

Interactive Newsprint: The Future of Newspapers? Printed electronics meets hyperlocal and community co-design

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Abstract:

The news industry is currently in a well-documented state of flux, with publishers from across the developed world examining new business models, reinterpreting existing relationships between their income streams and readers, while maintaining their ability to generate editorial output that is relevant and interesting to the communities they cover.

[Interactive Newsprint](#) seeks to add a new and revolutionary dimension to this media evolution by asking: can printed electronics and internet-enabled paper (technologies that utilise standard paper and printing processes and through conductive ink and battery power offer capacitive touch interactions similar to smartphones and tablets) create a new way of transmitting community-based news and information?

Utilising co-design techniques and practices, the project seeks to produce community-relevant hyperlocal text and audio content and place it on a centuries-old platform: the newspaper. As a result of the paper's internet connectivity, the project is also examining potential benefits of transplanting some online features such as analytic data on user interactions. Led by the School of Journalism, Media and Communication (JoMeC) at the University of Central Lancashire (UCLan), the 18-month, EPSRC-funded project is therefore examining the potential for community co-design and printed electronics to transform paper-based news and information for the 21st Century, along with revenue and data generation that is unique to digital formats such as websites, social networks, smartphones and tablets. Building on work carried out on the [EPSRC-funded Bespoke project](#), researchers from UCLan, University of Dundee, University of Surrey and commercial printed electronics firm Novalia are prototyping a series of paper-based community news platforms that are populated by content produced by community reporters and generated through an iterative co-design process.

This paper will outline the methodology, technological potential of interactive newsprint and how the project is looking to embed analytic data into traditional printed-paper formats. It will also focus on how members of the Preston community are shaping both the news and platform over the 18-month process. As the project is mid-way through, the paper will present an overview of the project to date, outline the design methodology and describe and demonstrate the early-stage prototypes. The paper will also hint at new editorial construction practices as community and professional reporters all contribute to the hyperlocally-themed editorial output. The authors will present a discussion of the theoretical framework that underpins the project as a whole. In addition to the practical illustrations, the paper will outline the authors' initial thoughts on how interactive newsprint – through its internet connectivity and potential for data transfer – could revolutionise editorial and advertorial relationships.

Media ecosystems and conference relevancy

Whether investigating new revenue streams such as crowd sourcing or establishing paywalls, ensuring readers find their content by employing social media or search engine optimisation tactics, or expanding multimedia coverage or creating interactive communities around their publication, media organisations are navigating a new digital world that offers challenges, commercial opportunities and the potential to create a rich editorial experience. Tablets, smartphones and the growing accessibility of mobile data and Wi-Fi enabled hotspots have also driven media companies to develop applications for the expanding device user-based. Analogue newspapers, and the advertising revenue associated with them, are in steady decline, seemingly usurped by digital innovation, multimedia expansion and the proliferation of high-speed broadband, 3G networks and quickening data transfer rates.

It is against this background, that Interactive Newsprint and the project's methodology and research questions are relevant to the 2012 International Conference on Media and Communication (ICMC), particularly the first stream of enquiry: business, process and practices of journalism in the 21st century. Social media and digital content are the catalyst for a global media revolution, and printed electronics, with its ability to use standard printing press and paper, but with the addition of digital content and internet connectivity, is occupying

a radical space that counters a widely-held and almost universally accepted assumption: that the printed paper news format is currently experiencing long, drawn-out but ultimately inevitable death throws. Interactive Newsprint instead investigates an opportunity to reach communities via printed text, but extract online values – such as audio interactions and information transfer from newspapers, newsposters or news-leaflets. This paper will outline and examine this potential at a crucial midway point in the project.

The future of news: Printed newspapers...?

INTRODUCTION

Within the current media landscape, there is a general assumption that continued technological advances, internet proliferation and a continual re-skilling of journalists into multi-media and multi-talented reporters will create an environment where media is screen-based and ubiquitous for many in the developed world.

This may be true. However, is the proliferation of touchscreen technology an inevitability and is the newspaper, a daily facet of human society that has evolved along with the printing press, really doomed? This paper, which examines the 18-month EPSRC-funded Interactive Newsprint project at its midway point, will question the assumption that technology and its evolution will naturally create a screen dominant experience at the expense of printed media. Using cutting-edge printed electronics and internet-enabled paper augmented with capacitive touch capabilities (i.e. printed matter that is capable of playing digital audio content when activated by human touch), along with community co-design techniques and iterative interaction design, it will discuss how alternative technologies that centre around a paper-product could see a Darwinian evolutionary strand that stands apart from high-end screen technology that, in some cases in the developed and developing world, restricts access to internet and digital content. Amid a shrinking distribution network of regional and national newspapers, which has been in steady decline since the end of the 20th century (Meyer, 2009) and continuing in recent years in many Western countries (OECD, 2010) we will also investigate whether in some communities, paper-based news and information with additional capabilities could form a solid commercial offering via a number of revenue streams. A key element to the research project is to ask if analytic data from paper-based interactions could add a vital data stream to advertisers. Could newspaper advertising, via this new technology, return click-through rates, time-spent statistics and a range of other information that would increase revenue for print platforms.

