The Information Society, 27: 281–294, 2011

ISSN: 0197-2243 print / 1087-6537 online
DOI: 10.1080/01972243.2011.607025

Routledge
Taylor & Francis Group

Video as Digital Object: Production and Distribution of Video Content in the Internet Media Ecosystem

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The media industry is undergoing comprehensive change due to the shifting audience and consumption patterns fostered by the diffusion of the Internet. This article describes how these changes shape established practices of video production and redefine the cultural categories of video and broadcasting. Drawing on an empirical case study of the practices within the British Broadcasting Corporation (BBC), the we show the production of video content to be increasingly unbundled and broken down into several smaller processes, which make it possible to manage and recompose in a variety of ways that transcend established institutional divisions and cultural perceptions. At the same time and as a means of accommodating multiplatform content delivery, video distribution is acquiring flexible and mutating formats that further destabilize the perception of video as a self-sufficient cultural form. In this context, video metadata rises to be an important coordinative medium that provides the cognitive resources for identifying and managing video content within and across particular settings and the link through which the operations of media organizations become entangled with the technical landscape of the Internet.

Keywords convergence, digital objects, metadata, new media objects, practices, video content

Received 29 December 2009; accepted 6 May 2011.

We are grateful to Ashley Highfield, former Director of New Media & Technology at the BBC. We are also thankful to Keith Little, Paul Dale, Spencer Piggott, and Mervyn Middleby for their support in granting us access to information and people at the BBC's DMI and DNI projects. Our findings are of course ours, and none of these or any other person we interviewed in the course of our investigation is responsible for the way we construct and interpret the relevant processes at BBC.

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Two important developments epitomize the rapid and comprehensive change in the media industry over the last decade. One, media consumption and audience composition have substantially changed over the last decade as the various software-based artifacts and technologies (e.g., the computer, the game console, the VCR [videocassette recorder], and other electronic devices) have increasingly converged to construct a comprehensive daily media ecology (Greenberg 2008). Two, there has been the gradual transformation of the Internet from a communication tool to a complex media ecosystem (Jenkins 2006) in which the creation and delivery of digital content increasingly challenge the formal and compartmentalized processes of media production and distribution that characterized the media industry for several decades. On a fundamental level, they redefine the meaning of media production versus media consumption (Levy 1997; Manovich 2001, 2008) through the increasing involvement of users in generating content and the dispersion of consumption habits away from fixed broadcasting schedules (e.g., YouTube, Facebook, MySpace, among others).

With these changes, the industry gets increasingly entangled with new forms of content creation (as opposed to sheer distribution) and delivery that considerably redefine its scope and restructure the professional and organizational practices with which the industry has traditionally been associated. Content creation becomes contingent on new sources of content (e.g., YouTube, Flickr) that are being integrated to generate a variety of forms of media consumption. These new forms are no longer based on just one linear source, such as TV. They are the outcome of several interactive digital sources operating upon a complex and constantly changing technical landscape. As a result of these developments, the media industry has been forced to deal with two cardinal technical issues. The first one is interoperability among the different formats to allow their manipulation and to expand their accessibility over devices and platforms. The

second relates to the management of information and the metadata that describes digital content and thereby enables its identification and accessibility in the ever-expanding information universe. Findability and accessibility are key prerequisites for operating and competing in the digital marketplace. As digital moving images become part of this new media habitat, their identification, ordering, and distribution are increasingly tied to the smooth recognition of their content that metadata is able to mediate.

The significance of these trends is not limited to the distribution of video assets. Producing video content is time-consuming and often expensive. The proper tagging of video makes possible the exploration of available video content and thereby facilitates reuse and mixing of video content in the modular, transmedia, and collaborative world of modern technology in which the boundaries of discrete video objects are blurred (Jenkins 2006; Manovich 2001). Accordingly, although it may seem in the first place a single technical issue, the generation of metadata impinges upon the entire gamut of activities through which video content is produced and delivered.

In the rest of this article, we seek to analyze some of these developments. We are primarily interested in dissecting the processes by means of which video production and distribution are currently carried out, and drawing the implications of these developments for the media industry and its practices. After this short introduction, we give a concise account of the Internet media ecosystem and how its development impinges upon the established practices of video production and distribution. In so doing, we develop a few theoretical ideas that allow us to connect the developments in the media industry with digitization and the computational rendition of video content. Drawing on Manovich (2001) and Kallinikos et al. (2010) we introduce the construct of *new media object* or *digital object* and describe the ways by which these objects are inherently distributed, editable, expandable, and reusable. In the section that follows we provide a detailed, empirically grounded description of current trends in the media industry. For this we have studied the Digital Media Initiative (DMI) at the British Broadcasting Corporation (BBC) and have interviewed a range of key industry actors and analysts. Next to it, we present our interpretation of the empirical study and depict the nature of the merging practices of the media industry that seem to be the outcome of the profound digitization of the processes of creating, producing and, distributing video. We subsequently associate these findings with the theory of digital objects and provide an interpretation of the developments on which we have focused from the broader horizon of the theory. Finally, in a postscript we briefly reflect on the wider issues that are associated with the recent developments that we claim coincide with the increasing understanding of cultural artifacts as information.

THE INTERNET MEDIA ECOSYSTEM: PROCESSES AND OBJECTS

We understand the term *Internet media ecosystem* as the ensemble of the processes, systems, operations, and devices that make possible the production, mixing, and dissemination of digital content that spans over the semiotic traditions of text, image, sound, and the institutional compartmentalization of culture to a variety of genres such as films, photographs, comics and games, news, and music, among others (Jenkins 2006; Kittler 1999).

In the information affluence underlying this ecosystem, the requirements of findability and interconnectivity of content make necessary the technical compatibility of the varieties of systems and information and also the presentation of content in cultural and cognitive forms that appeal to the users. It is important in this respect to point out that the growth and social involvement of the Internet have not only made possible new ways of communicating and exchanging information and culture but have, in addition, shaped consumer expectations and user behavior (Shapiro 1999; Silverstone 2007; Shirky 2010). The digital consumer is accustomed today to the fact that information and information-based cultural artifacts are readily accessible and interoperable (Deuze 2007). It comes therefore as no surprise that the packaging of content in ways that allow it to be readily viewed, accessed, consumed, or acted upon by the users has acquired vital importance in media organizations. The new generation of media producers is accordingly creating and enriching experiences through aggregating and mixing, as well as categorizing and finding content.

The prospect of not catching up with these developments propelled by information aggregators is threatening not just to traditional media (i.e., TV, radio, newspaper), but also to the entire media industry. The last decade bears witness to the consolidation of few players in the media industry and the inclusion of Internet companies inside their portfolio (e.g., MySpace, Bebo, Last.fm, Hulu), as well as the *de novo* emergence and rapid diffusion of information aggregators (e.g., Google, Yahoo!, YouTube, Amazon, eBay, Facebook, Twitter). Seen from this lens, several traditional media (such as the TV) are understandably trying to embrace the new media. The common and assertive response to the problem is associated with multi-platform delivery of content. As economic consolidation has taken place over the last decade, many media organizations have sought to digitize and merge their different operations to respond to the challenge of media convergence (Dupagne and Garrison 2006; Jenkins 2006; Lawson-Borders 2006).

