformation of HTML to XML. This made it possible for XML parsers to parse XHTML documents, or to map XML documents automatically to XHTML representations. The benefits of XML-based web documents (i.e. XHTML) include searching, indexing and parsing as well as future-proofing the web.

XML has been the driving force behind the disclosure of a lot of (meta)data that is stored in databases, spreadsheets, technical drawings, etc. And yet, XML still has many interoperability issues. The same piece of information as in the previous example can be described in XML as:

```
<author>
 <uri>http://www.vti.be/examples/Hamlet.pdf</uri>
 <author>William Shakespeare</author>
</author>
```

Or as:

```
<document href="http://www.vti.be/examples/Hamlet.pdf"
author="William Shakespeare" />
```

These XML documents both describe the same piece of information, which is obvious for a human. For a machine parsing these two XML documents, these documents produce completely different XML trees. This makes it very difficult and syntax-dependent to query the XML tree. Furthermore, the tags used in the XML document do not mean anything to a machine. For a human, the tags already provide a hint of what their semantic meaning may be. This makes exchanging information using XML a significant task.

A solution is Resource Description Language (RDF). RDF describes information using triples. These triples consist of a subject ("http://www.vti.be/examples/Hamlet.pdf"), a predicate ("author"), and an object ("William Shakespeare"). Using these triples, any piece of information can be described by an RDF graph, which consists of a set of triples. These RDF graphs can also be described in a textual, interchangeable format, e.g., via RDF/XML, N3, Atom, etc. When these textual descriptions are parsed by a machine, they all end up with the same RDF tree. This is done by RDF reasoners, which build up the RDF tree. This makes querying the RDF tree, syntax-independent. Furthermore, all the nodes of the RDF tree are given a semantic meaning in RDF. For this purpose, RDF introduced namespaces. Namespaces are Uniform Resource Identifiers (URIs). By appending a namespace to the XML tags, those tags become unique, which makes it possible to define the semantics of that tag. A tag with a namespace thus forms the predicate in RDF. This allows information to be easily exchanged, re-using information and reasoning over that information.

An extension to RDF is RDF Schema (RDFS). RDFS is very similar to XML schema: it describes the structure of the RDF document, and defines the semantics of its elements. It allows data to be structured with classes and properties on those classes. Another extension to RDFS is Web Ontology Language (OWL). OWL extends RDFS by introducing even more descriptive logic. For instance, it is possible to say that "all tragedies of William Shakespeare are plays", even if that current information is not included in the description of a specific play.

With these latest techniques, the *Semantic Web* is emerging. The machine-readable descriptions enable content managers to add meaning to the content, i.e. to describe the structure of the knowledge we have about that content. In this way, a machine can process knowledge itself using processes similar to human deductive reasoning and inference, thereby obtaining more meaningful results and helping computers to perform automated information gathering and research.

A SEMANTIC LAYERED METADATA SCHEMA PROPOSAL

Metadata is actually data about data. Resources are fully described using metadata. It accompanies, for instance, a multimedia object, describing that multimedia object in a machine-readable way. This metadata is described by a metadata schema. These metadata schemas are very domain-specific, as every domain has different needs in describing their data. The major problem we are facing is to bridge the incompatibility of the different metadata schemas used all over the arts sector in Flanders (and beyond). Our proposed *layered ontology* will be used for the descriptive metadata in the project. This model not only leverages the exchange of data between the performing arts institutions in Flanders, but also the possible dissemination to the general public. The model has to be applicable in the whole performing arts sector in Flanders (and preferably beyond). In

other words, it has to be general enough. Many of the institutions already have descriptions of their objects. Those descriptions are formulated using many different metadata schemas. Therefore, it should be possible to map those schemas that are already in use in the performing arts sector in Flanders to our proposed layered schema.

The schema has to deliver all the necessary elements to the user so that he can find information on the object of his interest (i.e. general search). When the user has found his information, he has to be able to link to a more detailed description of that object (i.e. specific details). In order to fulfil these requirements the model is split into two parts, a description part (for the search) and a provenance part (for the detailed info).

