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Abstract

Journalists and technologists increasingly are organizing and collaborating, both formally and informally, across major news organizations and via grassroots networks on an international scale. This intersection of so-called ‘hacks and hackers’ carries with it a shared interest in finding technological solutions for news, particularly through open-source software programming. This article critically evaluates the phenomenon of open source in journalism, offering a theoretical intervention for understanding this phenomenon and its potential implications for newswork. Building on the literature from computer science and journalism, we explore the concept of open source as both a structural framework of distributed development and a cultural framework of pro-social hacker ethics. We identify four values of open-source culture that connect with and depart from journalism—transparency, tinkering, iteration, and participation—and assess their opportunities for rethinking journalism innovation.

Keywords

computational journalism, data, hackers, innovation, journalism studies, online journalism, open source, participation, software development, transparency

In the past decade, the academic literature has yielded a picture of digital technology’s growing incorporation in the newsroom (Steensen, 2011): from early forms of online

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news (Boczkowski, 2004) and experimentation with convergence (Lawson-Borders, 2006; Singer, 2004), to journalists' later adoption of blogging (Hermida, 2009), user-generated content (Wardle and Williams, 2010), and social media (Hermida, 2012; Lsorsa et al., 2012).¹ However, a new phenomenon, crucial to this intersection of journalism and technology, is only beginning to be examined substantially: the fusion of computer science and journalism, as programmers assume an increasingly central role in news organizations and contribute to the growth of computationally derived forms of journalism, such as data visualizations, software applications, news algorithms, and other coding-based projects. Out of this interchange has emerged a new category of journalist: the so-called programmer-journalist, or 'hacker journalist' (Betancourt, 2009; Minkoff, 2011; Royal, 2012). As one programmer-journalist described the essence of this new role:

can you code, are you good at helping people learn about their world, and do you see how software as civic media might contribute to some sort of democratic or social good / making the world a better place? (Stray, 2011: para. 3)

Thus far, the discourse around this development has focused on a journalism-focused approach to taking advantage of these energized technologists.² However, both journalists and programmers have failed to interrogate what a technology-focused approach might mean for journalism innovation.

By a *technology-focused approach to journalism innovation*, we mean understanding how the ideas, practices, and ethos long held by communities of technologists could be applied to rethinking the tools, culture, and normative framework of journalism itself. Essential to this culture of technologists is an underlying commitment to the 'hacker ethic' (Himanen, 2001), an ideological frame through which '[p]rogrammers describe their craft as an activity that allows for personal unrestricted forms of creativity, expression, learning, and action, enacted through a medium, the digital computer, and preferably interfaced through a transparent and flexible, technical environment' (Coleman, 2004: 511). *Hacker* is a contested term, but in this context it refers to a broad range of computationally skilled actors (i.e. programmers, developers, coders, or technologists), and its ethic is marked both by experimentation and play as well as a pro-social interest in information liberation and democratic ideals (Coleman, 2012).

Journalists have been drawn to this hacker ethic—its DIY energy and entrepreneurial spirit—and hackers likewise have become increasingly invested in preparing journalism to tackle its digital future (Parasie and Dagiral, 2012). Crucial to this project of bringing together journalists and technologists, so-called 'hacks and hackers,' has been a focus on open-source software. Broadly defined, open-source software is a 'collective noun for all software with available source code, adaptable by all, under the limitation that the adaptations should be made available to others' (Wynants and Cornelis, 2005: 15). Open source—as both a practical approach to transparent and participatory coding, as well as a philosophy of sharing—is central to the hacker ethic, and provides common ground for groups and activities that bring together journalists and technologists.

The collaboration of journalists and technologists, with the ethos of open source at work, has become an international phenomenon stretching from inside traditional

newsrooms to news/tech start-ups on the edges of the journalism field. For instance, instead of seeing technology as the downfall (Usher, 2010), traditional journalism outfits are working hard to attract programmers' attention. Across the world, at news organizations such as Al Jazeera English in Qatar, Zeit Online in Germany, *The Guardian* and the BBC in the U.K., and the *New York Times*, NPR, and smaller metropolitan newspapers in the U.S., open source and hackers have drawn strong interest—and have begun to play important roles in creating interactive and data-driven content and infrastructure. The goal for these newsrooms, in part, has been to take advantage of the distinct way that programmers *think* about technology in terms of the hacker ethic we describe below, and to re-interpret this into the language of news.