Routines that for most of the media industry history have been accomplished through manual processes are becoming automated into an encoded and structured data discourse (Liu 2004, 2008). The intention to automate

as much as possible the "noncreative" practices of media management is perceived as a way of liberating and redirecting human creativity to the most important and innovative areas and to ease the learning of new competencies and skills (Deuze 2007). However, as much as it liberates, the automation of these manual processes reinserts human effort into new and often complicated arrays of procedures and tasks that reconfigure the creation and production of video in its entirety. Digital media information requires the production of tags (metadata) that describe the characteristics of a resource; it shares many similarities to the cataloguing that takes place in libraries. Simple as the production of metadata may seem, it is nonetheless a non-ending process. As Internet protocols and technologies are permanently changing, digital media has to be steadily updated to these new formats in order to be readily accessed and findable. As video becomes an integral part of this new media habitat, it also requires the creation of its metadata. These trends constitute a challenge for the media industry that has been a relatively secluded organizational environment in which the focus has been for decades the production of content, rather than its findability and accessibility.

To a certain degree, the phenomena we investigate can be associated with the institutional and economic conditions (markets, organizations) under which video content and services are produced and made available. After all, the recent developments in the media industry could be seen as the outcome of strategic deliberation (certainly under a number of constraints) by means of which various actors in the industry seek to accommodate their interests (Küng 2008). However, as suggested earlier, the state of affairs we describe is significantly reinforced by the shifting technological landscape within which the production of media content currently takes place. Digitization and the growth of the Internet ecosystem redefine media content and in this process alter the conditions under which it is produced and distributed.

These changes could perhaps be better understood through their association with the changing texture or composition of video content that results from the comprehensive digitization of the processes of video production and distribution. Digitization loosens up the bundled nature of the operations by which video content has traditionally been generated and the final product fixed to the material form of the tape (Flachbart and Weibel 2005). Born digital, video content can be shot *de novo* in the field or the studio and ingested in the system, but it can also be assembled partly or even entirely from available video bits and pieces. Studio productions have always entailed the reuse of available components. After all, the studio is an artificial setting for producing effects of particular kind under conditions that would have otherwise been impossible or too costly. However, digitization vastly amplifies these conditions (Manovich 2001; Marchessault and Lord 2008). Cast in digital form, video content can be reviewed, reread, cut, and edited in various ways that have not the irrevocable nature of video assets crystallized in videotapes.

These qualities converge toward establishing what Manovich (2001) construes as *new media objects* and Kallinikos et al. (2010) as *digital objects*, that is, a substantially new breed of editable artifacts amenable to wide manipulation and revision. New media objects or digital objects in general differ from conventional objects, in the sense of being open, editable, and expandable. They can be accessed by other software-based artifacts and modified or changed in a variety of ways. No matter how similar new and old media objects may seem in appearance, they differ substantially. A printed photo, for instance, is a substantially different artifact from a digital one, which it is possible to act upon and modify by means of photo-editing software. Digital objects, of which new media objects represent an instance, could perhaps better be seen as ensembles of operations temporarily stabilized than as objects in the traditional sense of a closed and fixed set of materialized attributes (Ekbia 2009). Against this backdrop, it becomes clear that a digital object never achieves the definite closure of traditional objects, while the ways it has been stabilized remain steadily amenable to decomposition and recomposition (Kallinikos 2006, 2009).

New media or digital objects are, in addition, distributed across locales, technological platforms, and institutional settings. In this respect, digital objects are evasive artifacts that lack the self-sufficiency and plenitude of traditional objects. A digital book, for instance, is rendered the cultural object we recognize as a book at the very moment it is accessed by the user. However, this is an instantaneous accomplishment brought into being by the impressive interaction of a large array of software applications that are mobilized at the moment the user requests that cultural artifact. Prior to this, the digital book exists simply as a heap of data and as a set of instructions on the basis of which the heap of data is assembled onto the object (pages, sections, chapters) we recognize as the digital version of a book (Kallinikos et al. 2010). These technological operations are of course grafted onto institutional scaffolds. Users (readers), media organizations (libraries), books, prices, and so forth are all institutional categories. Yet, as shown in the preceding section, the distributed character of digital objects reframes human interactions and impinges upon the social practices by which digital objects are produced, shared, and consumed. The significance metadata acquires in the current context of media industry is closely associated with the distributed character of new media objects and the aforementioned requirements of findability and accessibility.

While it is the outcome of several factors, the open and editable quality of new media objects is closely

tied to the architectural principles of granularity and modularity (Benkler 2006; Kallinikos et al. 2010; Manovich 2001). Digital objects are made of fine-grained operations organized in modules that are premised on functional adequacy within a greater framework of functional interdependencies. The ability to loosen up the interdependent functional and spaciotemporal nature of the production process and reassemble video products from bits and pieces distributed across systems and contexts is intimately related to the modular and granular constitution of new media objects. In this regard, digital objects are inherently networked objects sustained by a range of software-based systems and artifacts often distributed across platforms, information infrastructures, and institutional boundaries. The open and expandable character of digital objects in general and of new media objects in particular is thus closely tied to the interoperable landscape of systems and artifacts and the ability to act upon one system or artifact by means of another. While socially constructed through the invention and negotiation of standards (Bowker 2005; Hanseth 2004), these qualities are ultimately connected to the computational nature of software-based technology and the pliability it affords (Borgmann 1999). At the very bottom, digital video content is no more than an ensemble of numerically controlled operations (Kallinikos 2009; Manovich 2001). In this regard, computation provides the technical space upon which standards and interfaces as interconnecting modalities become possible in the first place.

The implications therefore of digitization and the diffusion of new media objects are crucial to the creation, production, and delivery of digital video content. In technical terms, digital video assets have been oriented toward having more data modularity, as a means of increasing their manipulability. Digital formats such as Quicktime, MPEG-7, or MPEG-21 are good examples of how video content and metadata are embedded on final video objects that are at the same time readily available to be reused due to their metadata layer based on XML.[1] Therefore, digital video is designed to communicate across platforms by means of the metadata embedded on it. As information becomes increasingly recomposable, its functionality grows even more. However, managing digital media assets in the long term is not an easy task. Nothing is gained for free. For example, archiving and preservation of digital assets require constant updating to new formats, and their management, to the degree that they embed more diverse types of metadata, will require more technical abilities. These issues increase the complexity of the management and technical skills required to create and maintain media assets. On the other hand, using content that is not digital inevitably restricts the operations of acting upon that content to the ones pertaining to the specific medium in which this content is cast. The media objects are today available in a unified platform that enables their use by different members of the organization at the same time. However, as digital objects are available through a database, the main requirement for their retrieval is their findability. Therefore, analyzing the practices and operations that the Internet is bringing to the media ecosystem offers an understanding of some fundamental changes and developments that the media industry is undergoing.