The first part or common layer describes the object. This description has to be general enough to be applicable to all the objects in use, but on the other hand it has to deliver the elements so the user can find what he is searching for. This part consists of an interoperability layer, a common layer above all the metadata schemas that are already in use in the field. This part then automatically offers the tools to query all those descriptions. In other words it has to be able to answer basic questions like who, what, where and when (the famous 4 Ws).

The second part or lower layer contains the information needed to link to a more detailed description, mostly to the complete record the first part is mapped from. This part has to at least reflect the namespace of the schema the original record is described with, a URI of the repository the record comes from and the identifier of the record in that repository.

For the definition of the new metadata schema, we used W3C's Semantic Web technology, more specifically the OWL ontology language (as described in the previous section). The expressiveness of OWL allows fine-grained property definitions to be created by splitting the definition of properties into 'attributes' and 'relations'. Attributes (corresponding to the OWL notion of a data type property) can take typed literals as value whereas relations (corresponding to the notion of an object property) can link to other resources such as content items or concepts taken from another ontology domain. The sublanguage is OWL DL, not OWL FULL. OWL FULL provides the most expressiveness, but does not guarantee the support of reasoning software, while OWL DL is a little less expressive, but it is guaranteed to be completely supported by the RDF reasoners. The framework BRICKS, which will make use of this schema and is described in the next section, also requires the schemas to be described in OWL DL.

The records are described in Dublin Core (DC). It is the most common metadata schema in use and it is general enough to describe all the objects of the Flemish performing arts sector. It is the largest common divider of all the metadata schemas that are used in the performing arts sector in Flanders. On top of that, all the fields of the DC model are optional and repeatable. This makes it possible to map nearly all the metadata schemas to DC. This also makes the Open Archives Initiative framework – Protocol Metadata Harvesting (OAI-PMH) compliant, because the offering of DC descriptions is a requirement for OAI-PMH compliance of the data provider. OAI-PMH is an XML protocol for harvesting metadata descriptions. It is used to *harvest and share* metadata. This protocol is a pillar within the BRICKS framework to import data from other OAI-PMH compliant repositories. For the implementation of the DC schema, all properties of DC were modelled as data type properties, which are all optional and repeatable.

As mentioned before, this lower layer should deliver at least three things: a) the metadata namespace of the originating record, b) the URI of the repository it comes from, and c) the identifier of that originating record in that repository. This layer is based on a schema that is used by the OAI-PMH protocol,

indicating the provenance of a record. This schema is described in an XML schema, so the schema was 'ontologised' in an OWL DL schema.

Finally, there needs to be an upper ontology that imports the two other ontologies and combines them into one ontology. This way each of the imported ontologies, the DC description (the common layer), and the Provenance description (the lower layer), can be altered independently.

THE DISTRIBUTED OPEN-SOURCE BRICKS FRAMEWORK

After an initial platform evaluation the distributed semantic open-source repository BRICKS was chosen as a development platform. It is the outcome of the European project Building Resources for Integrated Cultural Knowledge Services (BRICKS). The aim of the BRICKS project was to design an open user- and service-oriented infrastructure to share structured knowledge and resources in the Cultural Heritage domain.

The key feature of BRICKS is its semantic, service-oriented, distributed architecture. The Service Oriented Architecture (SOA) of BRICKS means that its architecture is composed of several generic foundation components (called 'core' and 'basic' components). On top of this foundation layer a number of additional specialised services are implemented (called 'pillars'). Those services can be invoked by applications as remote services. These services are standard Web services described by WSDL documents. A BRICKS node (called 'BNode') is an application that uses these services. This allows BRICKS to be extended with other functionalities or services, and makes BRICKS an excellent development platform. There is already a basic BNode implementation, called 'Workspace', available to users, on which they can start developing.