To further emphasize this growing trend, leading institutions such as the journalism schools at Northwestern University and Columbia University have begun offering scholarships and joint degrees in computer science. The Knight Foundation, a global leader in nonprofit support for journalism, has made technologists central to its goals for news innovation (Lewis, 2011, 2012a), most notably in collaborations with Google and in a three-year partnership with the Mozilla Foundation, makers of the Mozilla Web browser, to promote open-source solutions for journalism.³ Additionally, a new grassroots group started in 2009, Hacks/Hackers, now has a presence in some 40 cities across every continent, with the goal of helping journalists and hackers network and collaborate in solving technological problems for journalism.

This article tries to make sense of this burgeoning moment in news and innovation as journalists and programmers increasingly work together, organized around the ideal of open-source solutions for news. After explaining further what open source means, we will posit our critique: Because the focus has been on solving problems for journalism, we feel that less attention has been paid to how the larger culture of how open-source software production might inform journalism's broader innovation. This article has five key sections. The first organizes the literature about the intersection between computer science and journalism, before the present focus on open source in newsrooms. The second is our attempt to explain how open source might be understood in the context of journalism norms and values. The third presents current examples of open source and journalism in practice, offering a critical assessment. Fourth, and most significant, we offer a radical, imagined framework of what news might look like if it were to embody open-source values and practices. However, in our final section, we question some of the practical limitations. What we attempt here is a theoretical intervention but also an introduction to this new space in the development of journalism and technology. It should be noted that there are problems with a radical open-source approach to journalism—from inter-organizational competition to news sourcing practices—and we do not advocate a prescriptive approach but merely a rethinking of what might be possible.

Journalism and technology

There is a long history of journalists working with digital technology, often with the primary goal of improving the news story. This fusion of computing power and news reporting, sometimes called computational journalism (Flew et al., 2012), is designed to bring 'algorithms, data and social science to supplement the accountability

functions of journalism' (Hamilton and Turner, 2009: 2). Cox (2000: 1) argues that the first U.S. instance of computer-assisted reporting (CAR) was in 1952, when CBS used the Remington Rand UNIVAC to predict the outcome of the U.S. presidential race between Eisenhower and Stevenson. Reavy (1996) also points to innovators such as Philip Meyer, who in 1967 used an IBM 360 mainframe to analyze survey data about the Detroit riots. Other early-adopter journalists began using computers in their work to analyze data.

In 1973, Meyer wrote *Precision Journalism*, advocating for the greater integration of computers, data, and social science methods in journalism practice. That same year, in perhaps an early iteration of open-source ethics in journalism, the *New York Times* made public an interactive system with information about New York City police statistics. Possibly the most visible moment for computational journalism came in 1989 with *Atlanta Journal Constitution* reporter Bill Dedman's Pulitzer Prize-winning report on unequal housing practices and red-lining. The U.S.-based National Institute for Computer-Assisted Reporting was also formed that year (see Cox, 2000, for an excellent summary).

By 1991, Meyer argued in the second edition of his book that journalists interested in CAR were their own breed of reporters, who often bought their own computers in advance of newsroom technology (Meyer, 1991). Journalism scholars began writing about the CAR movement around this time, and in 1996 Houston identified three key aspects of technological innovation and journalism production: database reporting, spreadsheets, and online reporting. Other articles in the late 1990s and early 2000s function as scholarly discoveries of the increasing prevalence of the CAR journalist (Gamson, 1998; Maier, 2000). However, the computer-assisted reporter was still primarily a *journalist* rather than a technologist; the underlying goal was to produce a better story. Today, however, the programmer-journalist differs from this CAR reporter in seeing the end product not as a story but instead as a 'productive artifact' of 'information filtering' (Jonathan Stray, personal communication, 27 October 2011).

Royal (2012) may have been the first scholar to look at the programmer-journalist in this new iteration: as separate from the CAR journalist. She interviewed and observed interactive news journalists at the *New York Times*, and tried to assess how these technologists were integrating into the newsroom. Her understanding was that these technologists simply loved and appreciated the values of journalism. And, when Nikki Usher talked to lead technologists at the *New York Times*, the sentiment was more about the ideals and ethics of journalism than it was about the technology involved. As one technologist put it: 'I could work for Google and make a whole lot of money, but I just like journalism' (field notes, 14 April 2010). However, what this literature and these observations leave missing is how *technology*—its practices and philosophies—influence newswork.