VIDEO IN THE MEDIA ECOSYSTEM: PRACTICES AND OPERATIONS

Methodological Remarks

In this section we report the empirical investigation at the British Broadcasting Corporation (BBC) and the media environment within which the organization is increasingly embedded. The empirical investigation has been prompted by the overall research concerns stated in the introduction of this article. We have sought to elicit data and information with respect to how the production and distribution of digital video are related with Web technologies, and how digitization enables the BBC to respond to the demands of the Internet media ecosystem. Our objective has been to use the empirical study of BBC and its media environment as a means of capturing the operations associated with the creation, production, and delivery of video content in the present conditions and assessing the impact of the shifting nature of these operations for the organization and the media industry. The BBC is obviously just a case. However, the significance and scope of the organization make it a promising setting in which to explore both the developments taking place in the media industry as a whole and the evolution of digital video.

The empirical data has been collected through semistructured interviews with 20 BBC executives and also half a dozen of industry analysts. Data collection has also entailed the study of company documents, industry journals, and periodicals. The pre-understanding of the technological processes described in the preceding sections provided our orientation to the field. Data collection took place between January 2008 and September 2009. Interviews were done at the BBC headquarters in London (mostly with executive and managers) and at the BBC Northern Ireland in Belfast (specific interviews on the local deployment of Digital Media Initiative, DMI, which we describe later). BBC employees interviewed included executives, managers, and senior-level engineers; most of the interviewee's work had job positions directly related to the management, acquisition, engineering, project management, media management, and support of the technologies deployed by the DMI. Some of the interviewees had an extensive knowledge of the organization as they had been working at the BBC for more than two decades; therefore,

they had experienced several technological implementations during their career. The interviews tried to elicit information with respect to how people in the organization understood the changes associated with DMI, at both the technical and organizational level. By asking how people did a specific job before and after the implementation of the DMI, we were able to get an understanding of the way in which certain changes took place. The main topics discussed in the interviews were related to the working practices in long-form productions and their key technologies (metadata, digital archives, legacy systems, deployment of DMI). Long-form productions are defined as video products of long running times (usually no less than 30 minutes) that take the form of a drama, series, TV shows, documentaries, or film. Long-form productions take several months to produce and require long hours of shooting, editing, and post-production. These attributes and conditions distinguish long-form productions from other types of media products such as news or TV commercials.

Both the interviews and our observations have been directed toward collecting data associated with an overall understanding of new media objects as malleable and mobile and the significance these conditions might have had for the production and distribution of media content. However, theoretical concerns provided no more than an initial focus that had to be sustained and occasionally redirected as the outcome of our growing involvement in the industry and the organization. Data has been analyzed qualitatively by extracting a narrative out of the data corpus based on the recurrence of topics and the identification of key motifs and themes. Each interview has been transcribed, and the transcribed material has been repeatedly checked with the view of discovering common items, categories, and recurrent topics. These were subsequently aggregated to more encompassing motifs and themes and then assembled into the final narrative. While compiling the narrative we sought to remain as close as possible to the transcribed interviews.

BBC and the Digital Media Initiative

The BBC, with more than 27,000 full time staff, is one of the biggest broadcasting companies in the world, reaching millions of people each day through its 30 TV channels, 54 radio stations, 43 radio language world services, 48 magazines, and several online initiatives. Roughly three-quarters of its budget is paid by the citizens of the United Kingdom through the TV licensing fee.[2] Therefore, the main purpose of the BBC is to act as a public service broadcaster.

Around mid 2006 the BBC started to pursue a major reorganization with the view of making it easier for audiences to access its programs through multiple delivery platforms. Key to this initiative has been the aim of granting consumers of media the choice of deciding when, what, and on which platform they want to view content. As part of this new emphasis the BBC programs were streamlined, with a show's output across TV, radio, Internet, and mobile handsets considered equally important. These concerns were given further momentum by the establishment of the New Media division, renamed BBC Future Media and Technology (FM&T). The division assumed responsibility for the BBC's digital initiatives focusing on technology management and services on findability, navigation, metadata, video-on-demand, mobile, and the Web, including the BBC integrated media player[3] (known as "iplayer") and emerging Web 2.0 initiatives, as well as the digital archive. Within this context, technology strategy became more centralized, with a single team of technologists and a separate technology budget. The reorganization has affected other departments, which are now subsumed under *core media areas* rather than specific *traditional practices*. The Sport and News have been brought together in a new division called Journalism; an Audio & Music division has taken charge of the BBC's audio content for all platforms, from radio and television to podcasts; finally, BBC Vision group encompassed the former BBC Television, Factual and Learning, Drama, Entertainment, and Children's divisions (see Appendix 1).

Our object of study is the BBC Vision division, the new integrated broadcast and production group that emerged out of the reorganization of the old organizational structure. BBC Vision brought together the former production divisions of series, dramas, documentaries, and other long-form productions to become the center stage and the vehicle for multiple-platform commissioning for TV, the Web, mobile handsets, and emerging interactive technologies. BBC vision retained its responsibility for standard television and radio broadcasting.

The BBC reorganization and its attempt to deal with the comprehensive developments in the industry have been guided by the strategic vision summarized in a major company document, the *Digital Media Initiative* (DMI). The DMI aspires to have BBC's core operations relying entirely on information available on digital format. DMI is looking toward an asset management culture in which information about the content is as valuable as content itself and is captured in the context in which the media is produced. In doing so, it facilitates the exploitation of content from a media convergence perspective. DMI is driven, as we show next, by a series of technologies and services, concentrating on the management of media assets (search, navigation, metadata). This means that upon the completion of DMI, BBC's core operations will rely entirely on information available on digital format, mostly video and its metadata. Particularly important here is the use of Web technologies to enable the BBC to compete with search engines and other information aggregators,

while maintaining the company's high-quality production values.

The DMI Operations

The DMI operations through which video products are assembled and distributed are subsumed under six high-level functionality enablers (Appendix 2) grouped into three major categories: (1) Content Creation and Crafting, (2) Content Management, and (3) Content Delivery and Distribution. The three groups of operations are descriptive of the processes that are involved in long-form production of video content such as series and drama. It is worth pointing out here that the operations underlying the production and distribution of news in the media industry differ from the operations by means of which long-form production video content is assembled and delivered. Newsrooms and media convergence have already been the subject of a different breed of research (Zoch and Collings 2003; Boczkowski 2004; Dupagne and Garrison 2006). Our own investigation focuses on the management of long-form productions that have until recently been accomplished by traditional ways established over several decades and persisting without radical changes. The transformation of video content to digital (by shooting or ingesting the content digitally into the system) has changed the operations of video creation, management, and delivery rather dramatically and introduced significant shifts in skills and practices. We next describe the three major groups of operations and the technological developments in the Internet media ecosystem by which they are driven.