The BRICKS architecture is *decentralised* by default and can be used out-of-the-box, thus every performing arts institution can deploy its own instance of BRICKS, called a BNode, without any problems. These BNodes are able to communicate with each other using P2P technologies. These BNodes can thus form a network of BNodes. This network allows, for instance, a search for data in all the BNodes within that network. Such an approach avoids having central hubs whose failure or overload could stop the whole system. Hence, BRICKS is a very heterogeneous, adaptable system without the need for a central body to maintain the system, making BRICKS a cost-effective solution, as centralised administration costs for additional personnel and money can be avoided.

The BRICKS framework uses OWL to describe its data. As discussed in the previous section, this semantic web technique describes your data in a very expressive, machine-readable way. This promotes data exchange, enriching your data with data from other datasets (as will be described in the following sections), and complex reasoning over your data. That is why BRICKS was chosen as an ideal initial development platform for the bulk of the Flemish cultural institutes.

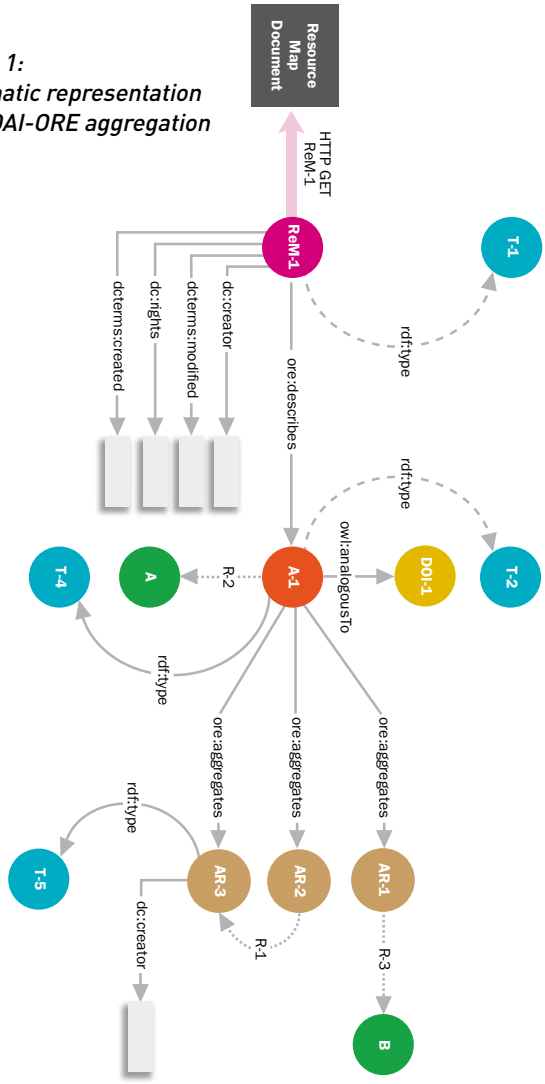
AGGREGATING RESOURCES THROUGH OAI-ORE

Besides archiving audio, video, photo, and text, the repository has to be able to store aggregations of these objects too. The performing arts institutions disseminate not only their performances but also introductions to performances, interviews with artists, programme brochures, reviews, etc. These aggregations have to be stored, disseminated, and exchanged too. For this, we developed an ontology based on the Open Archives Initiative Object Reuse and Exchange (OAI-ORE) protocol.

Today, many information systems, like content management systems, support the storage and identification of aggregations, and access to the aggregations and aggregated objects. In most systems, these objects vary in semantic type (e.g. article, book, video, dataset, etc.) and in metadata file format (e.g. PDF, XML, MP3, etc.). These objects can also be stored on different network locations, i.e., aggregated objects can be stored locally or externally. Information systems store, identify, and deliver access to these compound objects in an architecture-specific manner. Unfortunately, the way these information systems disseminate their compound objects is far from perfect and without any broadly accepted standard. In many cases, a lot of the advanced functionalities get lost when publishing the compound objects on the web. Mostly, the publication is aimed at the end-users (humans) and not at agents (machines) such as web crawlers. The structure of the object is often embedded in splash pages, user interface widgets, etc. This approach makes the structure of the compound object unclear for machine-based applications like browsers, web crawlers, etc. Consider the example of a scanned book, where all the pages get an HTTP URI. A web crawler can come across one of these pages and find links to the other pages of the book, to the chapter containing that page or to the book itself. A web crawler cannot distinguish between these links. For the web crawler these are untyped links or links that do contain information, but this information remains unreadable to the web crawler. Therefore, the order of the pages gets lost, etc.

