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THE INTEROPERABILITY OF INFORMATION AND ITS REPRESENTATION IN NEW MEDIA: A CASE STUDY OF A GLOBAL CONTENT PROVIDER

Abstract

This paper focuses on the construct of interoperability of web-based information applications, commonly known as 'mashups', reporting a case study of a global content provider and its RSS and API content delivery platform. We have sought to identify the technical and social settings that take form when supplying content in standardized form over the internet, and whether the interoperability of separate data sources may generate new innovative applications. The study shows that while the actors involved may have different visions on how to innovate and potentially develop commercial applications. We emphasize the dichotomy and the contradictions that arise when mixing content over the internet, under conditions that underline the need to maintain quality and trust in the original source. Finally, we provide a critical account on the consequences of interoperability emerging from the mixing of different sources of information. We conclude that in their current state of development, mashups do not live up to the expectations originally tied to them as regards their contribution to a socially driven internet.

Keywords: standards and meaning, mashups, tools for information interoperability, socio-technical impact of interoperability.

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1 INTRODUCTION

The diffusion of the internet is transforming our understanding of technology and impacts upon the forms through which data and information items are tied to meaning and signification. The dissociation between symbols (data tokens) and meaning and the local practices out of which meaning emerges is becoming more evident, as content delivered over the internet makes necessary its packaging and transmission in standardized, context-crossing, ways. At the same time, the forms by which we interpret technologically mediated symbol tokens are becoming flexible by, among other things, the creation of new interfaces. Strange as it may seem, the flexibilization of technological artefacts, coinciding with the ideal of a socially driven internet, also known as 'web 2.0', presupposes standardization. For, it is driven by the development and establishment of a series of protocols and standards necessary to render data interoperable.

In this paper, we seek to address a few issues that relate to these contradictory implications associated with the aforementioned trends. Interoperable information provides ample possibilities for combining diverse data sources and different modes of representation-communication (discrete symbol tokens, images, sound). It also harbours the ideal of empowering users by providing them with the possibility of acting upon and mixing data, in ways that reflect their predilections and preferences. On the other hand, the construction of this promising technological landscape is predicated upon the considerable blackboxing of key processes. On the Semantic Web, in particular, information about information is assuming a controlling role through the pre-programming of the terms (the semantic content of metadata) through which information becomes interoperable. This is especially true in the case of content providers that rely on massive, diverse and complex databases. In this paper we report on a case study of a content feeder initiative, BBC Backstage developed by the British Broadcasting Corporation (BBC). The initiative was launched as means of fostering innovative services that could, possibly, translate into new commercial services. In so doing, we identify and analyse a number of predominantly information and communication-based issues that are associated with this project in particular and the Semantic Web in general. Prior to that however we venture to place the understanding of these phenomena in the conceptual framework we feel they belong.

2 CONCEPTUAL FRAMEWORK

The issue of technological malleability and the degree to which artefacts are transformed by their use has been a central one in information and organization studies (Kallinikos, 2002; Nardi et al., 2004; Orlikowski, 2000; Orlikowski, 2002). There is, in addition, a significant number of studies that show how the internet is partly shaped by its use (Brown & Duguid, 2000; DiMaggio et al., 2001; Wellman & Haythornthwaite, 2002) and partly by the pressures exercised by strong commercial interests (Introna & Niessenbaum, 2000). However, research that takes up this problematic in the context of the Semantic Web and the technical and communication innovations it has brought about is still scarce (Halpin, 2004).