Content Creation and Crafting

Video content creation typically starts with the commissioning of an idea that gives birth to a new chapter of a series, a drama, or any type of long-form production. After the idea is defined, it is followed by the elaboration of the script and a shooting plan. Digital production breaks with this linearity. It makes possible archive search for finding previous shots that may be useful either as a reference or as potential material to be reused in the new production. The ability to search a digital archive depends upon the good quality of metadata describing the archived assets. Selecting moving images for reuse is a relatively new idea in long-form productions. Though the practice has been common for nearly two decades in newsrooms, it is relatively new in the creation of video content and departs from the ways by which producers of long-form productions have traditionally created their own video content.[4] In the news world, the short delivery time span requires a very fast reaction to tie the news with images that are or can be connected to it. Current news providers work at a much faster pace and use increasingly a range of reusable visual elements such as photographs, infographics, and video. The success of news-oriented broadcasters such as CNN, for example, is contingent upon abundant reutilization of these elements. Such practice is associated with the more "dynamic" culture of journalism but also with consistent strategic investments in developing news-gathering infrastructure both at an organizational and a technological level (Küng-Shankleman 2000; McCargar 2004).

Something quite different happens to long-form productions where commissions are planned with several months or even years in advance. Video content work practices do not have a culture for searching in archives for previous material. Traditional archives are not as pliable as digital archives, while the material that can be identified as relevant may be hard to reuse due to technological discontinuities. A key component of the long-form productions is the vast amount of data, which translates into hours and hours of media that has to be logged and indexed with the appropriate metadata. In the traditional regime, searching for relevant material had been done mostly by word-of-mouth and face-to-face communication among people, rather than by the use of technology. It is therefore quite frequent that similar content is shot more than once, which in economic terms represents an unnecessary cost. There are, of course, important aesthetic qualities underlying content creation that are associated with the way the content was shot or the type of camera that was used and other specific circumstances. The infiltration of aesthetics by economics has always been present in video production, entertainment, and other arts, but the current conditions mark a distinctive stage in which the recycling of existing material becomes widely feasible and crucially editable. The selection of archived assets to be reused requires new skills, starting from the selection of the shots that will be stored onto the digital archive, the disposability of the ones that are not selected, and the ways of retrieval of archival material through the use of keywords and other metadata that categorize, relate, and link digital material to specific topics and descriptions.

In an ideal all-digital archive world, commissioning will turn exclusively to the creation of new assets only if this yields a substantial difference from the ones that currently exist as archived assets. In the case when new shots are created, these would be done through tapeless devices conforming to the ideal of a completely digital video management process. Digital shooting is also the point of departure for the development of key metadata that will make the video content easily identifiable and accessible. The new process of digital shooting is also defined as "point of capture metadata entry," which makes necessary an extremely detailed set of information fields about the digital footage. Some of this information is simple, such as shooting date, title, feature, camera-operator name, and shooting director, but some is more complex and of an entirely different nature, such as geolocation

data (geographic positioning system [GPS]), and could be done automatically. In an Internet-driven environment, the more metadata included about the new media object, the better. As one of our respondents mentioned:

> The key to good metadata is to input it at source. One of the tasks for the digital media operation team is to do the ingestion and to ensure the quality of the metadata. . . . Involving the media managers with the production people helps them with the metadata creation.

Once digital shooting is done, the content is ingested into a digital system. The ingestion entails copying an asset and its metadata from an external device into an area of the DMI defined as the "Work in Progress" library. In this area the asset will start its transformation to its desired form. The library makes available the asset and renders it searchable within the system, enabling the browsing of both the asset and of its metadata. The process may also include the reviewing of an asset for editorial approval and the creation of rough-cut edits up to the point of submission to a craft editor. The crafting of a project is a very delicate task that involves the postproduction of the material shot in several stages until the director of the production and the other people involved in approving it are satisfied or are forced to be so by an imminent deadline. Crafting includes fine video editing, transitions, and special effects (animations, titles, or compositions), usually done in digital editing programs and specialized postproduction workstations. When the content is approved, other phases of this crafting processes will include final edits for titles, sound production, adjustments to audio and video levels, and the addition of subtitling and extra recordings (if the content will be delivered in more than one language).

Content Management

Once the digital asset is created and ingested into the system, it follows a trajectory marked by a clear set of rules and procedures. These include organizing the physical assets (if they exist); storing the assets digitally in an appropriate repository structure; moving the assets within and between repositories; and managing the asset life cycle from ingestion to deletion. The Content Management operation comprises a series of steps that requires specific and automated types of routines by means of which each media asset is assigned to a correct file structure and tagged with the appropriate metadata. The Content Management operation also has well-defined functionalities for its users, such as searching and viewing the asset and collaborating with the members of the production crew. Searching through metadata using a software platform as a way of retrieving audiovisual content is a relatively new process in the media broadcasting cycle. Prior to this, searching for audiovisual content entailed asking people who participated in the shooting of relevant footage or watching several tapes until the right footage was found. Today footage is described through metadata fields, which also means that if the descriptions in these fields are not good or appropriate, the content may be lost in the digital database. A senior engineer relates:

> One of the things that has changed is the way people are searching for the content. They are searching for how the things are tagged. . . . As the amount of image-based content is exploding, the value of content rests on its findability.

For this reason, the software platform also has some reviewing approval funnels, a process in which the assets (particularly the ones that are already crafted) are awaiting editorial comments. The system should include also the different versions or stages that the asset has passed through in order to be checked, if needed, against the storyboards conceived and the initial rough-cut edits.

Another operation that is complementary to the Content Management system is the Archive. As in the case of libraries in the past (and still now), there were people that knew exactly where to find a specific material. Information explosion in digital form renders it very difficult, virtually impossible, to detect some special traces or characteristics within each content. The Archive mediates not only new digital assets but existing archived materials as well, from legacy formats (such as tape or film), that have to be transferred and accessed online. Digitizing media assets can be driven by editorial priorities (i.e., material that will need to be converted to digital format first due to commissioning) or by preservation priorities (i.e., old film and tapes in bad condition or VCR and film decks that are becoming discontinued or out-of-order). An important process carried out by the Archive, as in the case of libraries, is the cataloguing, which means the inclusion of metadata developed for retrieval, searching, and look-up purposes. Both the Archive and the Content Management operations collaborate in order to generate good metadata for search, view, and retrieval purposes. Rather than being simply the repository of legacy formats, the Archive becomes a strategic and collaborative resource of information. In the words of a media manager:

> It is wonderful to search, but usually people are reluctant to organize their material. So people are realizing that if they put the metadata they will have more . . . At the end of the day it means that by means of the Information Archive people define what they should save or not based on the information generated. . . . Like it or not, collaboration was a fundamental part of the system.