The OAI-ORE standard tackles this problem by developing a standardised, interoperable and machine-readable mechanism that can express the information of compound objects. The standard makes sure that the logical boundaries of the aggregated objects and their mutual relations remain intact for machine agents when publishing the compound object on the web. To achieve this, OAI-ORE makes use of *resource maps*. These resource maps are RDF (machine-readable) descriptions of the aggregation. They list the aggregated resources, their mutual relations and the web context of the aggregation, together with the URI of the resource it is describing, i.e., the aggregation. In fact, these resource maps are named graphs. These graphs are RDF graphs, sets of triples, extended with a name, a URI, for the graph/resource map. The named graph is not the aggregation itself, but a representation of its description encoded in Atom or RDF/XML, as depicted in Figure 1. The ORE model demands that a resource map describes just one aggregation. An aggregation, on the other hand, can have multiple resource maps, each with its own representation. This makes it possible to describe the same aggregation, for instance, with an RDF description and an XHTML description. Clients and applications need to determine the URI of the resource map from the URI of the aggregation, to get a description of the aggregation. This can happen in two ways: one way is to append a fragment identifier ("#") to the URI of the resource map. For instance, the URI "http://example.com/aggregation" is the URI of the resource map, and "http://example.com/aggregation#" is the URI of the aggregation. In practice, this means that every aggregation should get a URI, just like any resource on the Web. From this URI, a web agent should be able to automatically get a machine-readable description of the aggregation, namely the resource map. Of course, this resource map also has a URI. This URI should be deducted from the URI of the aggregation. This is done, for instance, by using *cool URIs*. The web agent adds ".rdf" to the URI of the aggregation and gets its machine-readable description.

Figure 1:
Schematic representation of an OAI-ORE aggregation



LINKED OPEN DATA TO THE RESCUE

Sir Tim Berners-Lee first introduced the term Linked Open Data (LOD) in 2006. LOD lets people share structured data on the web as easily as they share documents today. It refers to a style of publishing and interlinking structured data on the web. LOD lets you use RDF data models to publish the structured data on the web and uses RDF links to interlink data from different datasets. This makes the web one giant database, the Web of Data.

LOD stipulates four basic principles. The first principle is that we first have to identify the items of interest in our domain. Those items are the resources that will be described in the data. The next principle is that those resources have to be identified by HTTP URIs (and avoid schemas such as Uniform Resource Names (URNs) and Digital Object Identifiers (DOIs)). The third principle is to provide useful information when accessing an HTTP URI. The fourth rule is to provide links to the outside world, i.e. to connect the data with data from other datasets in the Web of Data. This makes it possible to browse data from a certain server and receive information from another server. In other words, by linking the data with data from other datasets, the web becomes one huge database, called the Web of Data.

In practice, this means that every resource described by an RDF schema has to be identified by an HTTP URI, (e.g. "http://dbpedia.org/resource/Playwright"). Every resource should also have two representations: an XHTML (human readable) and an RDF (machine-readable) representation. Every representation also has to be identified by an HTTP URI (e.g. "http://dbpedia.org/page/Playwright") for the XHTML representation and for the RDF representation (e.g. "http://dbpedia.org/data/Playwright"). When coming across the HTTP URI of a resource, the LOD server determines which representation should be served, based on information in the Accept header of the user's client, and redirects

the client to the appropriate representation using HTTP's 303 redirect and content negotiation.

