
Connected Paper, EKKO and Analytic Futures: News and Paper Data

John Mills

Media Innovation Studio
University of Central Lancashire
Preston, UK
jmills@uclan.ac.uk

Tom Metcalfe

Thomas Buchanan Ltd
Pervasive Media Studio, 1 Canon's
Road, Bristol, UK
tom@tommetcalfe.com

Mark Lochrie

Media Innovation Studio
University of Central Lancashire
Preston, UK
mlochrie@uclan.ac.uk

Professor Paul Egglestone

Media Innovation Studio
University of Central Lancashire
Preston, UK
pegglestone@uclan.ac.uk

Andy Dickinson

Media Innovation Studio
University of Central Lancashire
Preston, UK
asdickinson@uclan.ac.uk

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author.
Copyright is held by the owner/author(s).
ITS '15, November 15-18, 2015, Funchal, Portugal
ACM 978-1-4503-3899-8/15/11.
<http://dx.doi.org/10.1145/2817721.2823489>

Abstract

Advances in conductive inks and increasingly accessible and flexible platforms, such as Arduino and Raspberry Pi, are allowing researchers to transform a range of surfaces, including paper and additive layer objects, into capacitive surfaces. When imbued with Internet connectivity, and placed within the 'Internet of things', opportunities to create interactive surfaces that respond to touch and offer audio playback or other data transfer via additional connected peripherals emerge. This poster explores the potential for web-connected paper interfaces with the media and publishing sector and an accompanying content management and system-analytics package to present a range of content, design, interaction and revenue-based opportunities for related industries. It also hints at how paper could be a viable interactive surface and posits potential related work on a wider and cross-industry spectrum.

Author Keywords

Interactive, Internet of Things, mobile, print, paper, conductive ink interfaces

ACM Classification Keywords

H.5.m. Information interfaces and presentation

Introduction

Over the last year, our work has sought to explore the intersection between the physical and digital in the context of the increasingly expansive field of the 'Internet

But why newspapers?

The news industry is one that is founded on paper. Its working practices, business models and identity have been closely aligned to print materials for hundreds of years. However, paper is increasingly becoming sidelined as a delivery platform of choice for audiences and for publishers, which is a trend that is decades old [11].

It is also less attractive for advertisers, who are instead captivated by the lure of the infinite reach of the web, and its personalisation. As such, our research explores both paper's novel properties and its potential for new digital connections both for news and media consumers and for publishers in the monitoring of that data. We frame this not in opposition to a web-based consumption but as an alternative method that combines digital media with the unique properties and opportunities of IoT paper.

of Things'. Our 'physical' incorporates conductive inks and capacitive touch paper and the digital takes the form of 'Interface': an 'Internet of Things' (IoT) publishing platform capable of transferring media and data to and from web-connected print. This poster presentation and extended abstract describes a prototype IoT printed 'supplement' co-created by the Liverpool Echo newspaper, the research team and design agency Uniform.

During the course of the project, our IoT supplement was created to utilise conductive inks connected and powered via a clip, named EKKO. This device recognises touch interactions and connects to Interface as a web-based Content Management System (CMS) and analytics suite. Here we will explore some of the development opportunities presented by a 'CMS for IoT' via a news-industry themed paper prototype and examine some of the unique facets and challenges of capturing analytic data from print, populating print with refreshed content, and reflect on what this could mean for users and content producers. Insights will be offered into how the news industry, a sector that retains print as a cornerstone of its operations, could re-articulate and repurpose print as a digital and dynamic platform within IoT.

Background

Paper has existed as a communications 'platform' for thousands of years. When production became scalable via the Gutenberg press, unprecedented social and political change followed. Parallels can be made between the 'adoption' of paper, and the rise of the Internet. Attempts to create a paper-digital product spanned a range of user-scenarios. Interactive Paper notebooks [8], replication of screen-based interfaces [3], maps [10], images [2, 13] and newsprint have all sought to re-imagine print as digital interface. A range of work has been carried out recently in exploring a range of opportunities conductive inks offer in terms of sensors, craft (www.bareconductive.com) and music posters (www.novalia.com). Within this work, the

uniqueness and emotional connection that printed circuits on paper can offer, that perhaps sits aside user experiences of screen-based digital media, has also been articulated [10]. Exploring systems to manage paper-based digital or media content has also been explored in related contexts, for example Singer [1] examined paper-encompassing CMS opportunities ten years ago. Although this work will focus mainly on conductive inks and affordable processing and peripherals, printed electronics have been manufactured and used for several years in the printing of conductive traces in flexible conductors [3]. Since the late 1990s functional devices such as batteries, displays and transistors have been printed via ink-jet, screen-printing or spray coating.