2.1 Representation in New Media

New media represents the convergence of computing and media technologies (Manovich, 2002). To be rendered technologically possible, the convergence of types of higher-level information presupposes its reduction to discrete (digital) symbol tokens possible to handle through automated rules of data processing. Beyond the appearances and the occasional euphoria created by the convergence of highly distinct modes of communication, new media technologies evidence the separation of the semantic content carried out by the artefacts it produces from the local practices and the lower-level procedures and operations of data manipulation that sustain semantic processes (Kallinikos, 2001; Kallinikos, 2006; Kittler, 1997). The internet has vastly promoted everyday

encounters in which the value and meaning of information that reaches the ultimate users is produced by an underlying mechanics of data tokens and the interconnectedness of data sets (Bowker & Star, 1999; Dreyfus, 2001). Interconnected symbols become meaningful by way of algorithmic programming. If however end-users are given the technical means, such as RSS (Really Simple Syndication) or APIs (Application Programming Interfaces), for acting on information, it would be possible to infer that meaning could emerge, at least to a certain degree, through their active participation in the processes of mixing and manipulating data and information.

Computers, being 'syntactic engines', are only sensible to standardized specifications of their input but not to their meaning (Bowker & Star, 1999; Dreyfus, 1992; Dreyfus, 2001). However, standardization also characterizes how codification constructs a message (Esposito, 2004; Kallinikos, 2006). The more digital information is available, the more complex it becomes to manipulate and organize that information; hence new functions are necessary to control its meaning and malleability. Meaningful information in new media can be understood as the construction of an interface to a database (Manovich, 2002). Data items assembled by means of such interfaces provide opportunities for re-inserting contextual elements in the process of using and interpreting information.

2.2 Protocols and Standards in the Age of the Internet

The internet has grown to become universal (Lévy, 2001), and though it is impossible to define guidelines for all its uses, there are standards that govern its interoperability. The internet does not only tend towards universality but also 'systematicity' (Lévy, 2001) manifested on such properties as interoperability, transparency and irreversibility. Underlying its layer of information manipulation, there is a suite of standards and functions. One of these technologies is the well known TCP/IP (Transmission Control Protocol/Internet Protocol) which refers specifically to standards that govern the implementation of technologies and achieve a voluntary regulation within a contingent environment (Galloway, 2004). These regulations operate at the level of coding communication, making one type of device able to communicate with another. As interoperability matters on the internet, it becomes increasingly harder to include new standards (Hanseth, 2000; Hanseth et al., 1996; O'Reilly, 2005). However, taking standards for granted not only makes them invisible but, to a certain degree, render them also uncontrollable (Galloway, 2004; Hanseth & Braa, 2000). The protocol has little to do with its meaning (Slayton & Witting, 2000) since it does not interface with the semantic value of data.

The Extensible Markup Language (XML), is becoming the standard for the interoperability of hypertext on the internet. XML and databases are ussually hidden from end users, partly because they have been first implemented at an institutional level and partly because their mechanics involves complex and blackboxed data acting procedures and operations. Today many organizations use XML as part of their standard enterprise and productivity applications (Liu, 2004). Being a markup language, XML has a schema, that is, instructions that explain its constituting elements, also referred as 'metadata' (Cover, 1998). These 'procedural instructions' allow a 'blind' interchange of information (Liu, 2004; Piez, 2001). Nevertheless, interoperable information only generates value for a group or an organization when it shares a set of common semantics. At a primary level, the mixing of different data sources could take place by using 'blind' XML feeds. However, a more substantial and goal-directed mixing of data sources may require defining shared meanings (Cover, 1998). In this respect, it is crucial to point out that metadata is well defined and agreed data but is not interpreted data (Berners-Lee & Fischetti, 2000; Halpin & Thompson, 2006). Increasingly, systems that manage meta-standards are being used within the framework of open and interoperable databases. The more data there is the more metadata is needed to sort and search the internet successfully without getting lost in the growing data universe (Dietrich, 2000). In other words, local appropriation of technologically mediated information makes necessary the long driven standardization of data items, data sources and data processes. Even though such a contradiction has haunted information and

communication since the emergence of writing (Kallinikos, 1996; Kittler, 1997) it is now acquiring new and massive dimensions that are not well understood.