The articles that specifically deal with journalism and open source point to promises and potential without delving into issues of philosophy, culture, or conflict. For example, Witt (2006) offers an 'annotated checklist to guide those interested in reinventing journalism.' We agree with Anderson (2012), whose sobering assessment of the majority of literature on computational journalism (which comes from technologists) is that it is simply far too concerned with output, too focused on journalism norms without question,

and overly utopian. Consider, for example, the optimism of Cohen et al. (2011: 1): ‘There is a real danger that the proud tradition of original, in-depth investigative reporting will fade away with the ailing traditional news media... Luckily, a second trend is on our side: the continuing advances in computing.’

Scholars write about journalism as needing an upgrade to the digital age through computer programming. Many argue that computational journalism will both lead to better investigative journalism and create new forms of engagement with audiences, as Flew et al. (2012) note. Hermida’s (2010) write-up of a workshop with IBM addresses how data visualization technologies can be used to enhance journalism and public knowledge. Diakopoulos et al. (2010, 2012) similarly suggest that computational journalism can help journalists with their work—for example, by providing tools for visualizing social media data and filtering it for source information. All of these are worthy goals, of course, but this journalism-focused approach to technological innovation might limit the ability of open source, as a structural and cultural dynamic, to inform new normative behaviors for journalism.

We acknowledge that one theoretical lens to explore the interaction of technology and open source is through science and technology studies (STS), particularly its emphasis on the social construction of technology. However, we have chosen to adhere more closely to the texts that speak about the nature of open source as well as to those texts that speak to journalism and innovation. By analyzing journalism norms directly through the language of open source, we seek to achieve a more coherent assessment of how these two value systems intersect.

Open source as architecture and culture

Open source—sometimes referred to in the literature as ‘free and open-source software,’ or F/OSS (e.g. Coleman, 2004)—can be understood as a practical desire for open programming and a philosophical belief in social responsibility through freedom and openness (Coleman, 2012; Coleman and Golub, 2008). In this sense, open source is about ‘operating systems and social systems’ (Kelty, 2008: 57), or both an *architectural* framework and a *cultural* context. It is this dual emphasis on the materiality of open source and the ethos of open source that is important for understanding and assessing how journalists and programmers have worked together to build open-source solutions for news. Both architecturally and culturally speaking, open source is:

characterized by a non-market, non-contractual transfer of knowledge among actors, sharing relevant information with a non-definite set of other actors without any immediate recompense. Actors share their ideas with the clear purpose of contributing to a joint development. (Balca et al., 2009: n.p.; cf. Benkler, 2006: 60)

Embedded in that definition are the key structural characteristics of open-source projects (Weber, 2004): they are motivated less by proprietary, profit-driven control, and more by a communal interest in the greater good (Turner, 2005); they rely on contributions from a distributed set of actors/experts, typically outside the boundaries of conventional organizations; they offer non-monetary forms of reward, such as reputation, play, and sense of belonging (Himanen, 2001); and they are premised on an underlying assumption

of open, collective intelligence (Lévy, 1997). In short, the assumption is that software works best when it is freely available and jointly programmed.⁴

At the center of open source is the source code itself: a recipe of computer programming language that structures the parameters of a software application's functionality (Raymond, 2001). The source code is the kernel from which projects are developed, line upon line of programming script. In open-source projects, users can access, modify, and freely distribute the source code, thus allowing for a successful idea to scale quickly as it is copied elsewhere or built upon by others. As such, open source thus renders transparent the DNA of the technology, encourages users to make their own contributions to the code, and potentially facilitates greater speed and efficiency.

The architecture of open source is about both the collaborative nature of open software coding (the process) and the substance of what such software can produce because it is collaboratively programmed (the product). Wikipedia is often heralded as one of the quintessential open-source projects because of its free-editing structure and its higher-than-expected quality (Bruns, 2008; Reagle, 2010). Open source thus takes as given that the whole is greater than the sum of individual programming parts (Raymond, 2001). This is not to say that open-source coding invariably produces successful sites or applications—for the vast majority of these efforts fail to garner a sustainable community of interested developers (Hindman, 2007)—but rather that open source carries normative assumptions about the proper architecture for software systems.