Through recounting the Interactive Newsprint project, the paper will focus on the potential impact of printed electronics on the news industry and suggest that a focus on tablet-based technical innovation may be blinkered. We will also outline our community-centred design methodology that places digital design expertise, professional journalists, human computer interaction academics and printed electronics developers within a co-design environment to better facilitate a community-focussed news and media output. Through employing this method, it is hoped the output would be relevant to a number of communities based in Preston, UK, that the content and business models are tailored and relevant to its users.

Project methodology: Community journalism and codesign

Between 2009 and 2011, the EPSRC-funded Bespoke project sought to innovate digital codesign methodologies through using community-based journalism. The combination of both digital innovation and community journalism produced a number of outputs. Our 'Insight Journalism' (Blum-Ross, Rogers, Marshall and Mills 2011) methodology produced a model for community engagement and design insights through the use of community-centric storytelling and publication. Through training and supporting local volunteers, and inviting other local agencies, organisations and agencies to contribute to our online and offline platforms, we built a multi-media rendering of a complex community. Bespoke's design teams sought 'insights' from the media that would aid the development of digital technology for that specific area and for those living there. Insight Journalists would produce stories on these designs once installed to judge their effectiveness and relevance. Designers would then iterate their concepts, refining it in light of the feedback they received: thus closing the reporting-design-report-design loop.

What became apparent during the two-year project was the value many members of the Callon and Fishwick community, which is classified as one of the ten-percent most deprived areas in the UK (Preston City Council, 2009), found in a printed newspaper covering their own area. We also found an enthusiasm for the co-design process from members of the community and local agencies/organisations – with a number of groups, individuals and organisations contributing to the project at various points over the duration of the research.

Through working with the same communities, along with new groups throughout the city of Preston, Interactive Newsprint hopes to continue both the methodological approach cultivated in the co-design elements of the Bespoke project, the relationships we nurtured on the ground, but also focus exclusively on the concept of printed news and information that is generated, influenced and consumed via printed matter. Bespoke published a monthly newspaper for 18 months, and following the end of the project, the partners that formed the Interactive Newsprint project, at its inception, felt that a key area for research would be to investigate how newspaper could form part of the 'Internet of Things' (a concept that sees objects in the 'real world' connected to the Internet through digital technology) in terms of both the content it held and analytic functionality. In theory, this would create a dual advantage for printed matter could span both consumption and commercial necessity.

Multimedia landscape and Interactive Newsprint

Over the last decade, the steady rise of online news and information production and the increasingly amenable broadband connectivity rates, falling costs of production equipment and home computers - the physical manifestation of Gordon E. Moore's prediction that the number of transistors on an integrated circuit board will double approximately every two years, and the resulting consequence of exponential growth of processing power and memory (Moore & Fellow, 1998) - have heralded a fundamental change in how the developed world produces, consumes and pays for editorial content.

So far, this has been the case and can be charted with the rise of online publication, and the shift to tablet and smartphone editorial output and consumption: which offer a number of distinct advantages, specifically new revenue streams (through subscription and 'app' purchase) and multi-media experiences for the user. This form of interaction also offers another facet of the digital world; which is to connect. Accessing communities and becoming part of a dynamic communications network as been advanced by digital communications and social networks. It is also this feature of the digital world that leaves printed newspapers remote and closed, with the only opportunities for offline interaction being either a call to the newsdesk or the 'letters to the editor' page. We have now reached a tipping point within the media landscape, which is that smartphones, laptops and home PCs are now prevalent within many communities and the ability to populate platforms is equally within the realm of citizens as well as media houses and publishers (Gillmor, 2006). With expanded data connectivity, falling hardware prices and a seemingly insatiable appetite for remote communications devices, media organisations are targeting this new market.

The future of newspapers, or more accurately the death of print news, has been a recurring subject for discussion for well over a decade. The steady decline of print circulation, loss of advertising revenues and pressures on the cover price appear nothing short of disastrous when pitted against print media's lofty past (Meyer, 2009). In the States a suite of long established titles have closed whilst in Britain and across Europe cost savings and efficiency gains are the order of the day. The promise of increased revenue from online advertising activities is turning out to be hollow at best. It is seven years since Richard Edmonds, a researcher at the Poynter Institute for News, predicted that assuming revenue from online advertisers grew at the admittedly rather optimistic rate of around 33% a year, it would equal print by 2019. It is a long way from looking like it will even be close and that is in spite of the continued fall in print advertising revenue. Johnston Press, one of the largest newspaper groups in the UK, expect their advertising revenue split between online (digital) and print to be 50/50 by 2020. A bold assertion considering lessons from across the Atlantic. CEO Ashley Highfield has already acknowledged that a 50/50 split of an ever dwindling pot will not be enough to fund the staff journalists who survive the next round of cost cutting to deliver local content relying instead on user generated content.