News Content Management Systems and analytics

Although the print is at the head of the user experience, the potential advantages for publishers also resides in the digital management and monitoring of that content. The scale and reach of the web has meant that creating content for news websites has moved quickly from hand- tooled HTML to complex CMS that automate the process of publishing online. A key concept of CMS is the separation of content from the code needed to display that content, an abstraction that has become more important and challenging with the rise of mobile technologies.

Discussion Traditional measure of print

Newspapers function on a dual-product model [12] creating content to build an audience that they can, in turn, measure and package to sell to advertisers. The most common measure in this context is circulation. In the UK circulation figures are self-reported to the Audit Bureau of Circulation (ABC) who independently audit and certify the figures. Whilst circulation figures are often cited as an indicator of popularity, they contain no qualitative data. The National Readership Survey (NRS) uses continuous large-scale surveys, to gather a more detailed view of readership and offers more socio-



Figure 1: EKKO connecting to Super 8

economic detail about the reader and their engagement with the print brands. The ABC and NRS have substantial industry support and provide the benchmark for setting advertising rates in print. However both offer little or no data that relates to interaction with content. Gathering insights into how a reader might engage with content is commonly done through focus groups. But researchers and designers have looked for more concrete measures by experimenting with eye tracking technology [9]. By using hardware that track a reader's 'gaze' on the page, researchers have sort to test design decisions more effectively [7].

Measuring content in the digital world

As the publishing industry moves into a digital marketplace, the dual-product model remains. The primary role of data is still to quantify audience for advertisers. Site metrics echo print's circulation and readership data with broad measures such as page views and unique visitors. However, tracking software and cookies (small files that store browsing data), allow publishers and advertisers to build a real-time picture of individual browsers far beyond the level of detail available to print. Publishers are turning their attention to metrics for engagement, with some moving away from advertising rates based on clicks or visitors to measures of 'time-spent' on a page.

The increasing consumption of multimedia online has created a similar focus on engagement. Traditional measures of audience for TV and radio (BARB, RAJAR) mirror print, with broad estimates of viewers and listeners. Digital platforms enable producers not only to measure how many people view a video but also the time each viewer spent watching and when they stopped.

Ink, IoT and bridging the gap of the physical/digital

The research presented here develops work from previous position papers [6] around using conductive ink to enable users to interact with print and connect it

to the Internet. This work has been carried out over the last year. This research investigates the questions around bridging the gap between the physical and digital, what types of analytic data can be derived from print, but more importantly what analytic data publishers require; what lessons are learnt from web analytics; are they transferable to print? This is a potentially unique moment in understanding paper interactions and digital data outlining user-behaviour can be captured and analysed by publishers and content creators within the news industry. There are also intriguing opportunities around taking standard online practices, often informed by the deep cultural and design understanding of print interaction - such as design for scanning personalisation, and reinterpreting them for a print experience. Equally, there are key challenges that span user interaction, scalability, robustness and design limitations around the conductive inks.

Case Study EKKO and Echo

The 'Super 8' prototype is a collaboration between Uniform, the University of Central Lancashire and publisher Trinity Mirror and was designed for regional newspaper the Liverpool Echo. The print takes eight of the most memorable moments from the career of Liverpool Football Club's former captain Steven Gerrard. By connecting a clip to the one page supplement, users can listen to audio, via a smartphone, from eight individual goals that are considered momentous. EKKO is connected to the edge of the print like a bookmark, pressing the printed buttons trigger online interactions through the use of conductive ink. This is dynamic so that the content can change over time whilst the print is static. Connected paper offers a radical expansion on a traditional platform. Through augmenting the print experience its readers move into an alternative space to the one offered by augmented reality platforms and QR codes. Paul Gallagher, Digital Innovations Editor at MEN Media said: "[The project allows us to] see if an internet-

connected product could drive new audiences, and ultimately lead to a new revenue model.”