2.3 Interoperability of the Web: Mashups

Built upon these series of protocols and standards, lies the layer of web services, known today as web 2.0. One of its characteristics is the creation of web applications stemming from the possibility of combining diverse data sources. Known as 'mashups', these hybrids enable, among other things, the development of new innovative services (Merrill, 2006). Feeds of content for building mashups are provided by interfaces such as RSS or APIs.

A mashup draws upon content and functionality from data sources that cross the boundaries of particular organizations (Dietrich, 2000). More than 90% of the content used for building mashups are generated by the main providers of digital content such as eBay, Amazon, Google, Yahoo!, BBC or CNN (ProgrammableWeb, 2006). Mashups can indeed be seen as symbolic processors. Many mashups are simply better ways of delivering the information that is already available, which also critically evidences the lack of innovation on the part of the established content providers.

Many of the feeds available today to create mashups are still on an experimental stage. Consequently there are concerns associated with the level of expertise required to build a mashup but also concerns with respect to their functioning stability. Conditions such as incomplete content, data not suitable for machine automation, incompatible definition tags, unreliable communication, unpredictable traffic loads and the inability to interoperate with other systems and services may disrupt its interoperability (Bosworth, 2001; Halpin & Thompson, 2006; Merrill, 2006). This may well be the reason why most of the XML feeds available are being used by communities of developers and not by end-users.

3 CASE STUDY: BBC BACKSTAGE

3.1 Institutional Background

The BBC is a public broadcasting company and one of the biggest global content media providers, operating through television, radio, printed media and the internet. BBC Backstage (http://backstage.bbc.co.uk) is BBC's developer network that offers much of the content of BBC online. Being still on trial, the content feeds are available for people to build applications in a non-commercial basis. BBC Backstage is seen both as a way to develop a creative use of BBC's content and to support innovation.

The initiative was defined as part of a long-term vision to position BBC as one of the leading online innovators, making available its content through all possible formats and offering BBC's customers the possibility of interoperating it freely with other different sources of information. BBC Backstage is part of a wider initiative that includes other projects at BBC, all envisaged as new media innovations. The main elements of BBC Backstage are the content feeds, a web site, a blog for posting official information and an email discussion list. The web site is also the main showcase of developer's mashups.

3.2 Research Methodology

Data collection comprised the review of documentation, such as reports, procedures, information available online and threads from the email discussion list. From the quantitative study of more than 300 threads and 2000 messages we identified the major topics posted on the list both in terms of their frequency and their monthly activity. Such an analysis was essential to provide us with an initial

understanding of the issues that mattered and the activities that were involved as the BBC Backstage project kept going on.

The data was analysed with purpose of obtaining an initial understanding of the issues associated with mashups. The case study research design and the data collection methods it is associated with are well aligned with that purpose (Yin, 2003). Works that adopt a similar methodology (Thompson, 2005; Walsham, 1995) use theory or theoretical ideas as initial guide to an iterative process of design and data collection decisions. We roughly conformed to such pattern. Some initial theoretical preoccupations about information interoperability and its implications shaped our initial concerns and provided focus to specifically analyse and group mashups on the basis of considerations such as their life span and usability. The design and data collection methods also sought to investigate whether the mashup model enables the generation of new meaning and innovative applications.

3.3 Visions and Promoters

BBC Backstage was envisioned as the future of BBC's content delivery. It was accordingly a key means for staying "ahead of the curve", especially after the further diffusion of the web 2.0 applications. Serious concern was given to the legal issues regarding the use of BBC's content. The web was already starting to become interoperable and developers were using the content illegally by means of 'screen scraping', a technique in which a computer program extracts data from a web site. BBC Backstage therefore solved this problem giving legal access to the content in a non-commercial basis. Another main concern was associated with BBC's reputation as one of the most trustful sources for global information. One danger was that the reliability and credibility of the company's content does could be affected by the missuse of their information.