Whilst the internet and all things 'digital' are consistently, and occasionally too conveniently blamed for the death of print there's also worrying evidence of a more general underlying trend of a falling appetite for news regardless of the platform it is delivered on. Whilst received wisdom has prompted a shift in some corporate news company strategy to capture a younger audience through a wholesale shift of news onto digital platforms perceived to be the domain of a post literate generation, those involved in this risky strategy saw their readership fall as they alienated traditional readers by diluting the print product, simultaneously failing to engage new audiences on digital platforms - desktops mobiles, tablets and in a few cases games consoles. Without exception the industry has failed to properly understand their new readers as 'users and producers', and no longer passive recipients. A recent survey on news consumption (Pew 2011) showed that people were no longer simply migrating from one technology (newspapers) to another (websites) for their news. Pew's research showed people beginning to exploit the capacity of new technologies to interact with information differently and in the context of news and information people were beginning to use new tools differently, exploiting their particular properties and using them alongside existing technologies. Similarly, print news organisations have misunderstood that the new digital platforms apparently adopted by the youth market were equally impassive offering users a media rich interactive experience fundamentally different to that on offer in print. Crucially, they have failed to invest in their own future, electing to protect unprecedented operating profit margins through cost cutting. As early as 2005 in the United States, the Project for Excellence in Journalism's State of the News Media observed: "If older media sectors focus on profit-taking and stock price, they may do so at the expense of building the new technologies that are vital to the future. There are signs that that may be occurring."

In 2012, short-term thinking still prevails against a backdrop of pending doom within print newsrooms fuelling further cost cutting prompted by a lack of investor confidence.

Meanwhile, as opportunities for printed news output dwindles the threat from online and social media competition increases. MSN and Google continue to build their businesses expanding into news and redirecting revenue and eyeballs from traditional media outputs. eBay and none profit sites like SwapShop, Freecycle and Gumtree are either soaking up revenue from newspaper's staple of classified advertising or replacing the need to pay for local advertising at all.

Such a comprehensive failure to lure digitally native and non-native audiences demonstrates the complexity of a dynamic digital landscape.

Hyperlocal: the failing of the regional press and expansion of the community reporter/citizen journalist

Looking specifically at the regional press, the perceived death of printed matter offers a different set of problems to local democracy and representation. When viewed at a national or international level, the move of news from the printed form to online rendering has seen the rise of the blogosphere, expansion of news agendas, led by likes of the Daily Mail, Telegraph and Guardian, have tended to target larger national or international marketplaces to ensure they foster new and growing revenue streams. Although the Guardian's notice.com community noticeboard website offers a new incarnation of local (or hyperlocal) reporting, the regional press – once a communal hub for communities across the UK that were geographically, socially and politically disparate from one-another – has fallen into an economic cycle of reduction and failure. Some regional papers are reducing their publication frequency and jobs are being cut regularly, and the impact this has on local reporting is stark. Hyperlocal publication, and initiatives from a number of funding organisations – such as the National Endowment for Science, Technology and the Arts' (Nesta) Destination Local Initiative (Nesta, 2012) are looking to invigorate local journalism, whether that be from a community, professional or start-up perspective. Nevertheless, questions can be asked around the current effectiveness of the regional press in the areas in which they are based. Working in a specific area in Preston, researchers based at the University of Central Lancashire (UCLan) found that certain communities felt unrepresented or even misrepresented by their printed publication. During the course of the Bespoke project, it was also mooted that the move to online output was something many within the area were apathetic about. Printed output was deemed to be a valuable commodity for a number of reasons. Delivered to 2,200 households it carried simple community content: details on local events, activities and general news on issues that were, for the most part, positive but on occasion dealing with harder news such as arson attacks. Also prominent was the ease of consumption that newspapers brought in an environment where PCs were perhaps not as prevalent in other areas of the country. Smartphones are present within the community, but older residents told researchers that they preferred basic functionality of dumbphones and had little interest in using other functionality. Interactive Newsprint, therefore, wants to provide an alternative point of contact between these communities and offer them a unique, and digital-based interaction portal through printed electronics.

Printed electronics and paper interactions: what is interactive newsprint?

Interactive paper is a type of “smart” paper created by printing electrical devices on various substrates. Printing typically uses common printing equipment or other low-cost equipment suitable for defining patterns on material, such as screen printing, flexography, gravure, offset lithography and inkjet. The resulted paper matter is responsive to a human touch, can connect to the internet and play a sound once a certain area on the surface is pressed. This means that sheets of paper can turn into reactive displays. For example, imagine a

community news poster with an interactive title. This could be designed to advertise and illustrate articles read aloud at the push of embedded buttons around the edge of the poster. The title text could show the times of forthcoming community events or meetings.

Alternatively, imagine a home notice board display or picture frame containing active paper to which community club members could broadcast club news in short SMS text messages or voicemails.