A third functional goal of Content Management concerns the sharing of media assets with external parties. As many commissions are being done not in-house but by

TABLE 1
The digital space of video content

Basic operations	Task sequence: the digital pipeline	Functional prerequisites	Metadata-related operations
Content Creation and Crafting	• Content inspection and reuse • New footage • Ingestion • Indexing • Editing	• Content search and retrieval • Compatibility • Interoperability	• Creation • Insertion (for internal use) • Search
Content Management	• Storing • Moving within and across repositories • Managing asset life cycle • Archiving • Sharing with externals	• Content search and retrieval • Compatibility • Interoperability	• Search • Updating
Content Delivery and Distribution	• Asset conversion • Scheduling and availability	• Interoperability • Asset identification	• Insertion (for consumer use) • Consumer search • Platform adequacy

third parties, it is crucial for a broadcasting company that the systems sustaining these operations include also some sharing functionalities available for independent producers. This enables the transfer of media assets and some limited content management functionalities for third parties and facilitates file-based transfer of assets and asset information between the media company and external repositories and organizations.

Content Delivery and Distribution

Once digitized, cleaned, organized, and indexed, the media assets are ready for delivery. The operation of content delivery and distribution enables the assets to become available for several types of devices of the Internet media ecosystem and provides the means of knowing how the content is finally being consumed. Peculiar as it may seem, the digital asset that has been seen during the stages of creation and management as flexible and interoperable within the bounds of the systems that made it possible, it must take on a specific format for a specific platform when broadcast (such as mobile phone or a Web player). Therefore, one of the most important tasks in this operation is the asset conversion, which transforms it into the appropriate delivery formats. The Internet does not have a specific format for video (it depends on the device it plays on as well as on certain data speed), which makes necessary the compression of the same media asset into several new versions to accommodate the different platforms and Internet bandwidths. Compressing video assets usually results in the reduction of the original quality of these assets (Cubitt 2008). For this reason, compressed video is useful only for broadcasting and delivery but not for archival. A high-quality version of the asset, usually with no compression, will be rendered back to the archive.

There are two additional operations that connect the formatted version of the media asset with the Internet media ecosystem. One relates to the schedule for delivery to a target system or users. Though the Internet is by and large an interactive medium in which the standard broadcasting scheduling is no longer relevant, the scheduling organizes and plans for how long the asset will be available and where and when to put it online. The second element is its scheduling metadata, which will enable the asset to be findable on the Internet.

DISCUSSION: MERGING PRACTICES IN THE MEDIA INDUSTRY

The account of the BBC and the media industry presented here suggests digitization to have a series of implications that cut across the basic operations of creation/crafting, management, and delivery of video content. Video digitization helps establish a unified (not necessarily smooth or seamless) technological platform along which the operations and tasks associated with the production and delivery, storage, sharing, or reuse of video content take place. The single and all-embracing nature of that digital space emerges most clearly when compared with the miscellaneous practices and the technological fragmentation that have over several decades underlain traditional forms of video production and broadcasting. The empirical data suggests that with the exception of new footage that is ingested into that platform from an external yet

compatible device, all other tasks and operations (including the considerable editing of new footage) basically occur within that digital space organized, to use a process-oriented metaphor, as a digital pipeline (see Table 1).

The manipulability of video content within the digital space certainly depends on a number of functional requirements, including the adequacy of the unified software platform on which the various operations rest, the diffusion of standards, and the interoperability of the applications within but also beyond that platform. But manipulability of whatever kind (i.e., reviewing, editing, scheduling, etc.) presupposes access, easy circulation, and availability of video content. Accessibility, smooth circulation, and availability of content provide the preconditions for the successful enactment of all other tasks and operations. In the affluence of the digital content that marks that technological space and its environment (other operators, subcontractors, the Internet), these tasks are critically contingent on the ability to identify what one is looking for or what one may think s/he is looking for. Metadata assumes its critical role within that context, becoming the passport, as it were, allowing video content to travel across the many tasks and operations by means of which it is produced, delivered and ultimately consumed. These are the key issues that emerge from the empirical narrative of the BBC and the media industry given above. They are schematically summarized in the Table 1.

The investigation of video production and distribution in BBC makes it clear that the technological innovations occurring in the organization are inseparable from the conditions under which video content is accessed and consumed. Trivial as it may seem, such a state of affairs signals an important shift whereby the relationship of the organization to the media industry is drastically refigured. Whatever is produced must conform to the standards of accessibility and distribution over the media ecosystem and, crucially, what that ecosystem is not yet but it may well become in the future. The DMI at the BBC certainly responds to the present conditions of Internet access and media convergence but in ways that should remain open enough to accommodate possible adaptation to future changes. These are developments of paramount importance that transcend the confines of BBC and relate to wider changes of the media industry in its entirety. Let us explain.

Before the Internet, the delivery and distribution of video depended specifically on the TV medium. TV had a defined format and clear "on-air" fixed scheduling. The TV as an artifact defined this format; the air spectrum as a mode for communication defined its instantaneity. Still today, the production and distribution of video content are dominated by the logics of TV as a medium, and the established economic and organizational system of broadcasting and media companies. However, the technological

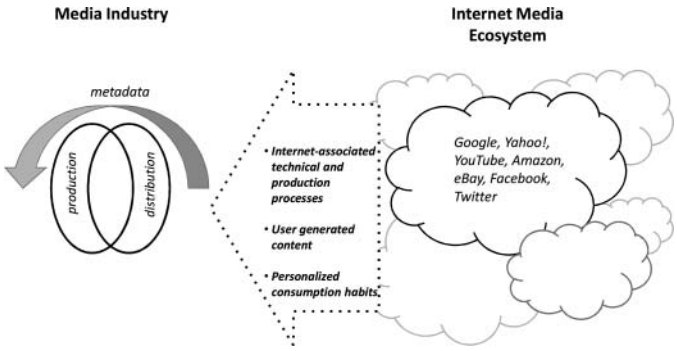


FIG. 1. The entanglement of the Internet Media Ecosystem with Media Industry Operations.

developments underway increasingly imply the "merging" of certain practices and processes that before were dealt with separately during the stages of video production and distribution. In the typical broadcasting environment, the production was clearly separated from the distribution system. The two processes belonged to substantially different environments. In large media companies such as the BBC, the production of content has usually been, partly or entirely, commissioned to third parties or conducted by specialized departments inside the organization that have had creative and production expertise. The distribution, on the other side, coincided with broadcasting along established TV channels (TV programming schedule and transmitting through air signals). As content is delivered over the Internet through a variety of platforms, many of the traditional processes are shifting dramatically. First, the metadata produced in connection with the creation of new content becomes key for its distribution and findability. Thus, assigning the correct metadata and adapting it to each delivery platform requirement are crucial tasks. Second, video-on-demand differs from TV scheduling and prime-time nomenclatures, since relevant content is defined in the Internet media ecosystem through personalized and continuously shifting user experiences and audience data profiling. These developments suggest, as schematically shown in Figure 1, that the distribution of video moves closer to the production processes and the BBC's internal operations become entangled with the technical landscape of the Internet, including strategies of audience making, and the user and consumption habits that the diffusion of the Internet promotes.