This architecture motif can be extended to thinking about how software gets *built*. Raymond (2001) famously outlined two general approaches to software development: the 'cathedral' model, which represents the traditional method of engineering software through centralized control, clearly defined roles, and top-down direction by a select few designers; and the 'bazaar' model, which represents the (now common) open-source method of assembling software through a bustling hive of collective, incremental contributions. This latter method emphasizes treating users as co-developers; encourages their participation in reporting errors (or bugs) in the source code and working to fix those bugs; allows them to participate in the iterative testing of software throughout; and invites them to annotate their contribution in a running log of the software's progress.

Like the architecture of open source, this open-source culture carries with it certain assumptions about technology's normative values: namely, *transparency* (coding in the open, with bug-tracking); *iteration* (continuously releasing unfinished code for beta-testing); *tinkering* (privileging play and experimentation, focusing on the *process* of work more than its outcome); and *participation* (encouraging input from the widest possible group of collaborators). This open-source culture can be understood as part of the larger 'hacker culture' intertwined with the historical development of the internet itself (Keltz, 2008). With this in mind, we take these normative values and see how they might work within the context of journalism.

Journalism as transparency. Hackers are 'frequently committed to an ethical version of information,' believing that information ought to be shared for the greater good (Coleman, 2012: 3). Open-source culture assumes a transparent rubric whereby changes to the source code are shared, accompanied by excessive documentation. Journalism itself strives for transparency as an ideal (Singer, 2007), and digital journalism has

enhanced opportunities for such transparency (Phillips, 2010). But open-source transparency can push journalism further. Instead of seeing news as the end product, users would be able to see journalism as a more fluid set of interactions—a *process* to which they can meaningfully contribute (Robinson, 2011). *The Guardian* revealing its newslister of the day's stories,⁵ begins to shed light on how media organizations give shape to the news. Yet the transition to such openness, because of the challenge it poses to journalistic autonomy, 'has yet to make the kind of impression forecast by many scholars' (Karlsson, 2010: 543).

Journalism as tinkering. Open-source culture also advocates an ethic of tinkering, in line with burgeoning 'maker' communities of DIY hobbyists (Sivek, 2011). This ethic privileges playfulness, remixing, and radical experimenting, with a pro-social interest in doing good. Tinkering—whether it's simply toying with a product that may already seem to be working fine, in hopes of making even small improvements, or seeking to make something more finely suited to one's needs—is a core part of the hacker ethic, with hackers having an 'inquisitive passion for tinkering' (Coleman, 2012: 3). Journalism could use a little more tinkering. Too often, newsrooms get swept up in attempting big change (as in the push for convergence documented by Singer, 2004), when, instead, newsrooms might tinker with their existing product: perhaps recalibrating small pieces of the organization, or making incremental improvements to the workflow. Tinkering also means building, suggesting that journalists could begin rethinking how to play with their existing products (e.g. blogs and social media) and recharge them. Nonetheless, we can see journalists as tinkerers already, working to refine and perfect a story; yet, it remains possible to push journalism beyond this form of tinkering.

Journalism as iteration. Along with tinkering comes the freedom to fail. Open-source software privileges iterative forms of development. In contrast to the traditional 'waterfall' method of software development—where a product only appears after a step-by-step cascade of formalized and centralized planning, design, testing, and implementation—an iterative method focuses on process rather than product: on releasing beta versions early, engaging users in collaborative design, and being agile in responding to user needs as they are discovered (Chocano, 2004). In open-source development especially, feedback from the community is crucially important in the rapid progress of new ideas (Wusterman, 2009). Traditional journalism faces many challenges as it attempts rapid change that might be unsuccessful, in part because of the economic pressure on many legacy news organizations, leaving little room for failure. But not every change need be a 'reinvention of the newsroom,' as the *New York Times* described its 2007 efforts (Susan Edgerly, personal communication, 2 April, 2010). Newsrooms can take small chances, make incremental steps toward change, and ultimately overcome the fear of failure. Some are starting to do so, and out in the open, such as the Journal Register Company, a U.S. newspaper firm that encourages open news meetings, suggesting that 'the process of journalism matters as much as the product' (Garber, 2011).