Communities

Across the UK, the charge that can be levelled at some quarters of the news industry, and particularly the regional press, is the lack of representation and adequate coverage of the communities that those publishers are covering, informing and representing. With the drain on online advertising revenue (Perry 2012), UK-based publishers such as Johnston Press, Trinity Mirror and others are searching for effective revenue streams and balancing what content, in a changing media world, would appeal their audience: if an audience could be defined within a dynamic geographic level. This current malaise may also be accentuated by falling staff numbers and a move away from the traditional printed newspaper, as highlighted in the North American market by Philip Meyer (Meyer 2009).

Newspaper journalists – or more accurately the companies they work for are good at identifying threats to their revenue streams. They are less adept at recognising opportunities and positively moribund when it comes to taking them. Despite their community roots and desire to ‘engage’ local newspapers have been as uncomfortable accepting content provided by their readers as they have been with information supplied by press offices. Yet the growing number of community activist and participatory journalism projects throughout the UK offer a considerable opportunity for news operations, many of whom would seemingly still re-write press releases from communications officers than grasp the nettle of ‘Indymedia’.

Dueze (et al; 2003) explored the principles and ideas of Indymedia as a source for and form of news. They interviewed activists in and from different countries on their use of public journalism, open source journalism and online publishing. Their work examined how mainstream corporate news media may be able to adopt some of the principles and practices of Indymedia, developing relationships with practitioners and sharing content. The research concluded that the structures of traditional news media were incompatible with Indymedias’ radically different interpretation of journalistic ideology. More radical still Deuze, Bruns, and Neuberger (2007) explored participatory news, examining how journalism is preparing itself for a time where news agendas and stories are chosen and produced by professional

journalists and amateurs. The research, based on a series of case studies in the Netherlands, Germany, Australia and the United States suggested attitudes were changing:

“...mainstream news is taking note of what the citizen journalists are saying, and uses content generated by users as an alternative to vox-pops, opinion polls, or in some cases indeed as a partial replacement of editorial work”.

They noted that the community news sites studied were not only flourishing but were delivering relevant news to their audience and stimulating discussion and concluded that:

“...professionally enhanced participatory journalism has legitimacy as a form of news production in its own right well beyond the apparent ambition of some news barons to harvest bottom-up news as a cheaper alternative to the content produced by costly in-house staff”.

In the UK the position is fairly different. Thurman (2008) notes that the British press particularly has been slow to respond to community or citizen journalism's use of web sites, wiki's and blogs to publish news for their neighbourhoods. Dueze (2005) pointed to a number of potential barriers that might explain the difficulties citing:

‘...notions of professionalism, objectivity, and carefully cultivated arrogance regarding the competences (or talent) of “the audience” to know what is good for them’.

Either way, it is increasingly clear that citizen media is transforming local journalism practice and even what it is and what it can do. A good deal of user-generated content isn't "content" at all, at least not in the sense of material designed for an audience. Instead, a lot of it is driven by the audience as part of a *conversation*. According to Clay Shirky (2008) 'Mainstream media has often missed this, because they are used to thinking of any group of people as an audience. Audience, though, is just one pattern a group can exist in; another is community. Most amateur media unfolds in a community setting, and a community isn't just a small audience; it has a social density, a pattern of users talking to one another, that audiences lack. An audience isn't just a big community either; it's more anonymous, with many fewer ties between users. Now, though, the technological distinction between media made for an audience and media made for a community is evaporating.'

As such, Interactive newsprint seems to take the disparate and complex community stories, and place them at the centre of a new media platform – from its inception to execution.

Interactive Newsprint: Project implementation

At the conclusion of Bespoke, the Interactive Newsprint project was put together under the Research Councils UK's Digital Economy funding stream. It sought to build on some of the co-design work completed throughout the Bespoke project, as well as respond to the local need for effective and sustainable news platform that was community generated. Novalia: a commercial venture specialising in printed electronics, provided the ability to recreate capacitive touch features, audio capabilities via embedded storage and speakers: all of which could be achieved on paper. In this way, the project seeks to examine how paper-based multi-media journalism would be shaped through a co-design process. Interactive Newsprint sought to innovate within a community setting with multimedia output, but with paper as its platform – rather than the increasingly ubiquitous but expensive smartphone or tablet technology.

What is also a key area for the research project is to work on the commercial underpinning of the paper platform: without a resilient revenue model, the iterated platform would remain as a prototype within the confines of the research project.

Designing a platform for community news

As highlighted above, the process of designing a new platform for community news was approached with a genuine desire to enable participants from the community to work with the research team and technology partner to design their own platform. Editorial content would be delivered from the existing community journalism process established during 'Bespoke' and developed through the more recent Nesta-funded 'Speak up Preston' project (www.speakuppreston.org). Content would be adapted for interactive printed display. Originally, the team intended to use their 'Insight Journalism' methodology as the mechanism for obtaining early community feedback on design proposals and reporting on user trials, however they later settled on a traditional participatory design process which enabled those who would've been community reporters gathering feedback to take part in the project without compromising objectivity. A series of demonstrators were to be with input from the technology partner before user testing of robust demonstrator documents was carried out in laboratory conditions. Refined document prototypes will be populated with content in the field trial in Preston.