An important outcome is the connection of the different operations we have been describing in the digital space that drives the "merging" or streamlining of a range of processes that previously belonged to different units or systems. As these processes are tied together to a digital pipeline two things seem to happen. First, the *video production becomes broken down into several smaller and*

detailed processes: from ingesting and crafting video content to managing it through data repositories and shared interfaces (see Table 1). Second, the *video distribution is acquiring flexible forms* that seek to accommodate what is defined today as *multiplatform content delivery.* The functional prerequisites for each task sequence produce different types of metadata-related operations (creation, search, updating, among others), which constructs a flowing path along all basic operations.

On the Internet, contrary to what happens in traditional broadcasting, the delivery of content does not take place according to fixed programmed schedules but is constantly available and updated, possible to access at any time. For these reasons, the standardization and findability of content become crucial requirements when delivering video over the Internet (Kink and Hess 2008). Online accessibility and findability are connected to the ways in which metadata mediates information search. This may seem just a simple task in which the metadata required for the manipulation of digital information has to be added upon a preexisting product (like a tag on a baggage) or simply included on a routine basis during the production process. However, a set of delicate problems arises as to how relevance (the semantic relationship between the tag and the object, as we discuss latter) is constructed, how projective use is anticipated in the metadata, when and who should produce the metadata, how the metadata should look like, and when should it be updated.

The recycling of existing content is obviously contingent on the capacity to match archive metadata with metadata about new content. To a certain extent the identification of archived assets with the view of considering whether they can be reused in ongoing productions is similar to the issue of findability associated with the diversity of video assets in the growing media ecosystem. Yet our BBC study suggests that archives raise temporal, cultural, and also technical problems in addition to those diversity engenders. Finding archived assets is an act of choice guided by relevant keywords occurring in the present. Text descriptions on the basis of which the asset was archived may well not be compatible, let alone available in a digital format, to present concerns. As new assets are created digitally *de novo* they acquire several constituencies that previously archived media assets may lack (such as a new specific field required for a particular delivery platform). Even generational gaps produce different definitions about some descriptions and keywords used. Creating and searching metadata are complexly coupled to social meanings. This makes metadata time-bound and subject to the depreciation of its relevance, if not regularly updated and maintained. What is relevant today for some groups or audiences may become irrelevant the next day. In a digital environment, the cost of sustaining and updating information includes not only the preservation of media assets but the possibility of recalling its meaning relevant to present concerns. This last may require a permanent human participation capable of accomplishing such a semantic attunement (Dreyfus 2001).

METADATA AND NEW MEDIA OBJECTS

BBC's attempt to address the challenges raised by the developments in media industry described so far can neither be separated nor fully understood without confronting the distinctive makeup of new media objects. As shown in the theory section, new media objects are a specific breed of digital objects marked by the preponderance and ubiquity of the moving image (video content, footage) (Manovich 2001). Short of a confrontation with the distinctive nature of new media objects, the DMI at the BBC and its organizational implications could simply be read as a series of strategic or technological adaptations to the institutional and technological changes occurring in the media industry, an interpretation common within strategic management and media economics (Küng 2008; Napoli 2003; Picard 1989). Correct as such an interpretation might be, it is, however, too generic and, for that reason, misses the distinctive profile of these changes that is the outcome of the editable, open, transfigurable, and distributed nature of new media objects and the implications such a profile has for social practice (Kallinikos et al. 2010). The significance metadata assumes in the contexts we have outlined is inseparable from the mutating, emergent, and distributed nature of new media objects and the problems of control and manageability they raise in the instrumental culture in which most institutions are embedded.

Most of the tasks in the digital pipeline we have outlined are closely associated with the identification of video content within and beyond the organization (i.e., multiplatform delivery). Identification seeks to solve the problem of video content recognition that is created by the distributed, mutating and shifting nature of video content brought about by digitization. It belongs, however, to the nature of digital objects not to be fixable (Kallinikos et al. 2010; Manovich 2001). Accordingly, the remedy offered by metadata as a means to identification and recognition is no more than a transient accomplishment that is, in addition, bound with further complexities. The separation of content from the material or formal representation (i.e., text, keywords) that is metadata reaches deeply in the practice of metadata generation (Liu 2004). However, the rich and semantically dense character of video content and the variable character of the conditions under which the content is accessed make video a more complex object to categorize than texts (Goodman 1976; Kallinikos 2009, 2011). Metadata is, after all, textual (or numerical), and the image-based nature of video content must accordingly be reduced or translated to textual

descriptions when tagged with metadata. On the other hand, and similarly to verbal text, which for its contextualization presupposes a narrative, video assets also need to be inserted into more encompassing signifying contexts such as films (or sections of films), series, documentaries, or other types of visual narratives. New media assets in the form of images are highly context dependent and may become ambiguous if decontextualized (Sontag 1977). The contrived nature of the relationship between metadata and the content it describes renders therefore the meaning of metadata potentially changeable and tricky (metadata is itself a digital object) and its coordinative role unreliable, irrelevant, or inconsistent (Shirky 2006).

It is worth pointing out here that while becoming a means of enabling and controlling digital video content, or any content whatsoever, metadata also restricts the semantic journeys of that content (Shirky 2003). The new media object is not simply the content it conveys but crucially how this content is signaled and packaged (McLuhan 1964) in the bewildering media ecology. As more video acquires digital format, it becomes critical when, what, and how to define the parameters of its metadata. Therefore, the meta-information that is increasingly embedded into the new media object may make it potentially more usable but also alterable in the future. We are still at the dawn of these types of practices; however, our empirical observations suggest that both the software platform and the metadata parameters embedded in the media objects are crucial to enabling but also restricting the use of content. Video search engines in the media industry are still on their infancy and will certainly evolve into more elaborate tools. At the same time, the contingent form of new media objects, and particularly the case of digital video assets as compared to text or other narrative structures, certainly eludes many of the definitions and practices associated with codifying information. Its nonlinear nature does not conform well to the ways we are accustomed to read or write (McLuhan 1964; Ranciere 2007).

An all-digital pipeline may seem to streamline and simplify the processes and steps that new media objects have to follow. But the constitution of new media objects through a digital pipeline introduces new and recalcitrant complexities. Little wonder that the new media objects as such are easier to produce, manage, and transform by computational technologies. After all, this is a principal motive for introducing digitization in general and the BBC's DMI we have considered in this article.