Journalism as participation. Similarly, open source hinges on distributed participation. The concept, though not historically part of journalism's normative framework, is emerging as a growing fact of life for news organizations (Singer et al., 2011) and a 'founding doctrine' of news innovation—a journalistic ethic for the digital age (Lewis,

2012b). Open source reinforces this ethic with the assumption that ‘given enough eyeballs all bugs are shallow’ (Raymond, 2001), that collective intelligence and wide-scale participation inexorably lead to better, faster, and more efficient development of software. In peer-to-peer (P2P) projects like open source, even though claims to power and authority are unequal, the rhetoric of equal contribution allows participants to construct a cultural framework in which ‘they can be imagined as peers devoted to a collective mission’ (Turner, 2009: 77). An open-source approach to news thus continues to build on what is already happening in journalism writ large (for examples, see Robinson, 2011; Singer et al., 2011), but suggests that users take on a more active, interlinked, and monitorial kind of role—helping to supervise the ‘software’ of news, rather than merely adding comments post-publication, as too often is the case.

In sum, open source as architecture and open source as culture together represent a platform for and ethic of transparency, tinkering, iteration, and participation. The next two sections extend this focus on architecture and culture, examining first how they have been applied (or not) in institutional newsrooms and, second, how they might lead to a fundamental rethinking of journalism. Notably, these values *do* (and in some ways are intended to) clash with existing practices of newswork, as we note later.

Open source and the newsroom

Though journalists and technologists are increasingly working together to bring open-source tools into the newsroom, they have largely failed to interrogate the old processes of newswork. Instead, their collaboration has focused on new tools that help traditional journalists further their goals of doing journalism the way it has always been done. While it is notable that journalists have new ways for achieving the best of traditional journalism, what open source has yet to do is push journalists beyond the newsroom, figuratively and literally. For instance, many of these tools are created mainly for newsrooms, even if the open-source code, by its nature, implies possible applications for anyone online. Furthermore, most tools fail to provide the kind of transparency that open-source journalism could ideally embrace.

A consistent trend has emerged as newsrooms have adopted new technologies: journalism practices, norms, and routines have made ‘ordinary’ the potentially innovative nature of blogging (Singer, 2005), user-generated content (Wardle and Williams, 2010), and social media (Lasorsa et al., 2012). For example, user-generated content has been deemed useful only if it meets the needs and quality of a pre-determined news story (Usher, 2011). Newsrooms have been quick to impose social media ethical guidelines; instead of experimenting with how audience participation might change the journalism conversation, news institutions have tended to retrofit yet another reporting tool (Hermida, 2012).

This approach of tool-driven normalization is apparent in several emerging examples of open source in journalism, all of these much heralded by the journalism community at events such as the Online News Association convention or by institutions such as the Knight Foundation.⁶ In concert with the literature reviewed that celebrates what open source can do for journalism, these tools signal the acceptance of traditional journalism practice and methods as an inherent good, and aspire to help journalism reach its ideals.

Yet open source offers the capacity to rethink some of these practices because of its alternative emphasis: participation from multiple sources, collaborative community building, and increased transparency.

The *New York Times* developed Fech,⁷ a tool that helps journalists crawl financial disclosures by political candidates simply by knowing a filing number (Strickland, 2011). Just as the discourse around open-source tools emphasizes their pro-social benefits, Fech's creators note that more access to these filings will lead to better journalism (personal communication, Derek Willis, 24 October 2012). This is quite in line with open-source thinking that more transparency will produce better results. However, there are barriers to entry that limit wide public participation: while the source code is posted on GitHub for other developers, the tool has been built mainly to help people in the newsroom. Those who do not have the skills cannot build upon the tool.

Some open-source advocates have pushed for greater transparency with news and investigation, suggesting that the public can actually help ongoing investigative work (Meredith and Meinrath, 2011). However, other open-source tools continue to maintain a one-to-many relationship with the public. ProPublica's TimelineSetter—an interactive HTML timeline tool that turns 'ugly spreadsheets into pretty timelines' (Phelps, 2012)—makes it easier for the public to understand the unfolding events of a particular news issue.⁸ The process of reporting the story is shared with the public—but generally after the fact. The practice of keeping every reader apprised of a new detail is not what we advocate; but we do think that reporters could tell the story of how they do their work as they do it, perhaps inviting the community to participate in the open-sourcing of their news processes.

Tool builders themselves have begun to critique this practice of building applications that assume this normative approach to solving problems. As *New York Times* programmer-journalist Jacob Harris (2011, para. 2) wrote:

What we're really looking for is something that will tame the complex work of reporting itself. What we see in each new tool is the frothy hope that it will be, somehow, The One. But it never will be. There is no tool that will make the journalism simple.