The current prototypes

In preparation for the first participatory design workshop researchers concluded that in order for people to glean a reasonable understanding of the capabilities of the interactive print

platform – and in order to demonstrate its potential – a series of three working models would be produced. Each prototype was intended to display a different affordance and application of interactive print technology within a context of news and information. The choice of themes and design of each prototype was done without reference to the community. Final choices did, however, reinforce the key emphasis of the original research questions and set the agenda for discussions within the design workshops. The first prototype was a simple community news sheet which looked much like a standard tabloid newspaper. Audio, image and textual content was created by community reporters for inclusion in the prototype paper. The second was a music poster featuring a track provided by local producer and the third prototype was a mocked-up version of a classifieds page that had interactive adverts from national and local organisations.

Taking lessons learned about the individual and community experiences of the single page interactions, researchers plan to build multiple page designs that follow emergent themes. Example design deployments are for news (this might be a full newspaper augmented with sections of interactivity); for Sport (this might be an interactive Fanzine) or for Lifestyle (this could involve a development of a housing association guide to living on the estate including content covering recycling information and family finances). For interacting across the community, an interactive calendar may be deployed with each day having audio feeds updated from community services and groups. In the final phase, the combined knowledge of waves one and two will be applied to the final (or series of final) prototypes.

The project's participatory design workshops were hosted at community radio station Preston FM. Volunteers were drawn from contacts who had either trained as community reporters on the Bespoke project, partnered with the research team or just participated in some of the events organised during the project; from volunteers working with UCLan researchers at Preston FM on the National Endowment for Science, Technology and the Arts (NESTA) funded 'Speak Up Preston' project; and from local companies. Key to the selection criteria was that participants were based in the communities where - largely they - would generate the news and information content and the prototype platform(s) would be tested later in the process. The design team were also keen to limit the number of participants to around 20 for purely practical reasons of managing the process effectively.

For those unfamiliar with the participatory design process (Schuller, Namioka 1993) for the November workshops began with introductions from the research team and participants.



[Figure 1. Interactive Newsprint workshop: November 19th]

A series of 3 platform prototypes intended to demonstrate the technology and stimulate discussion on usability were presented briefly. Researchers briefed the group about the overall project objective and their specific objectives and expectations for the workshop itself. Groups naturally formed around each demonstrator prototype and a member of the research team joined each group as a reporter on the discussions that followed. The conversations explored a range of issues – from the specific limitations and affordances of the technology, through usability and into the economic models that might make a new platform for community news viable and sustainable. The conversations were recorded using lightweight video and audio recorders. Researchers in each group also took extensive notes.



[Figure 2: Interactive Newsprint workshop: participants sketch future technology uses]

Further discussion was prompted by a series of pre-prepared templates inviting participants to design their own community newspaper detailing the technologies they thought most useful, whilst adding their own ideas on further developing and refining the technology and on what content they thought might be most appropriate and useful for their communities. At the end of the workshop, the research team took all the conversations and completed templates away with them promising to review the data and to produce a small workbook featuring common aspects of all the design ideas generated by the community – and to distribute the workbook for a second stage review by participants to further iterate the next series of prototypes.

The review process took place in January 2012 and the workbook was produced and distributed during a second participatory design workshop in February 2012. The booklet served as a tool to assess and review whether the expectations of the community and the objectives of the research team had been met.



VOTING SYSTEM
 LOCAL VOTING SYSTEM



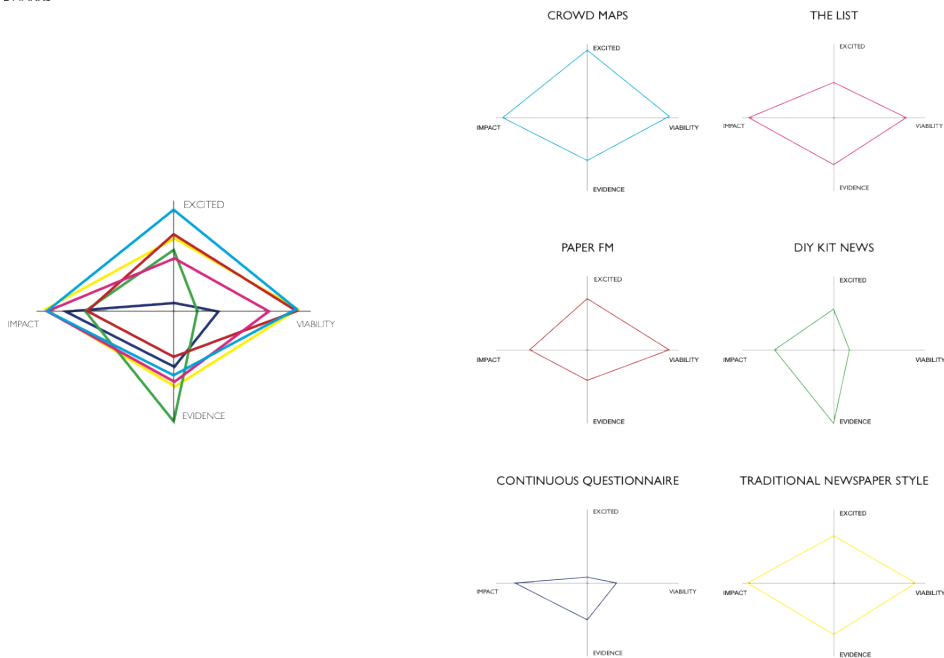
LETTER FROM PRINCIPAL
 LETTER TO ALL, IMPORTANT
 NOTICE OF EVENTS/NEWS
 AT SCHOOL
 - CALLING MEETINGS.