Publishing resources as LOD, conforms to the way OAI-ORE offers to publish aggregations. OAI-ORE demands that aggregations have to be identified by a URI, and have to be described using an RDF schema, i.e. a resource map, which also has a URI. When clients use the URI of that aggregation, they should be able to automatically detect the URI of the resource map with the appropriate representation for the client. This principle conforms to the way LOD publishes data, except that with LOD, the client gets automatically redirected to the appropriate representation, based on the client Accept header (which is a benefit).

For publishing the records from a triple store as LOD, the open-source tool Pubby was used. Pubby is actually a Linked Data frontend for SPARQL endpoints. A SPARQL endpoint is a web service that can handle SPARQL queries. These SPARQL queries can be seen as semantic SQL statements. BRICKS does not provide such a SPARQL endpoint. That is why the triple store in the BRICKS framework was replaced by the open-source OpenLink Virtuoso triple store. This triple store offers a SPARQL endpoint by default. By configuring Pubby for the SPARQL endpoint, provided by the Virtuoso triple store, the records stored in the triple store are published as LOD. This means providing HTTP URIs for all the records served by the SPARQL endpoint, providing a simple HTML interface showing the data available about each resource, and taking care of the automatic redirecting to the appropriate representation.

In fact the BRICKS framework has no problems storing the resource maps, but cannot handle the cool URIs. Within BRICKS you cannot define your own URIs. This problem is solved by publishing the records from the JENA triple store from BRICKS as LOD, as was described above. This way, you get full control over the URIs used. Publishing the records as LOD offers the opportunity to use cool URIs to redirect the client (web crawlers, HTTP browsers, machine agents) to the appropriate representation. This way, clients that come across the HTTP URI of an aggregation can be redirected to the resource map, a representation they understand, preserving the typed links between the aggregated resources. Hence, storing the resource maps and publishing the resource maps as linked data makes the repository OAI-ORE compliant. This allows the BRICKS repository to manage, exchange, and share aggregates of resources, e.g. a video of a performance, accompanied by a program brochure and a transcription of the performance, conforming to the OAI-ORE standard. Because the records are published as LOD, the publishing of the records is not handled by the BRICKS platform anymore. It becomes solely an administration platform, regulating the imports into the triple store.

GETTING EVEN MORE THROUGH METADATA ENRICHMENT

Finally, the stored records, constructed via our metadata schema and published as LOD, are extended with links to information from datasets like GeoNames and DBpedia. This way, the records are enriched with information from external datasets, weaving that extra information into the Web of Data.

To enrich the data automatically, the choice was made to provide extra information on the title of the resource, the people, organisations, events, and the places involved. In practice, this means iterating all DC descriptions of the records and seeing if there are people, organisations or events in its DC descriptions. When such concepts exist in the description, the DBpedia dataset is queried, asking for information about that concept. The same is done for places, but for these concepts the GeoNames dataset is queried. The results, returned from these queries, are HTTP URIs

with extra information on the requested topic. This HTTP URI is added to the DC description via the object property: rdfs:seeAlso.

The descriptions of the resource (values from the dc:description datatype property from the DC description) are also examined. These strings, describing the resource, are investigated for people, organisations, companies, brands, locations, and events. For this, we rely on the OpenCalais web service, which is able to investigate strings and return certain concepts mentioned in the description. The results for the people, organisations, or events concept are forwarded to query the DBpedia dataset. The results for the places concepts are forwarded to query the GeoNames dataset.

By applying our metadata enrichment algorithms, the records are enriched with links to information from an external dataset. This not only puts the records on the Web of Data, but also enriches these records with extra information.