EKKO and Experiences

The work so far has explored the design and implementation of the EKKO clip and the experiences of two interactions; newsprint and games [6]. EKKO consists of three components; the clip, companion app and publishing platform. By designing EKKO to run independently of the publication, third party publishers can develop content and release it onto the platform. The platform has been designed to work for any publication. It is as simple as reconnecting EKKO to a different print artefact. EKKO comprises off the shelf technologies; an Electric Imp combined with a capacitance sensor to measure the ink button presses, a small rechargeable Li-Po battery and an LED for user feedback. It is situated at the edge of a piece of print and clip pressure enables a circuit connection (Fig. 1). The Electric Imp was adopted due to its ability to easily scale, open community and security.

The companion app is a second screen to print, currently developed for iOS. It connects the user with the rich content from the print. Each user first pairs the two devices by specifying the friendly name or MAC Address of the clip with the mobile application; this allows multiple users to connect. When ready, users specify the print they are reading, this then downloads the media for that publication to a user’s device to allow for seamless playback. The media is removed when the user selects a different publication. EKKO enables publishers to create novel and exciting experiences in addition to print such as playing audio, video and revealing information via feedback mechanisms.

The publishing platform is the glue to the project; it allows publishers to curate the rich content and monitor interactions through an analytics dashboard. The platform allows publishers to gain unique, rich insights into how users are interacting with their print products

in much the same way that readers’ interactions with web-based content can be recorded through analytics platforms.

Collecting Data from Print

As discussed above, audience measures and engagement with print have centred around distribution figures and focus group responses. Digitally generated figures for Internet traffic present publishers with specific datasets to which they can respond on a broad range of levels, many of which are now considered to be industry standard approaches. These include tailoring content, tracking data and user behaviour, monitoring advertising campaigns and targeting specific demographics. Our research suggests a range of factors that could emerge from conductive ink and IoT paper. These generally span two forms: updatable content consumed from static print, and monitoring users’ usage of a paper-based platform. The latter could include listen time, page navigation, location and personalisation. We’ve have termed this process ‘Paper Data’. The interactive functionality also allows users to engage with print in new direct ways, so to complete voting tasks or rating.

Interface: Analytics and CMS platform

‘Interface’ provides real-time updatable audio content to internet-connected print and displays analytics associated with the print, its touch-points and user engagement with content, and therefore generate record and visualise ‘Paper Data’. Additionally, Interface is being developed to work with other internet-connected objects.

It is designed to be only accessible by the publishers of the audio and print content and therefore the design choices for how it works are influenced by ease of use for publisher, their workflow and how they would choose to experience the platform. There are three principal areas to consider for the user-experience of Interface. 1.) The initial, one-off setup to configure the

print and its connection to the database and therefore the physical print within the publisher's account on the Interface website, 2) The CMS that enables the publisher to relate audio content to the physical print in real-time, and subsequently update it, and 3) analytics that provide real-time figures and charts of user interaction and data that is associated to the print, i.e. location and print id.



Figure 2: A screenshot from Interface analytics

Interface is designed to be simple and add little work to the publisher's workflow. Once a print version file is finalised, it is uploaded to the Interface platform. This file will then appear on the publisher's Interface CMS platform. The next step is to configure the location of the touch-points so each can become connected to the Interface database and to the corresponding touch-points on the physical prints (Fig. 2).

Once setup, the physical print touch-points correspond to clickable buttons that appear on the website. Interface treats this in two ways; it allows each touch-

point on the print to be associated with audio content and analytics. To add content or see analytics the publisher simply clicks the button associated to the physical touch-point. A tool-tip type menu will appear and display a choice of 'analytics' or 'add audio'. Click 'analytics' and the hovering tooltip expands and the publisher is presented with analytics that currently include: the publication; reader; location; dwell time on content; the duration between interaction; number of clicks; average duration of listen; and percentage of engagement based on a predefined time threshold of the audio content. To add audio, the publisher can either drag and drop audio content to the button, or click and a Finder window will appear and the publisher selects an appropriate file, this all happens in real-time and every print that the publisher has in the world will instantly be updated.