[Fig 3. Design book drawings]

However, the workshop provided another opportunity to further refine the ideas that would become the next series of prototypes through an additional requirement of participants to begin the selection process.

Again, completed workbooks were taken 'back to the lab' by researchers for a further stage of review, assessment and analysis. Data from both workshops resulted in a second design book containing six ideas. This time, each idea was accompanied by a 'kite mark' axis prompting the researchers and technology partner to score each idea before discussing the various merits and pitfalls of their choices.

TOM'S KITE MARKS
 20120419



[Fig 4. Design kite marks]

The trouble with participatory design.....

Using well established participatory design models as the foundation for developing a new platform for community news formed the basis for creating and testing prototypes. This model is not unproblematic in the context of community participation. Whilst the ideal of inclusivity in the process of developing a new platform for community news was the core of the project, practical realities make the delivery of the ideal difficult. Laying the foundations of any mutually beneficial relationship between participants and researchers starts with ensuring that project goals are negotiated. This process begins before the submission of a formal application for funding to ensure that goals and values of all parties are not compromised by any funding conditions. Either way, establishing clarity about the purpose of the research, uses of the data, the ownership of the data and the experiences that will likely ensue is a fundamental component of informed consent. All parties must be able to express their interests and discuss the benefits of more collaborative models of production or other acknowledgements of the shared nature of the undertaking, such as recompense in kind. Members of communities are often invited to participate in workshops or sit on steering groups and advisory panels. For some research projects it's inherently logical. There's a genuine desire amongst many researchers to democratise the process. However, it is difficult to suggest there is any parity between the salaried academic or industry participant and the community representative using personal or community funds to attend a workshop.

The process of participatory community engagement starts with the framing of a research question and finishes with the submission of a final report. Both aspects of the process are set up (not deliberately perhaps) to exclude the people researchers are trying to include in the project itself. Consequently, the research team identified the issues, framed the research questions, hosted (and de-facto led) the workshops and despite endeavouring to define their role as equal participants in this process, work commissioned on this basis inevitably perpetuates an imbalance of power. This exclusion is further extended as the research team talk through the methods they will use to 'extract' the data and information they require. Methods have been decided without reference to the community or other non-academic participants. Unfortunately, this imbalance of power is inherent in the current process of university research and it is difficult to imagine any significant improvement without dismantling the hierarchical commissioning structures and dispensing with the requirement to start research with a research question. Enabling individuals, groups and communities to set their own research agenda by framing the questions they would like to ask is fundamental to notions of agency and ability to design the engagement process.

However, the Interactive Newsprint research team are committed to working with participants to address issues of long-term sustainability (beyond the duration of the project funding) to try and ensure shared ownership of the process and the product(s) by the community throughout the project. To this end the team will work with participants to agree a roadmap for handing

over all viable elements of the project to nominated community groups and/or individuals for their continued development and exploitation beyond the duration of the project.

Expansion beyond newsprint: paperapps and music innovation

Internet connectivity is fundamental to this project and has been a key technical challenge to the design team. The ability to receive, store and transmit data to and from paper is a key enabler with the potential to breathe new life into print as discussed in the section below on data analytics in the context of news, information and publishing. But the potential for internet enabled paper beyond news and information is even greater still. For example, a simple touch sensitive restaurant menu would enable customers to order food and drinks from their tables. A cardboard CD cover with a headphone socket could store and play music without the need for listeners to download the recording to their MP3 player or iPod. The technology is easily adapted as an electronic ballot paper enabling people to vote without needing to mark the paper. There are medical applications too. Electronically enabled pill dispensers' light up when it is time to take medication. Connected online the pillbox could message a carer or relative each time the box is opened. The patient might need to touch a particular area of the tray to demonstrate they have taken the medication. Again, this signal could be relayed via the Internet.

The increasing ubiquity of wireless and bluetooth technologies enabling connections between both mobile and static devices and the Internet are already creating new opportunities for sharing or downloading site specific or geo-located content and information. A paper-based, highly portable web-enabled plastic electronic platform offers a range of geo-located content delivery opportunities in print creating new types of relationships with potential customers and audiences as well as a new series of different user interactions.