BEST PRACTICE SUMMARY

The solution proposed in this chapter elaborates on the distributed semantic open-source BRICKS archiving and distribution architecture, since ease of use, robustness, independence of central authorities, low cost, and flexibility in offered services are crucial within the cultural community. This platform allows the institutions to configure, extend and manage their own digital repository according to their needs. In order to store and exchange all the information on their productions, a new layered metadata schema is developed on top of the BRICKS framework. This is an OWL DL schema consisting of two layers: Dublin Core and Provenance. The Dublin Core layer describes the digital objects in a general way as a greatest common divisor. All the fields of Dublin Core are optional and repeatable. These characteristics allow for easy mapping to and the adoption of the proposed metadata schema. It forms a common interoperability and discovery layer on top of the descriptions that are already distributed by the institutions. The second layer indicates the provenance of the Dublin Core descriptions. In most cases, the institutions have their own metadata schema which is mapped to Dublin Core. The provenance layer indicates the identifier of the original metadata description and the namespace of the original metadata schema. This information allows linking to the original descriptions, which are in most cases richer in information. To aggregate the digital objects in bundles (for educational purposes among other things) the BRICKS framework is extended with an OAI-ORE web service. It describes aggregations of Web resources in a semantic way via dereferencable URI's. Furthermore, we enrich the metadata semantically following the Linked Open Data principle. In our case, we apply linguistic processing on the plain text contained to various elements of the metadata such as title, contributor, subject, and description. The linguistic processing consists in extracting named entities such as people, organisations, companies, brands, locations, and events using the OpenCalais infrastructure. Once the named entities have been extracted, we map them to formalised knowledge on the web available in GeoNames, for the locations, or in DBpedia, for the people, organisations, and events, and feed this new knowledge back into the system. This way, BRICKS is semantically adapted and extended to offer an end-to-end solution to the institutions and third parties (schools, broadcasters, etc.) that can search, harvest, and publish all data via web services.

CONCLUSION

This chapter showed how performing arts institutions can disseminate their content using semantic web technologies, like RDF, OWL, and Linked Open Data. The Semantic Web is an evolving extension of the World Wide Web in which the semantics of information and services on the web is defined, making it possible for the web to understand and satisfy both the requests of people and machines to use the web content. To benefit the search and discovery of the records, these records have to be described by a *uniform metadata model*. This model has to be applicable for a variety of data: text, audio, video, and aggregations of them. For this purpose, three semantic models were designed and implemented: a Dublin Core description, describing the resource in a very generic way, a provenance description, referencing the original record, which can give a more detailed description of the resource than the Dublin Core description, and an OAI-ORE model to describe aggregations. This way, the performing arts institutions can share and exchange their (aggregations of) information, avoiding many interoperability issues. By publishing the records in a Linked Open Data way, the server can redirect clients (people or machines) to the appropriate representation, XHTML for people and RDF for machines, which is compliant to the way OAI-ORE publishes aggregations. By further enriching the data with links to information coming from DBpedia and GeoNames for instance, the more expressive records are weaved into the Web of Data, making the Web of Data one huge database.

As such, we showed how all performing arts productions media can be archived, bundled and disseminated using distributed Semantic Web technologies. In the end, everything is demonstrated within an end-to-end Proof-Of-Concept showing the feasibility of the approach in Flanders' cultural institutions, establishing a durable cooperation between all actors involved where a) the institutions have an easy-to-use, robust, decentralized archive; b) the institutions can bundle and exchange their assets; c) the institutions can use a common metadata schema combined with their own schemas; and d) the institutions have their (meta) data enriched and interlinked.

This is a new approach for disseminating records from the performing arts sector. Mobilising the sector to adapt this approach is not a trivial task, although the awareness comes from the sector itself. This is why VTi, the Flemish Theatre Institute, as a coordinating body for the performing arts in Flanders, chose to implement this approach first of all and to offer this approach as a service to the other institutions in the performing arts. This way, the institutions are more easily mobilised and encouraged to adopt this way of disseminating archived multimedia of the performing arts produced in Flanders.

About IBBT
Stimulating ICT innovation

IBBT (Interdisciplinary Institute for Broadband Technology) is an **independent research institute** founded by the Flemish government to stimulate ICT innovation. The IBBT team offers companies and organizations active support in research and development. It brings together companies, authorities, and non-profit organizations to join forces on research projects. Both technical and non-technical issues are addressed within each of these projects.

MISSION

Through **multi-disciplinary** demand-driven **research** carried out for the Flemish business community and the Flemish government, IBBT creates highly competent human capital. This research includes technological as well as legal and social dimensions.