BBC Backstage was thought not as a product available for the mainstream audience, but rather as a laboratory of data innovation intended for a developer community. There is sufficient evidence that making software and content a free and 'public good' encourages innovation (Cusumano, 2004). BBC considers that BBC Backstage supports innovation both outbound and inbound. Outbound is tied with BBC's capacity to bring up and maintain a developer community in their effort to create prototypes and innovative applications. Inbound was expected to develop to the degree to which some prototypes could potentially be implemented and rendered as standard services on BBC.

In the first year more than 90 prototypes were submitted to BBC Backstage web site, the majority of which, 75 prototypes, were created during the first 4 months. One of the ways of fostering new prototypes was through prize giving competitions sponsored by BBC. After the first 6 months (which included the first competition), the initial excitement was halted considerably, both in terms of design of new prototypes and activity on the email discussion list. In the recent months, a small increase in the number of mashups being developed and a second competition, this time focused in the development of widgets, provides evidence that elucidates some new trends regarding the evolution of the mashup model.

3.4 The Developer's Mashups

We now focus in the mashups developed using BBC Backstage (http://backstage.bbc.co.uk/prototypes/). Great part of the data used has been extracted from BBC Backstage discussion list, an open and non-moderated list. As in other types of computer-mediated systems, the main use of the discussion list has been to share information resources (45 % of the threads). Another representative proportion of the email threads (14 %) had dealt specifically with the discussion about prototypes being developed using BBC Backstage. These threads tended to contain more and better articulated messages, which indicates the interest of BBC Backstage developer community around new prototypes. The discussions held can be grouped to two broad categories: either technical, concerning, for example, the use of an algorithm, a programming practice and the likes; or, functional, being associated with the effectiveness, ease of use or a GUI-approach.

Taking into consideration these arguments and the most recent submissions of prototypes (as of November 2006), we have been able to identify three types of web mashups developed using BBC Backstage: type 1 are revisions (or updates) of previously submitted mashups, type 2 are mashups developed as widgets; and, type 3 are mashups that compare and assess information in a critical manner [1].

3.4.1 Type 1: Mashups' revisions

We analyzed two mashups that had been originally developed when BBC Backstage was launched and had been recently updated, *Mood News* and *gtraffic*. Mood News (http://www.latedecember.com/sites/moodnews/) rates the news of BBC as good, bad or neutral, based on keyword scoring from a vocabulary of words and phrases. The most recent implementation, *Mood Memories*, uses BBC's *The Time When* (http://www.thetimewhen.co.uk/) to do the auto-analysis classification. gtraffic (http://www.gtraffic.info/) provides updated traffic data, including BBC data, and plots it on Google maps; the new update offers a new interface with selection menus to indicate the datasets available, new ways of categorizing and sorting the events and some help pages.

Upon a closer look both revisions seem to pivot around two aspects: the first relates to improved ease of use (i.e. look and feel); and, the second to additional functionalities that mainly include new features (i.e. 'permalinks' or social book-marking) and additional use of feeds from BBC. The possibilities to give new functionalities to the mashups are endless. However we should point out that both the revised mashups and the threads in the discussion list indicate that what matters most is predominantly centred on the visual configuration or functionality of mashuping information. These concerns are usually dissociated from the actual content of the rendered information.

One of the basic problems of the information available today on the internet is its abundance. Mashups could address this problem by filtering the amount of information by means of the feeds and metadata; however, the examples we have looked at indicate that mashups focus more on issues relating to functionalities and ease of use than on mastering information abundance. Meaning itself gives ways to procedure and the functionality of the application.

3.4.2 Type 2: Widgets

There is a recent trend towards the use of desktop and web widgets. Widgets are small desk accessories with specific functionalities, such as a calendar, weather monitor or a calculator. Widgets are easy to develop and are available for client desktops (Dashboard widgets in Mac OS X and Gadgets in Microsoft Windows) and personalized web portals (Yahoo! and Google). Due to the fact that widgets are fairly simple to use and create, this could engage a wider audience including even end-users in its development. Taking this into consideration, BBC Backstage launched a new competition solely focused on widgets.