Whilst this project actively seeks to avoid direct comparisons between screen-based and print technologies, interactive print offers one obvious and quite specific advantage over screen based Internet-enabled technologies often overlooked. Scale. For example, maps delivering geo-located and updatable audio information can be created to any size, unlimited by pixel widths or screen resolutions. Point of sale material can be life size and any shape, ranging from business cards to billboards.

Interactive print can host original audio recordings from paper microphones embedded within the paper permitting users to leave audio comments on the printed content. And in March 2012 during a panel session at South by South West (SXSW) Interactive Festival in Austin, Texas, the project team distributed sets of working paper headphones to members of the audience.

One key advantage of this development is that interactive newsprint could be a cheaper way of mass producing (simple) digital connectivity than tablet, smartphone and PC options.

However, a key element yet to be examined is the commercial model that would underpin any advancement in the printed electronics marketplace.

Paper-thin? Creating sustainable newsprint

According to Neilson, (2011) many advertisers still debate the value of online advertising because there is no way of measuring the effectiveness of online audience delivery. Advertisers never really know who is viewing online advertising. Consequently they have no data on whether online advertising is delivering the target audience. A physical news product produced and distributed locally ought to be much better placed to know who its market is and will be able to offer advertisers a demographic breakdown. However, current methods of measuring circulation do just that. They record the number of copies sold or distributed in a given geographical area, but there is no way of knowing actual readership figures using this method, or how many engaged with individual ads or advertorials in a paper, magazine or bulletin board.

Paper data.

Bringing together journalism, design and technology makes for an interesting academic enquiry into the potential for a new platform for news, but the 'elephant in the room' is the age-old issue of economic viability and long term sustainability of any news operation. Whilst these are generally accepted as two sides of the same coin, Preston's Interactive Newsprint researchers immediately started to tackle its commercial imperative raising questions about whether the technology could be used to increase the commercial value of an interactive print product. This would almost certainly be the case if the print proposition included the ability to connect paper to the Internet. Data from user interactions with the print product could be recorded in much the same way as 'click-throughs' from websites. The recording and display of a series of user interactions with a single news sheet, (the research team believes) will create a rich set of data traceable specifically to the content at the source of the users interaction (e.g. a story, image or a printed advert).

The Interactions that can be recorded and transmitted for storage in a database include simple touches of specific areas on the paper; multiple presses on the same area of the paper; multiple presses on multiple areas of the paper. The paper is also capable of hosting audio content. Again, the duration of all the audio content played between single or multiple

presses from each touch point can be transmitted for storage in a database. All the stored data is searchable and retrievable. We call this process of recording user interactions 'paper data'.

Part of the project will include working with advertising agencies and news organisations to produce an online interface displaying the most meaningful datasets in a way that is easily interpreted by anyone with responsibility for print advertising spend.

COMMERCIAL IMPERATIVE: Analytic development: building a sustainable platform

Analytic data is now a prevalent force within online operations. Services such as Google Analytics, Yahoo Analytics and open source Piwik analytics provide a range of options for publishers and editors to work with. For example, Google Analytics stream a range of different data sets that provide information on website hit rates, dwell time, geographic location of users, referral sites and social media interactions. Initial interview-based research conducted by the Interactive Newsprint team shows that analytic tools are being used by online editorial staff to shape and hone content production, as well as by commercial teams who can shape advertising campaigns and also monitor the success of a website in terms of user participation within the online environment.

As a result of analytic information, advertisers and publishers have a more effective way of judging the economic success and overall proliferation of their content. For example, click-through and conversion rates and referral information allow advertisers to know how many users are engaging with their content and generating revenue for them. This allows ad spend to be assessed in terms of its penetration and resulting profitability.

Data is now manifesting itself as part of an editor's toolkit and accessing and utilising it forms part of his/her working day. Consequently, content is changing as a result of this live data feedback: both in terms of individual stories and shaping output as a whole. If users have a registered profile with a publisher, and provide age, gender and other personal details, even more trend-based analysis can be completed. James Andrews, finance editor at Yahoo! News states:

"You can see what was popular and wasn't, you can see what people were reading and what they are engaging with. You've also got comments and [user] ratings under articles, so you can genuinely get a feel for right now for what's going on at a story-by-story level."

Data and the ability to monitor wider trends, as well as the performance of specific news stories, is impacting on the way some online writers shape the text of their pieces. Knowing what headlines work and which don't were the realm of the sub-editor, but online analytic functions now allow editors to know their audience's preferences in a more scientific manner. Andrews explains:

"There are also very specific words that [readers] do and don't engage with. Words like mystery is a good one, words like rip off engage older readers but not younger readers. Equally, "Scam" is a word that's read by older readers rather than younger readers... insurance: no one engages with."

"There's other stuff that's quite fun. Like MPs. People don't like reading about MPs, at least on our sides. If you'd had 'Cow destroys MPs garden it would get fewer clicks than 'Butcher's garden destroyed by cow, which is very counter intuitive but is one of the things you look at by attacking the data and trying to find out what's going on".