Instead, he argues that we ought to relish the complexity of journalism and think more broadly. The best programming happens as a result of complexity and unknowns, and, as he argues: 'The essential complexity in journalism is there because good journalism is by its definition not something that's been done before' (2011: para. 8). Open-source tools are not the answer if they reinforce the status quo; their potential lies in the capacity to challenge the existing norms of traditional journalism.

Some tools do embrace open-source culture, primarily because they create opportunities for collective intelligence and bug-fixing, and because they envision journalism as process rather than product. One such example is DocumentCloud,⁹ a Knight News Challenge winner led by Aron Pilhofer of the *New York Times*. The goal of DocumentCloud is to host primary source documents for researchers and journalists, which they can then annotate and publish to the web. 'Readers will also be able to quickly search, annotate and bookmark documents—and for the first time link directly to specific pages or passages' (Seward, 2008: para. 4). This collaborative, annotative journalism resembles the

kind of documentation that is common to open-source software practices, from the back-end of Wikipedia to Linux kernels.

New frameworks for news

With architecture and culture in mind, we propose a possible intervention by rethinking the framework of traditional news. Going beyond merely swapping tools or tinkering with newsroom culture, a tangible, radical change might be to imagine how to make news structurally different. This process of rebooting journalism might embody values that are different from, but are nonetheless still complementary to institutional journalism. Such a reshaping requires both change in structure (technology architecture, in this case open-source software) and change in milieu (technology culture, in this case the hacker ethic), played out across the profession at large and, in particular, newsroom contexts where innovations get deployed. This rethinking might take up questions such as: how might news production become more participatory, more open, and more iterative and process-based—in the style of open-source software development? Likewise, how might newswork be rethought to engage information in new kinds of ways, reconfiguring the journalist's role relative to the community to encourage transparency and engagement? How can newswork, both structurally and culturally, become more iterative and open to learning through failure? Herewith we suggest two thought experiments.

Imagining the news story as code

We begin by considering the story as source code. The journalist would provide the kernel of the idea, much like the first few programmers provide the beginnings of a new software program. But from this source code, the collective input of readers could be harnessed to make newswork a visible and engaged process. The story could still be reported according to traditional means, but after the story is published, it takes on new life. News organizations could harness energy directed toward developing, trashing, or commenting on the story. For example, with the rise of 'annotative journalism' (Graves, 2012), whereby news increasingly gets fact-checked and added upon by the public and professional monitors, it could be possible to add a wiki layer on top of a news story. Users could be encouraged to document their suggested edits alongside the original 'source code' of the story.

There are two potential problems with this idea, however. The first is that not all users might think like open-source collaborators—and a wikispace could easily turn into the 'wikitorial' fiasco that the *Los Angeles Times* experienced when it opened its editorial page to collective editing (Bradshaw, 2009). As a result, the community contributing to the story would either have to be entrusted with policing the content of this annotative journalism, or a news organization would be tasked with this role. It is unlikely that a news organization could take on this additional role, given already overtaxed journalists and current problems with regulating comments on stories. However, new technology has increasingly made automated post-comment moderation a possibility.

Furthermore, for annotative journalism to become 'officially part of the story,' journalists would also have to be willing to integrate 'fact-checked' and crowd-sourced

content into the branded and bylined content. Both fact-checked and crowd-sourced information increasingly figure into the news product, but these often remain as stand-alone columns or blogs, not as part of existing and evolving stories (Graves, 2012). It is possible, though, that newsrooms are adjusting to a more fluid form of news (Karlsson, 2011), particularly with constant updates in a 24/7 news environment. As such, the notion of the news story as code offers one way to think about bringing open source's idea of documentation and deeper transparency to journalism—and one way to think about giving a story life beyond its initial publication.

Imagining journalism as knowledge management

Journalism, of course, plays more than just a role in transmitting information (Carey 1989); it also acts as a cultural repository of memory and values (Kitch and Hume, 2007; Zelizer, 1992). Open source can bring together this split between journalism as information and journalism as culture by considering journalism as knowledge management—which takes the burden of information dissemination and combines it with the idea of cultural participation in knowledge creation. As the Mozilla Foundation puts it:

News should be universally accessible across phones, tablets, and computers. It should be multilingual. It should be rich with audio, video, and elegant data visualization. It should enlighten, inform, and entertain people, and it should make them part of the story.¹⁰

Thus, news in a world of open source brings together people by sharing information as a cultural experience and not just as an information-seeking process.