We analyzed two widgets that were part of BBC Backstage competition, BBC *World News Widget* and *My Favourite Bands*. BBC World News Widget is a Mac OS X widget that shows the latest world headlines on a revolving 3D map. Additionally, when selecting the news desired, it offers the possibility to review the complete story. My Favourite Bands is a Google Gadget that takes the favourite bands from the RSS feed of last.fm (a social network of music listening habits) and then searches the BBC for both news about them as well as TV and radio performances of these bands.

Widgets have very well defined functionalities and are usually developed for specific platforms, narrowing even more their use. The functionality of BBC World News Widget is similar to other widgets previously available; the main difference is that the information used is extracted from the BBC. From its revision we can clearly state that the main intention for building them was to display information in better ways (or as the developers say "in nice fashion"). The BBC World News Widget is more a new way of presenting rather than 'mashuping' information (in contrast to My Favourite Bands). Therefore, conceptually speaking, it is contestable whether it could be classified as a mashup.

3.4.3 Type 3: Experiment with the data

During the last months, more people have realized the potential of using the data provided by BBC Backstage for questioning information accuracy. This indicates a sense of awareness or social concern in the search for new understandings that could be extracted from publicly available information sources.

News Sniffer is one of these projects. It features two tools: *Watch Your Mouth*, which acts as a monitor of the information available at the BBC online forums and detects when comments get removed or censored by BBC; and, *Revisionista*, which monitors news websites and detects when the content of articles are being changed, highlighting these changes. Due to the completely different nature of these mashups, they have generated discussions in the BBC Backstage community concerning legal issues or matters that are associated with BBC's decisions of filtering or changing the information available online. The BBC Backstage team considered these mashups as 'experiments with the data' and reacted positively showing BBC's openness vis-à-vis the use of their information. The head of global news for BBC even stated in his blog that "it's a good idea and no news organisation should be worried about being held to account for changes made […] and when it may be of some consequence news organisations should be prepared to explain." [2]

As a way of concluding the evaluation of these three types of recent mashups we identify the following issues. First, the evolution and updates of mashups have been more related to their visual representation, rather than to new ways to analyze and relate together different sources of information. Second, the developers are giving priority to the ease of use of mashups. As the outcome of that the possibilities for exploring new relations between information sources on the part of the users are becoming limited. Third, certain mashup prototypes are not easy to classify unambiguously as mashups. Some of them constitute indeed new ways of representing information that is already available or comparing different sources of information, similar to the case of data profiling applications.

Against the background of the observations we put forth above, we can infer that in the current stage mashups do not live up to the expectations that were initially tied to them. Advanced ways of relating different information together will require a more sophisticated use of the metadata and semantic relations that are not found yet in many of the mashups available today. A computer program can learn about what the data means to process it. Interestingly, some 'experiment as data' prototypes may challenge if it is really possible to find a way of doing so.

4 DISCUSSION AND CONCLUSIONS

Drawing on our own observations and on Floyd et al. (2007) we can claim that mashups provide a way of accessing large amounts of information organized in forms that would be impossible to do on an individual basis. This is a key quality of mashups. In this respect, mashups are the outcome of a series of protocols and standards that enable the interoperability of diverse data sources publicly available on the internet. The convergence of computing and media technologies and the increasing sophistication of information processing have enabled the interoperability of information sources and modes of communication. However, while these developments may generate information that is useful they can also lead to meaningless and easily disposable information (Kallinikos, 2006). The cases of mashups analyzed above seem to suggest this latter case as an imminent possibility.