Interactive Newsprint researchers also found that publishers with an online presence – ranging from regional titles to national and international portals - have varying degrees of interaction with data and analytic analysis. Although all interviewees use it in some manner.

For the Interactive Newsprint team, our research behind how analytic data is being utilised across the industry is at an early stage, but it has already become evident that a challenge in creating a sustainable platform is to replicate or even further the advantages that are already native to an online world. As such, we have begun work on an embryonic analytics service that can provide advertisers, commercial staff at publishing organisations in the news industry and editorial content producers with valuable user data. This data can then be streamed to editors and other content producers to enable them to cater and publish for their audience in a more effective manner, and for commercial arms and their ad clients to monitor printed matter return on investment (ROI).

With the advance of local ad networks – such as Addiplay - and Google's geo-specific advertising, the research team feels this is a valuable and potential radical opportunity to create a paper-based revenue model that offers increased value for those who use it.

New types of adverts: research in practice

As briefly discussed above, the second of our first phase prototypes was an advertising sheet. It contained a series of fictional and actual local adverts combining graphics, text and

audio but excluding the data connectivity that would enable the updating of audio content or the recording of user interactions.

Whilst, like the cover price of any newspaper advertising revenue alone is not sufficient to support the production and distribution of a local newspaper this project is exploring the unique affordances of printed electronics to create new types of adverts. The processes involved draw on the strengths of established print adverts. Potential adverts start as traditional print artwork which can be enhanced through the addition of updatable audio streamed to each individual advert or embedded within the print edition, or through the simple inclusion of LED's.

The use of fixed graphics and dynamic audio with the ability to return datasets on user interactions is a unique idea and a major element of this project that requires further exploration. Questions around additional production costs for enhanced adverts and scales of charges for various levels of enhancements remain at this stage of the project. As do similar questions around charges for various levels of enhanced adverts, the number of audio updates, and the supply of user data via the online interface.

A physical community newsheet has some advantages over its online counterparts in terms of advertising revenue streams too. In 2010, author of the Long Tail and founder of TED Chris Anderson (Anderson, 2010) noted the advertising value associated with one hour of an Internet user's time was less than \$0.10 This figure is low even compared to television, which comes to \$0.25 Print adverts hold up a little better at around \$1.00. However, things get worse for online with over a third of all advertising revenue handed to Google. As traditional newspaper proprietors and independent broadcasters have known for some time, ownership of the distribution channels is the only guarantee that 100% of the revenue flows back into company coffers.

Printing process.

It might seem regressive to talk about the benefits of printing a community newsheet locally using traditional lithographic printing methods in 2012. However, with a little training any printer can produce interactive newsprint locally with a lithographic press. This means that traditional (local) printers can expand their revenue streams by offering interactive print products to interactive newsprint customers and their advertisers. Granted, print work needs to be shipped elsewhere for the pre-programmed silicon chips and power supplies to be placed on the paper, but they can make money printing with digital ink. As the project progresses we will endeavour to identify a local printer and put this workflow to the test.

Future research and development

The biggest challenge to the future development of this platform is beyond the scope of this project. The entire ecosystem, which might enable interactive newsprint to flourish, requires structures and support for community enterprises wishing to use it. Developing the people and skills to enable them to create original content, sell the new forms of advertising, ensure volume production/distribution of the product, retaining quality throughout whilst endeavouring to maintain currency with new technical aspects of the platform is necessarily complex.

However, there are a number of challenges to the future development of this platform that fall within the context of the research project. Some are technical, specifically relating to the platform; delivery of smaller and faster microchips with the capacity to support a greater number of more complex interactions with product would improve the user experience and enrich the data capabilities. Similarly, thinner batteries or the inclusion of alternative power supplies (e.g. the latest solar batteries) would improve the user experience and may increase longevity of the product. More power would also provide greater data handling capabilities; particularly in terms of potentially increased bandwidth also offering improved audio quality. Some are bigger HCI questions for the design of the new platform; creating ways for people to interact with the this new platform may include the creation of a graphical lexicon of possible user interactions visually describing how to turn digital paper on, control the audio levels or scroll through the audio. Graphical representations will be tested in the lab alongside gesture based alternatives and/or physical interactions with the paper platform itself. Some challenges are editorial: these are largely related to how the new technology might change the narrative structure for the story teller and the way a listener or reader receives the story. Other challenges relate to the method for expanding the analysis of paper data and presenting it to target advertisers.

Through the series of planned participatory workshops and further workshops with media advertisers and advertising sales people researchers are tackling these questions. It is likely that the final wave of prototypes will include a major UK based media industry partner, however, the research team are equally keen to create and support a new community-based news and information provider. This will enable them to develop and test the robustness of the emerging business model developed during this project in future research. A local news business will provide the team with a small scale operation to test the service model for the platform and enable controlled examination of issues surrounding large volume production, quality issues (editorial and technical) and to assess problems within the broader supply chain.

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