However, new media objects become less self-sufficient and autonomous as their mode of being in the media ecosystem becomes inextricably bound up with metadata and the ways metadata signifies. The new media object's metadata is bound to accompany it through the different stages and processes in which the object moves. Rather than being an obedient servant to the new media object, the production of metadata generates a number of interesting phenomena that we have tried to indicate in this article. Even when the new media object is "fixed" and content is delivered, the metadata would speak and signify on its own, making the content findable, interoperable, and (ir)relevant. In the context of the growing number of delivery platforms and their interlocking, metadata becomes key to content innovation after the content is delivered; the craft of a new media object has also become the way metadata is being produced. The shadow overtakes the object that casts it; in postmodern parlance, the supplement evades and undoes the core; the signifier threatens to dissolve both the signified and the referent (Baudrillard 1988; Derrida 1978; Ranciere 2007).

As personalized content increasingly becomes the norm, the delivery of content would be triggered by the consumption habits of the users more than by fixed scheduling classifications. It is yet not clear whether the assortment of devices that construct the media ecosystem would also require new types of metadata that are more closely related to the delivery platform as such. Our account suggests that video content and the processes by which it is produced and distributed are inextricably bound up with the conditions that ensure its online accessibility, findability, and interaction. It was earlier possible to disentangle both production and distribution into two different worlds. Under the current conditions this is no longer the case. Video production and distribution become interrelated and dependable one upon another.

POSTSCRIPT

The making of metadata to an important means of managing the tasks and operations evolving around the creation of, production, and delivery of video content is not a sheer technical issue. Rather, it is closely associated with the diffusion of information tokens across contemporary cultures. The proliferation of data and information tokens, detached from and circulating far beyond the contexts in which they usually originate, render necessary the invention of a cognitive currency, so to speak, that allows these tokens to be recognized and become objects of social interaction, exchange, and use (Borgmann 1992, 1999; Kallinikos 2006, 2011). Though certainly a hyperbole, in a world dominated by information tokens, we all tend to become librarians of a sort (Rosenfeld and Morville 2002; Weinberger 2007).

New media as a social field represents the convergence of computing and media technologies (Manovich 2001). Though not perhaps evident at first glance, the effect of this convergence has increasingly been the translation or, perhaps more correctly, the *reduction of all existing media to computational processes*. Images and video content in general are assembled by a variety of operations, most

of which are sustained by underlying numerical representations that render them programmable, manipulable, and, crucially, transferable and interoperable. In this respect, the developments we describe in this article are indicative of wider transformations by means of which the polysemantic space of culture is increasingly infiltrated by information and the processes through which it is generated, managed, and disseminated (Kallinikos 2009). "Software takes command," in Manovich's (2008) recent and provocative book title. In so arguing, we do not necessarily subscribe to what Briggle and Mitcham (2009) call moninstic views of information culture usually underlain by a universal model of causality. There is no single causality here anyway but an orchestrated set of interacting realities. All we claim is that the transposition of the processes of culture creation (here a variety of long-form video production) to digital media and the media ecosystem is related to and accompanied by important institutional and economic transformations.

The coordinative and organizational significance we attribute here to the humble medium of metadata in the media industry may strike noninitiates as exaggerated or even misplaced. The understanding of the increasingly important role metadata assumes as a mechanism of social coordination cannot properly be appreciated apart from the background of the wider developments to which we refer. Metadata is no other thing than an *idiom of exchange and communication* in a universe in which information tokens and automated information processes become increasingly central and pervasive. Our research in the media industry in general and in the BBC's DMI in particular suggests that these technical processes lie at the heart of far-reaching institutional changes. The need to make sense and manage new media objects drives the fusion of operations that have remained largely foreign to one another. The digital pipeline, as we have described it in the article, brings together a variety of specializations and carries its expertise over activities as distant as scripting, shooting, and montage. Very little of the implications of these far-reaching yet nascent technological, semiotic, occupational and economic developments have been sufficiently explored so far (e.g., Jenkins 2006; Manovich 2001, 2008). We have just described some of these developments and alluded to the kind of changes they may drive. Much more of course remains to be done.

NOTES

1. XML (Extensible Markup Language) is a set of rules based on open standards for encoding and interchanging data, documents, and Web services over the Internet.

2. http://www.tvlicensing.co.uk

3. http://www.bbc.co.uk/iplayer/

4. With the exemption of documentaries, which could gather footage material, most long-form productions had required the creation of new content (either by shooting or by postproduction).

REFERENCES

Baudrillard, J. 1988. *Selected writings*. Stanford, CA: Stanford University Press.

BBC. 2007. Digital media initiative: Project summary document. *BBC-Backstage*. London, BBC, p. 9.

Benkler, Y. 2006. *The wealth of networks: How social production transforms markets and freedom*. New Haven, CT: Yale University Press.

Boczkowski, P. J. 2004. The Process of adopting multimedia and interactivity in three online newsrooms. *Journal of Communication* 54(2):197–213.

Borgmann, A. 1992. *Crossing the postmodern divide*. Chicago: University of Chicago Press.

Borgmann, A. 1999. *Holding on to reality: the nature of information at the turn of the millennium*. Chicago: University of Chicago Press.

Bowker, G. C. 2005. *Memory practices in the sciences*. Cambridge, MA: MIT Press.

Briggle, A., and C. Mitcham. 2009. From the philosophy of information to the philosophy of information culture. *The Information Society* 25(3):169–174.

Cubitt, S. 2008. Codecs and capability. In *Video vortex reader: Responses to YouTube*. eds. G. Lovink and S. Niederer, pp. 45–52. Amsterdam: Institute of Network Cultures.

Derrida, J. 1978. *Writing and difference*. Chicago: University of Chicago Press.

Deuze, M. 2007. *Media work*. Malden, MA: Polity.

Dietrich, F. 2000. Data particles—Meta data—Data space. *Switch Journal*. http://switch.sjsu.edu/nextswitch/switch_engine/front/front.php?artc=12 (accessed July 1, 2011).

Dreyfus, H. L. 2001. *On the Internet*. New York: Routledge.

Dupagne, M., and B. Garrison. 2006. The meaning and influence of convergence: A qualitative case study of newsroom work at the Tampa News Center. *Journalism Studies* 7(2):237–255.

Ekbia, H. R. 2009. Digital artifacts as quasi-objects: Qualification, mediation, and materiality. *Journal of the American Society for Information Science and Technology* 60(12): 2554–2566.

Flachbart, G., and P. Weibel. 2005. *Disappearing architecture: From real to virtual to quantum*. Basel: Birkhauser.

Goodman, N. 1976. *Languages of art: an approach to a theory of symbols*. Indianapolis, IN: Hackett.

Greenberg, J. M. 2008. *From BetaMax to Blockbuster: Video stores and the invention of movies on video*. Cambridge, MA: MIT Press.

Hanseth, O. 2004. Knowledge as infrastructure. In *The social study of information and communication technology: Innovation, actors and contexts*, eds. C. Avgerou, C. Ciborra, and F. Land, pp. 103–118. Oxford: Oxford University Press.

Jenkins, H. 2006. *Convergence culture: Where old and new media collide*. New York: New York University Press.