Thinking of journalism as knowledge management would involve displacing the newsroom as the center of newsgathering. Instead, journalists would be helping to bring together all of the accumulated knowledge that people have contributed across open-source platforms and social media venues. Journalists would be curators in a community conversation, directing the goals of the conversation but involving community members as active participants, much like the pro-am collaboration envisioned by Jarvis (2006) and Beckett (2008).

Technology tools and platforms provide journalists with the capacity to act as knowledge managers. The tools themselves are inert, but with open-source technology, journalists can better access the knowledge of the community. Technologists have long been in the business of organizing complicated information systems (Swedin and Ferro, 2005). Combining the hacker know-how of software architecture with the open-source culture of participation emboldens journalism to think of information as both process and product. For instance, information that gets scribbled in a reporter's notebook (process) but never makes it into the resulting story (product) can find new life, as it were, as data embedded in a knowledge management system. Such a database might better organize the daily trove of information that journalists gather and also render that information more accessible and useful to the public, resulting in value both internally to the newsroom and externally to the community.

Or, to flip the equation of information flow: a knowledge management system might focus less on what journalists gather through their own investigation and focus more on managing the far larger pool of data produced daily by other actors in the

media ecosystem, with the goal of filtering that information in a way that makes it more understandable and actionable for users. Whether inside-out or outside-in, both efforts at open-source knowledge management not only enhance the normative goal of transparency described previously, but also encourage journalists to rethink their role relative to information, communication, and society.

In all of this, we must acknowledge journalists' source-related limitations, such as off-the-record confidentiality, state secrecy, and the like. However, open-source journalism need not mean revealing and documenting every conversation that takes place, or the results of every interview. Rather, open-source journalism invites the reader to better understand the process through which journalists understand the knowledge that they gather, and choose what to report. Radical transparency is neither called for nor necessarily desirable.

Of course, these suggestions are more hypothetical and even idealistic than immediately practical. There has been a long history of trying to bring together journalists and community, most notably with the 1990s public journalism movement and its effort to make newsrooms more aware of and responsive to ordinary people's concerns (Haas, 2007). What is different now is that technologists can lend their expertise to helping journalists act as curators. With technologists' help, journalists can begin to re-situate their role as knowledge managers, combining both the ritual and transmission experiences of journalism: making people part of the story, and extending the story's flexibility and reach at the same time.

In conclusion, open source, as architecture and culture, challenges journalism to move beyond thinking of its work as confined to a traditional newsroom. It encourages newswork to be a shared, unfinished and imperfect process as much as it is a refined and authoritative product. Open source further creates an opportunity for traditional journalism to exact a greater claim to authority—working together with the public, journalists can catch all bugs—and, in so doing, produce greater accountability.

The limitations of open source

Open source, like journalism, also requires critique. As such, we find it necessary to raise some of the most common problems with open source, which are also likely to come with open-source journalism. Open source has been criticized for its lack of scalability, its re-creation of hierarchies, and its unclear relationship with corporate entities. Within the context of combining open source and journalism, we should also question the influence of major institutions like Knight, Mozilla, and Google in this integration. These problems, however, do not overshadow the promise of the underlying ethos of open source as a starting point to rethink some of the normative assumptions about journalism; rather, examining the concerns avoids making open-source journalism sound overly utopian.

As Raymond (2001) notes, every good open-source project starts with a developer's itch. But open source requires that people build and contribute (Keltly, 2008)—and many such projects fail when a critical mass of participation never appears or quickly falls off (Hindman, 2007). Newsrooms face two challenges in this regard: the first is attracting top programming talent to news projects, beyond the informal get-togethers of Hacks/

Hackers and the contest-style collaborations of Mozilla and Google. The second is attracting people to projects once they are built: for example, getting citizen contributors to put the dots on the map to show where an event has taken place. Hackers need to continue to feel that working with journalism is indeed a project that helps further the freedom of information; if newsrooms are too reluctant to innovate with greater transparency and iterative development, hackers may be less likely to choose to spend their time working with journalism. Similarly, users need to feel that their contribution to an open-source project makes a real difference to the process, not merely as an afterthought to the published product.

