NewsThings

EXPLORING JOURNALISM AND THE INTERNET OF THINGS

John Mills

Mark Lochrie

Tom Metcalfe

Alison Gow

Paul Gallagher

uclan

Reach

MEDIA
INNOVATION
STUDIO

THOMAS BUCHANAN

Contents

01: Introduction

NewsThings: unlocking the potential for IoT and journalism

Digital platforms have created unparalleled challenges for journalism: the shift of audiences, advertising and other revenue streams have all been affected by the emergence of digital as a disruptive technology.

A new platform is emerging: the Internet of Things (IoT).

IoT is tipped by some analysts to be the next industrial revolution and the realisation of 'ubiquitous' computing, which rather than being surrounded by interactive screens, users see intelligent and reactive computing systems recede into the background. Technology will become imperceptive until needed. A range of industries are beginning to take advantage of IoT connected objects, and the new experiences, processes and data they may create.

Defining IoT

In the broadest sense, connected objects are things that have a digital connection. They can transfer or receive digital information and potentially respond to their environments or the system they're connected to. For manufacturing, 'industry 4.0' promises smart production lines, increased efficiency and enhanced personalisation. For retail, NFC and RFID technologies can provide new ways to interact, provide information and communicate with customers, and proximity wi-fi can target information directly to users' smart devices. IoT offers healthcare a new way to monitor patients remotely, and beyond health centres. This moves into a new space: the Internet of Human Things, which explores what the possibilities are when people are connected to complex digital systems: potentially realising a further incarnation of the computing ubiquity outlined above. What has emerged over the last 10 years is a complex mix of development pathways that are examining connected objects, and what affordances this brings to people and their interactions.

NewsThings asks what could an *Internet of Journalism Things* be and how could journalism lead the development of new IoT technologies and experiences?

Combining a wide range of skills, the project was a 'pathfinder' initiative to discover the potential for connected objects and journalism. A collaboration between publisher Reach, the Media Innovation Studio at the University of Central Lancashire and design and innovation studio Thomas Buchanan, and funded by the Google Digital News Initiative, NewsThings explored how journalism could develop new 'connected' products and experiences. Through creating new 'things' that played, showed, captured or demonstrated journalism, it sought to break new ground in how news objects could be inspired, built and tested.

Running for 16 months between March 2017 and August 2018, the project prioritised people in the innovation process. It placed users at the centre of its innovation work, and, before doing any ideation or product development, sought to understand audience requirements. As will be outlined in the report, the partners worked together to deconstruct news consumption to understand how users consumed news and information in its broadest possible sense throughout each day. NewsThings challenged users. It asked them to reflect on news, journalism and what it meant to them. In using methods such as cultural probes (see chapter 4), audiences were proactively engaged in shaping the data and objects that the team created.

This report will outline the products we created: ConeThing, RadioThing and PrinterThing, how they sought to meet user requirements and industry concerns, and how we combined new IoT tech - such as text-to-speech and sentiment analysis, in products and services that were of genuine value and relevance for the communities they were designed to serve.

In adopting a 'user-centred design' approach, audiences were put at the heart of the innovation processes through methods taken from the design research community. The project's aspirations were to provide an alternative to focus groups and analytic data, and to generate 'rich insights' from users. The NewsThings team - a mix of technologists, designers, behavioural scientists, journalism and innovation academics and industry, could respond to this data and create objects that were relevant, timely and useful to their users, and to plant seeds that could be grown in follow-up projects: placing publishers at the forefront of innovation, rather than as adopters of platforms and services.

As the project was a formative one, and self-consciously at a research and development stage, the prototypes could both test the concepts and be provocative. The project and the process we adapted encouraged audiences and industry to imagine what journalism things could and should be. Some were multifunctional objects that could test full concepts, others were manifestations of an idea that the team thought was worthy of sharing with the wider test group.

NewsThings also aimed to move beyond the creation of new physical things. As a pathfinding project, we wanted to touch on wider concerns, and understand how IoT and journalism could combine on a number of levels. NewsThings explored what data could be extracted from these objects, and how they may offer new ways of understanding audience behaviours. With a mixed team of industry and academia, we were keen to examine new business models that connected objects could create.

This report

As an end of project wrap up, this report will document the project, its rationale, processes, insights and the final prototypes we created. Early chapters will outline background and formative work that underpins NewsThings, and some of the key reasons why we collaborated as a project team. It will then move on to process and methods: detailing the tools and approaches we took to generate user insights, and how the project attempted to find out what objects within *Internet of Journalism Things* could be.

The report will outline the prototypes we created, the rationale beyond them and how they could be developed in the future. The next section will outline some fundamental insights and 'learnings' from the process. NewsThings was a challenging and multifaceted project, that didn't always go according to plan. The project team are keen to share insights that may be of interest and, ideally, useful, to the media and journalism innovation community more broadly.

We'll run through a few areas that we feel could be of interest in future work. At the end of the project, the team feel more convinced than ever that connected-objects could offer valuable and fundamental opportunities to create, experience and respond to journalism in new and exciting ways.