Further work and conclusions

Following the development of Interface and EKKO, the research team feel there is a broad range of future work to be pursued within the news industry, but also beyond it. The ubiquity of paper and its role in our everyday lives heralds a range of opportunities. For example, rather than conceptualising paper-based news as newspaper, publishers could reimagine 'news paper' and find opportunities for audio publication that is activated by non-newspaper products that can be updated and monitored via a CMS/Analytics platform. These could be, for example, connected coffee cups, travel tickets or posters.

There are also key opportunities to explore advertising models via conductive inks. It is well documented that newspapers reliance on print advertising revenue has been challenged online by social media, search engines and web only news startups. Digitally-connected paper, and related Paper Data analytics, could leverage the industry's long and deep experience of print to offer advertisers opportunities that have only previously been possible through internet-connected and screen-based interaction. Equally, packaging and other paper

goods could offer a range of functionalities if located within IoT, and a degree of 'smartness' i.e. an awareness of location and monitoring user interactions could create valuable data for users and the organisations that produce, ship, sell or recover/recycle paper-based products. Interface and EKKO could offer intriguing opportunities within these fields and others.

Nevertheless, there are key challenges that the research team have begun to identify. These include further developing the robustness of conductive ink platforms within a real-world environment, to explore additional analytic data sets generated by Interface that are derived firmly from within the context of print interactions, and are uniquely encapsulated within an IoT use-scenario rather than one curated via a standard PC, laptop or smart-device. For example, how do users navigate augmented paper content? Other work would be required to establish what infrastructure would need to be created within industry standard desktop publishing workflows to allow publishers, such as Trinity Mirror, to seamlessly integrate existing enterprise level CMS systems with the IoT counterpart Interface. Additional work could be undertaken to understand and analyse analytics from a publisher's perspective, explore what this data might 'mean' or indicate.

References

1. Beat Signer. Fundamental concepts for interactive paper and cross-media information spaces. Diss. Swiss Federal Institute of Technology Zurich, 2005
2. David Frohlich, Guy Adams, Ella Tallyn. Augmenting photographs with audio."Personal and ubiquitous computing 4, no. 4 (2000): 205-208.
3. David A. Roberson, et al. Microstructural and process characterization of conductive traces printed from Ag particulate inks. Materials 2011
4. David Holman, et al. Paper windows: interaction techniques for digital paper. Proceedings of the SIGCHI conference on Human factors in computing systems. ACM, 2005.
5. Edison C. Tandoc Jr. & Ryan J. Thomas. The Ethics of Web Analytics, Digital Journalism
6. John Mills, Mark Lochrie and Paul Egglestone. Paper-based web connected objects and the Internet of Things through EKKO. British HCI 2015
7. Kenneth Holmqvist and Constanze Wartenberg. The role of local design factors for newspaper reading behaviour-an eye-tracking perspective. Lund University Cognitive Studies 127 (2005): 1-21
8. Lisa J. Stifelman. Augmenting real-world objects: A paper-based audio notebook. Conference companion on Human factors in computing systems. ACM,1996.
9. Mario R. Garcia, Margaret Mary Stark, and Ed Miller. Eyes on the News. Poynter Institute, 1991
10. Michael Shorter, Jon Rogers, and John McGhee. Enhancing everyday paper interactions with paper circuits. Proceedings of the 2014 conference on Designing interactive systems, pp. 39-42.
11. Philip Meyer, The vanishing newspaper: Saving journalism in the information age. University of Missouri Press, 2009.
12. Robert G. Picard. Media economics: Concepts and issues. Vol. 22. Sage Publications, Inc, 1989
13. Tim Kindberg, Ella Tallyn, Rakhi Rajani, Mirjana Spasojevic. Active photos. In Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques, pp. 337-340. ACM, 2004.
14. Volker Paelke and Monika Sester. Augmented paper maps: Exploring the design space of a mixed reality system. ISPRS Journal of Photogrammetry and Remote Sensing 65.3 (2010): 256-26