Additionally, while open source suggests equality of contribution, rooted in the rhetoric of technology culture (Turner, 2009), good open-source projects require leadership. Open source can be led by a 'benevolent dictator,' as in the case of Torvalds' steering of the Linux operating system (Raymond, 2001), or it can function as heterarchy (Bruns, 2008), with distributed authority. But someone must be in charge of standards. If the open source community becomes too concerned with standards, innovation and participation may be hampered—as can be seen in the case of Debian Linux kernel, which requires credentialing and testing for potential programmers to become certified. Ultimately, many open-source projects have drifted toward centralization and bureaucracy; this is true even of Wikipedia, the widely heralded open-source success (Reagle, 2010).

We are also concerned with claims that journalism should become more like Silicon Valley, as news prognosticator Alan Mutter (2011) put it. Silicon Valley, as a culture 'promiscuously combin[ing] the free-wheeling spirit of the hippies and the entrepreneurial zeal of the yuppies' (Barbrook and Cameron, 1996; see also Turner, 2005), inspires the freedom to fail, but Silicon Valley also represents a culture of backstabbing profiteering by venture capitalists and bursting bubbles. And, like corporate culture generally, it's driven by a profit motive that doesn't always sync with the public service orientation of journalism's ideals. Open source, decoupled from its roots in free software (Stallman, 2002), in many instances has been co-opted in this environment; major corporations such as IBM have been among the largest investors in open-source development (Hindman, 2007). While it's true that open-source software continues to shift away from purely 'free' projects, it nevertheless can and should preserve its origins in the hacking spirit of transparency.

Finally, these problems with open source also point to the need to question its aggressive promotion by the likes of Knight, Mozilla, Google, and other institutions seeking to shape the future of journalism and technology. Issues of power, ideology, and control ought to be part of future studies of this emerging connection between the journalism field, tech communities, and open source.

Conclusion

With the emergence of programmer-journalists in the newsroom, the energy around open source and journalism is more than a passing fancy of the hacker community. What hackers bring to journalism has the potential to reinvigorate newswork in a way that moves beyond merely thinking about newsroom economics and gets to the heart of newsroom

philosophy. Open source offers the opportunity for technologists and journalists together to think about traditional journalism as espousing new values—not diminishing long-standing virtues, but instead providing a new framework that makes journalism more relevant in a participatory, digital culture. These values of iteration, tinkering, transparency, and participation, each embedded in the open-source ethic, can be brought into the newsroom as architecture *and* culture—as a structural retooling of news technologies and user interfaces, and as a normative re-articulation of what journalism means in a networked media setting. While acknowledging that our repositioning of new frameworks for journalism may be radical, we hope that they also offer a chance to think expansively about the new intersection between open source and journalism in the newsroom.

Thus, we suggest an important warning: just as journalism and its professionalism can become calcified ideology (Deuze, 2005), creating barriers against needed innovation, open source too can become ideology (Kreiss, 2011). The culture, ethic, and practices of open source should remain open to critique. Open source should not be seen as the end-all answer but rather as a strategy among many for accomplishing innovation. Codifying what it means to do things in an ‘open-source’ way necessarily limits the expansive opportunities for unexpected creation that might occur outside such a framework. Ultimately, we should be careful not to fetishize this concept, or any other, as a panacea, particularly at a time when the latest technology invention is too readily seen as the salvation for journalism’s troubled model in the 21st century.

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Notes

1. For a thorough review and related case studies, see Domingo and Paterson (2011).
2. See for example: <https://wiki.mozilla.org/Drumbeat/MoJo> and <http://microsoftcambridge.com/Events/HacksHackersONAHackDay/tabid/849/Default.aspx>
3. See: <http://knightmozilla.org/>
4. As a clarifying note, open-source code is free, but it may in fact be created for commercial ends (hence the rallying cry ‘free as in speech, not as in beer’).
5. See: <http://www.guardian.co.uk/help/insideguardian/2011/oct/10/guardian-newslist>
6. A number of news-related open-source projects can be found in a new repository called Source, available at: <https://source-dev.mozillalabs.com/en-US/about/>
7. See: <http://open.blogs.nytimes.com/2011/08/29/introducing-fech/>
8. See: <http://www.propublica.org/nerds/item/timelinesetter-a-new-way-to-display-timelines-on-the-web>
9. See: <http://www.documentcloud.org>
10. See: <https://drumbeat.org/en-US/journalism/about/>

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