As far as meaning is concerned mashups provide some of the terms by which information has to be combined. In this respect they both delimit and participate in the construction of meaning on the internet (Esposito, 2004). It is important to point out here, as previously illustrated, that developers are principally preoccupied with the smooth use of mashups and in so doing they 'mock it up'. This means that after the information sources are combined, there is an abundance of information that has to be dealt with by organizing, simplifying and sorting it in visual and comprehensible ways. As the

developer works with that information in order to make it understandable and accessible to the end-user, the data sources may change format, forcing the developer to update the way in which the information was being visualized. This is also the reason why many of the mashups that have been developed a while ago are currently inaccessible. Since the developers do not control the data sources, their format may and does change unpredictably in ways that render the mashup obsolete. Furthermore, the format of the data sources' feeds is beyond the influence of the mashup developer. This issue preconditions the way the mashup is constituted as an artifact. In other words, though a mashup is understood as an artifact created upon combined information, the information source from which it becomes combined is already a pre-defined representation or mindset. This condition is endemic to the internet, since the sources that provide the feeds do not know *a priori* (and they cannot even know) nor do they directly care for what are being used *a posteri*. This issue restricts even further the intended flexible use of data feeds for developing Semantic Web applications in a broad public infrastructure.

As we noted in concluding the preceding section, the mashups studied give us enough evidence to claim that the developers effort to make the mashups easy to use, impacts their functionality and what the end-user can do with it. Functionality and ease of use become a bottleneck; they do so by introducing a number of constraints through which the generation of meaning, deriving from the combination of different information sources, must pass. This happens through the streamlining of the data feeds themselves and the ways they can be combined. Simplification is intrinsic to technology but the ways mashups narrow the electronic corridors though which data are passing to get mashuped are worth further and systematic investigation. One strong limitation in this respect is that the majority of these mashups have not passed through user's test to confirm whether their functionality is being constructed in a proper way. There is no any study of the practices of particular social groups from which mashups can gain inspiration. The developer's community takes the role of the final user in evaluating these functionalities, which is questionable, due to the fact that a developer community represents a very specific and certainly much narrower knowledge domain. Furthermore, such a practice conflicts with the rhetoric around the socially driven web 2.0 paradigm.

On the other hand, as we had seen in the case of the widgets, mashups of this type account with the quality of the content visualization or functionally features but not with its meaning. The inclusion of widgets reinforces the use of a new type of instrumentation that does not generate any innovative application; furthermore it may become more limited and restricted. However, these restrictions may also play a positive role in the sense that the resulting information becomes more narrowed or specific rendered information. The applications are not web mashups but client based applications, which reinforces the idea that the most developed mashups tend to become stabilized applications through its use.

The use of XML in the interoperability of databases is making more information visible; yet, the question is how this information is enabling new types of meaning. As we had seen from some examples, such as News Sniffer, there are applications that seek to develop new ways of evaluating information and constructing meaning, but these are still few and their use is often limited. Furthermore, though in the case of BBC, being a public service, the use of its feeds for critical or experimental purposes is not seen as a conflict, this may not be the case in other contexts. In the private sector mashups may reinforce the restriction of two key elements that are necessary for the interoperability of information. First, by means of metadata private interests would control the use of information; Metadata is powerful form of relating information items. Secondly, private interests would also turn to restrict the availability of information on the internet, as a consequence of legal reasons.

Many of the ideas behind the Semantic Web are related to the project of automating, in an intelligent manner, the information that is publicly available (Halpin, 2004). If we have not stabilized sufficiently sophisticated mashups, it would be difficult to realize the ideals associated with the Semantic Web. What our study suggests is that the technical but also the legal and institutional factors

surrounding the use of mashups are bound to heavily condition the transition to a socially driven internet.

Notes

[1] We could include a fourth type of mashup, which are the ones initially developed and that had no longer been updated; we will not focus in this particular type due to the fact that some had gone offline or are no longer extracting correct data feeds. Additionally, we believe that the permanent update of a mashup is critical for its evolution into a much more elaborated model or application.

[2] Available at: http://sambrook.typepad.com/sacredfacts/2006/10/sniffing_out_bi.html

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