The Flemish government invests in multi-disciplinary broadband research. The objective: To make Flanders a leading and internationally recognized player in the information society of the future.

THE IBBT ORGANIZATION

- The **central staff** of IBBT consists of 30 fulltime employees. They are responsible for operational support and external communication..
- IBBT has an extended network of **partners**, including over 300 companies, non-profit organizations, government representatives and knowledge centers.
- IBBT unites more than 700 **researchers** from numerous Flemish universities and knowledge centers. Each research group is specialized in one or more of the basic competencies of IBBT. The composition of the research groups is flexible and aligned to the evolving needs of companies and organizations.

IBBT'S RESEARCH DOMAINS

IBBT stimulates research that addresses current social and economic issues.

- **eHealth**: ICT applications for the healthcare sector
- **New Media**: exploring the possibilities of new communication media
- **Mobility & Logistics**: research into ICT applications that enhance the mobility of people and goods
- **Enabling technologies**: basic research into ICT support for a wide range of applications
- **eGovernment**: ICT applications for public authorities

THE ENVIRONMENTAL IMPACT OF ICT

Lots of products and processes tend to leave an 'ecological footprint'. Information and Communication Technology (ICT) is a key enabler in lowering these effects. But as ICT uses up 4% of the total energy production (taking into account the complete ICT life cycle, from production to disposal) green ICT 'on its own' should also receive our specific attention. To lower energy consumption, optimize the usage of materials and enhance the quality of life is therefore one of the major challenges at hand.
IBBT wants to help to create a sustainable society by working on these social, environmental and economic aspects of ICT services. Thanks to our user-centric approach, we aim to offer new experiences while ensuring sustainable development.

CONTACT

IBBT
Gaston Crommenlaan 8, b102
9050 Gent
Belgium
Tel: + 32 331 48 00 | Fax: + 32 331 48 05
info@ibbt.be
www.ibbt.be

About VTi
Centre for the Performing Arts

Since it was founded in 1987, **VTi (Vlaams Theater Instituut)** has developed into an open organization with strong links to both the sector itself and the policy-makers. The reason for its existence is the need for sound information among the public, theatre professionals, politicians, students, press and academics. On performing artists and their work. On cultural policy and stage matters. On international work. On developments and trends. On infrastructure, distribution and art education.

VTi wants to provide all this information in a broad range of easy-to-use resources. To this end it currently fulfils three main functions: documentation, research and information/awareness. Its intention is in this way to contribute to the ongoing growth of the sector and help build a social environment for artistic creation.

DOCUMENTATION CENTRE FOR THEATRE, DANCE AND MUSIC-THEATRE

VTi assumes responsibility for the intensive documentation of performing arts practices. The sector and its context are observed, artistic and policy-making developments are recorded, sorted and made accessible by means of the extensive database, library and website.

SECTORIAL THINK-TANK IN A DIVERSE AND INTERNATIONAL FLANDERS

Applied research is a major component of VTi's work because it converts the information in the database and collections into a useful form. The research is applied to actual practices by means of descriptive and analytical fieldwork. In this regard, the performing arts are not simply the object of research, but also play an active part in shaping opinion.

CRITICAL INTERFACE BETWEEN THEATRE-MAKERS, THE PUBLIC AND THE POLICY-MAKERS

VTi is a place for knowledge, study and also vision. It is for this reason that it sets debates going, and wants to actively inform people and increase their awareness. Research and new insights are presented as feedback to the sector on the website, in publications and the periodical *Courant*, through the library and at study sessions. The chief concerns here are reflexive dialogue, practical usefulness and an overview of the broader picture.

In all these activities VTi links current events in the performing arts to long-term projects. At the moment, for example, special attention is being focused on a thorough analysis of artistic practices and oeuvres, on public participation (concentrating on art education, distribution and criticism) and on the challenge of international and intercultural cooperation.

DAY-TO-DAY BUSINESS

VTi's three core tasks are organically combined in its day-to-day business.