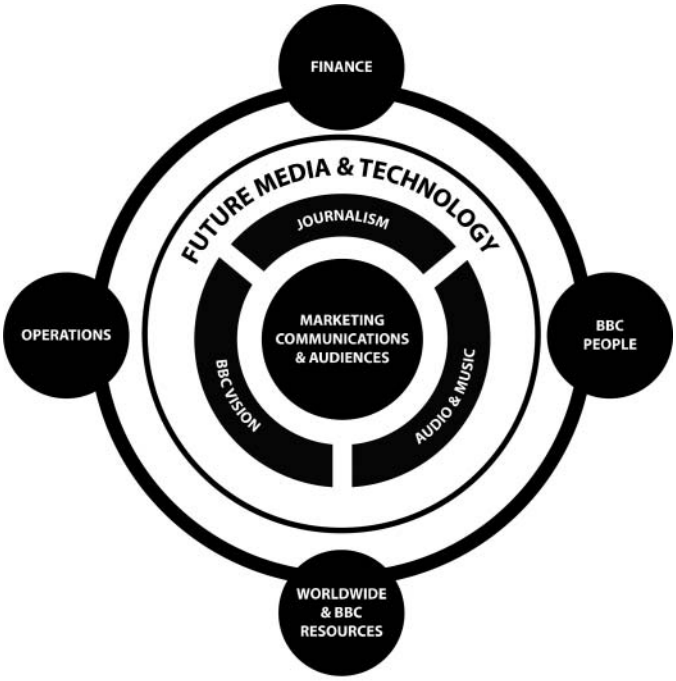
Kallinikos, J. 2006. *The Consequences of information: Institutional implications of technological change*. London: Elgar.

Kallinikos, J. 2009. On the computational rendition of reality. *Organization* 16(2):183–202.

Kallinikos, J. 2011. *Governing through technology: Information artefacts and social practice*. New York: Palgrave/MacMillan.
Kallinikos, J., A. Aaltonen, and A. Marton. 2010. A Theory of Digital Objects. *First Monday* 15(6). http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/rt/printerFriendly/3033/2564
Kink, N., and T. Hess. 2008. Search engines as substitutes for traditional information sources? An investigation of media choice. *The Information Society* 24(1):18–29.
Kittler, F. A. 1999. *Gramophone, film, typewriter*. Stanford, CA: Stanford University Press.
Küng-Shankleman, L. 2000. *Inside the BBC and CNN: Managing media organisations*. London: Routledge.
Küng, L. 2008. *Strategic management in the media*. London: Sage.
Küng, L., N. Leandros, R.G. Picard, R. Schroeder, and R. van der Wurff. 2008. The impact of the Internet on media organization strategies and structures. In *The Internet and the mass media*, eds. L. Küng, R. G. Picard, and R. Towse, pp. 125–148. Thousand Oaks, CA: Sage.
Lawson-Borders, G. 2006. *Media organizations and convergence: case studies of media convergence pioneers*. Mahwah, NJ: Lawrence Erlbaum Associates.
Lévy, P. 1997. *Collective intelligence: Mankind's emerging world in cyberspace*. Cambridge, MA: Perseus Books.
Liu, A. 2004. Transcendental data: Toward a cultural history and aesthetics of the new encoded discourse. *Critical Inquiry* 31: 125–148.
Liu, A. 2008. *Local transcendence: Essays on postmodern historicism and the database*. Chicago: University of Chicago Press.
Manovich, L. 2001. *The language of new media*. Cambridge, MA: MIT Press.
Manovich, L. 2008. Software takes command. San Diego, p. 245. http://lab.softwarestudies.com/2008/11/softbook.html (accessed December 29, 2010).
Marchessault, J., and S. Lord. 2008. *Fluid screens, expanded cinema*. Toronto: University of Toronto Press.
McCargar, V. 2004. News that moves: Accessioning video for newspapers archives. *Moving Image* 4(2):22–37.
McLuhan, M. 1964. *Understanding media: The extensions of man*. Cambridge, MA: MIT Press.
Napoli, P. M. 2003. *Audience economics: Media institutions and the audience market place*. New York: Columbia University Press.
Picard, R. G. 1989. *Media economics: Concepts and issues*. London: Sage.
Rancière, J. 2007. *The future of the image*. London: Verso.
Rosenfeld, L., and P. Morville. 2002. *Information architecture for the World Wide Web*. Sebastopol: O'Reilly Media.
Shapiro, A. L. 1999. *The control revolution: How the Internet is putting individuals in charge and changing the world we know*. New York: Public Affairs.
Shirky, C. 2003. The semantic web, wyllogism, and worldview. *Clay Shirky's Writings About the Internet: Economics & Culture, Media & Community, Open Source*. http://www.shirky.com/writings/semantic_syllogism.html (accessed July 1, 2011).
Shirky, C. 2006. Power laws, weblogs and inequality. In *Reformatting politics: Information technology and global civil society*, eds. J. Dean, J. W. Anderson and G. Lovink, pp. 35–42. London : Routledge.
Shirky, C. 2010. *Cognitive surplus: Creativity and generosity in a connected age*. London: Penguin.
Silverstone, R. 2007. *Media and morality: On the rise of the mediapolis*. Malden, MA: Polity Press.
Sontag, S. 1977. *On photography.* London: Penguin Classics.
Weinberger, D. 2007. *Everything is miscellaneous: The power of the new digital disorder*. New York: Times Books.
Zoch, L., and E. Collings. 2003. Preparing for a career in the unknown: convergent newsroom managers need and want. Paper presented at the Meeting of the Association for Education in Journalism and Mass Communication, Kansas City.

APPENDIX 1

This chart outlines BBC's current organizational model, which was made public in July 2006 to explain the reorganization of the corporation. The reorganization placed BBC Future Media and Technology Division (FM&T) at the core of all operations in order to make the corporation the world's most compelling digital media services provider.



BBC's current organization model

APPENDIX 2

The various elements that the DMI program delivers to the BBC are described through a set of enablers (BBC, 2007). An enabler can be understood as a set of capabilities that the business will have following the implementation of a joined up people, process and technology solution.

The DMI program consists of six enablers defined as follows:

- *Enabler 1—Work in Progress*: Enables smarter decisions early in the production process, multiple users accessing content, and added agility in the multiplatform production process.
- *Enabler 2—Archive*: Allows content that is "born digital" to "stay" digital, richly tagged to enable the content to be exploited for both audiences and commercial use.
- *Enabler 3—Bundle and Package*: Provides the ability to seamlessly convert content from finished form for various platforms.
- *Enabler 4—Shoot*: Allows tape to be removed from the shooting process, reduces time spent ingesting footage, and provides the opportunity to record metadata during the shooting process.
- *Enabler 5—Craft*: Enables complex editing to be completed on lower cost desktop based packages.
- *Enabler 6—Share*: Facilitates multiple users including third parties to access content adding increased agility to the production process.