In the **VTi library** visitors can consult books, periodicals, cuttings and documentation free of charge and without enrolment. It includes:
- documentation on organizations in Flanders
- books on the performing arts, cultural management, policy, art education, etc.
- at least 10,000 plays, in both published and manuscript form
- current subscriptions to over 120 professional journals
- cuttings archives of relevant information from newspapers and periodicals
- a video library with over 5,000 hours of tapes

The **www.vti.be website** is intended to be flexible and keep pace with current news. It enables you to keep track of VTi's work, with a survey of all its activities and policy documents. In addition, the site contains a mass of useful information on the performing arts sector: the ins and outs of subsidies, a list of premieres, the latest job vacancies, etc. An ingenious search engine also provides you with a huge amount of online information from the database.

The quarterly information booklet ***Courant*** keeps performing arts professionals up to date with special topics, in-depth articles and brief news items.

VTi staff also answers **specific questions** from Belgium or abroad by phone, e-mail, fax or post.

CONTACT

VTi (Vlaams Theater Instituut)
Sainctelettesquare 19
B-1000 Brussels
Tel: + 32 2 201 09 06 | Fax: + 32 2 203 02 05
info@vti.be
www.vti.be

VTI STAFF

Ann Olaerts (director)
Annick Lesage (documentation)
Christel De Brandt (library)
Diane Bal (reception)
Dries Moreels (documentation coordinator)
Joris Janssens (research)
Maarten Soete (documentation)
Marijke De Moor (communication)
Martine De Jonge (library)
Nikol Wellens (business manager)
Stefan Maenen (administration)
Wessel Carlier (IT)

You can contact us by e-mail. All our personal e-mail addresses have the same format: firstname @ vti . be

Photographs used by courtesy of the producers

The moment we knew nothing about each other (1992) by Peter Handke in a production of Ruud Gielens & Kaaitheater, with music by Jan Goovaerts

Play: Simon Allemeersch, Nico Boon, Zouhaïr Ben Chikha, Katleen Geens, Chun Hee Lommelen, Iris Van Cauwenbergh, Geert Vandyck, a.o.
Orchestra: Jan Goovaerts, Rob Goovaerts, Jean-Pierre Hallet, Jan Van den Bosch, Nele Van den Broeck
Chorus: Tien Callaerts, Filip Coltura, Edouard De Boey, Veerle Krokaert, Anne Nys, Joke Smedts, Ria Turcksin, Ties Van Hooff, Jef Van Laeken
Dramaturgy: Marianne Van Kerkhoven
Assistance to dramaturgy & direction: Bart Capelle
Movement advice: Haider Al Timimi
Scenography: Ruud Gielens
Costumes: Ann Weckx

Production: Kaaitheater
Premiere: 18/01/2006 (Brussel)

Photograph:
Kurt Van der Elst (www.kvde.be)

www.kaaitheater.be

The Deer House (2008)
by Jan Lauwers & Needcompany

The Deer House is made in collaboration with Grace Ellen Barkey, Anneke Bonnema, Hans Petter Dahl, Viviane De Muynck, Misha Downey, Julien Faure, Yumiko Funaya, Benoît Gob, Tijen Lawton, Maarten Seghers, Inge Van Bruystegem

A Production by Needcompany and Salzburger Festspiele
Coproduction: Schauspielhaus Zurich, PACT Zollverein (Essen)
Premiere: 28/07/2008 (Salzburg)

Photograph: Maarten Vanden Abeele

www.needcompany.org

table of contents

COLOPHON

ISBN 9789074351386
D/2009/4610/3

www.vti.be
www.ibbt.be

Editors: Tom Evens, Dries Moreels
Copy editing: Dice
Layout: Gunther Fobe (www.tiktaalik.be)
Printer: Ypsilon Digital Printing Engineers
Photo credits: consult page 151

Vlaams Theater Instituut vzw | IBBT vzw
Brussels, August 2009

With the support of the Flemish authorities