NewsThings is, hopefully, just the beginning of a rich area of research and discovery.

02. backgrounds
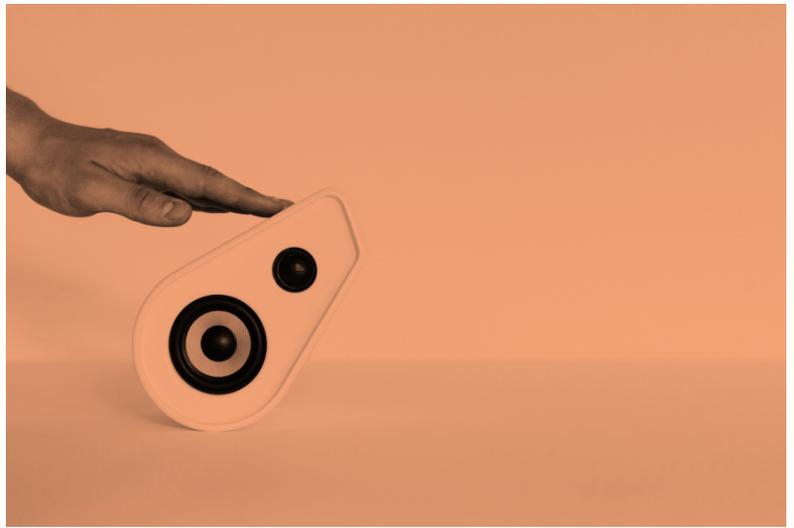
Previous work

The project team - Reach, the Media Innovation Studio and Thomas Buchanan - have been exploring the potential of the Internet of Things for a number of years, collectively and individually. The thinking and approach to many of these projects demonstrate key elements of the NewsThings project: exploring new ways to interact and engage with journalism, and the development of new products and services as a result.

Media Innovation Studio

The Media Innovation Studio has prototyped connected objects since it was established in 2013, and its researchers' activity in this space pre-date this. Since 2009, projects such as Bespoke and Interactive Newsprint have explored how IoT could be utilised by journalism in a number of ways. Bespoke - a collaboration between the universities of Surrey, Central Lancashire, Dundee, Falmouth and Newcastle running between 2009 and 2011 - combined citizen and community reporting with connected product design, and explored how IoT objects that were specifically designed for one community could have an impact. Prototypes included connected cameras that could stream youth football highlights packages direct to the club house, memory boxes that replayed audio memories of a family's treasured possessions and connected voting machines that streamed community's preferences on a particular issue or topic in real time. The project investigated how user-centred design could shape new products and services; to make them relevant.

Following Bespoke, Interactive Newsprint (2011-2013) envisioned how paper could be a disruptive platform. Through an R&D project between the University of Central Lancashire, University of Dundee and University of Surrey, along with industry partner Novalia, the research team worked closely with professional and community media to reimagine news via internet-connected paper. Rather than e-ink, the project created printed items that could detect touch, and then respond accordingly. Interactions included playing music tracks and full journalistic interviews, voting on content, liking and sharing stories to social media and hearing audio versions of stories. The team explored interactions, how content might evolve to meet the demands of such a physical-digital platform and the potential for data to be extracted from print. In this way, muchof the thinking from Interactive Newsprint has been continued to other projects like NewsThings.

More recently, the Studio continued to innovate around interactive print with its EKKO project. EKKO connected a range of publications, including a print supplement in Reach's Liverpool Echo, to the web - and the 'Interface of Things' analytics platform, initially designed by Thomas Buchanan, to explore opportunities around 'paper data'.

The research team have also explored other incarnations of IoT: From a wearables angle, Google Glasses were deployed in Reach newsrooms throughout the UK to explore and assess their potential as professional tools - examining the potential for IoT to be a newsroom asset.

The Studio team also worked with Sir Ranulph Fiennes production team to create Ran's Dashboard during his attempt to run the Saharan Marathon de Sable in 2015. Using a smartwatch, the team explored how the data could be used to tell the story in a new way, creating a dashboard that combined with rich media and expert insight to create an alternative narrative experience. This project demonstrated the potential for IoT, data visualisation and rich media to offer new narrative forms and insights.

Overall, a number of projects that have emanated out of the Studio or involved them have explored the potential of connected objects, digital interaction and content opportunities in a number of guises

Thomas Buchanan

Thomas Buchanan is a design and innovation studio based in Bristol, UK. It specialises in crafting compelling experiences with emerging technologies.

The studio's practice is characterised by its focus on people and its critical approach to designing new experiences with objects, environment, and space.

The studio has worked across a wide range of industries and sectors. They've harvested clouds in the Scottish Highlands for Innis and Gunn to make SkyPA; created useless objects, Chindogu, for Yo! Sushi; developed a mind-controlled beer pouring robot for brands including Marriott, TEDx, and Twitter Live; designed a unique physical-digital concept store in an old spa in Covent Garden, London for the revolutionary fashion brand, UNMADE; identified insights and opportunities in household care, through design research, for Unilever; designed new user experiences for industrial IoT scalable predictive maintenance systems for the automotive industry; developed internet-connected objects for audiences in Immersive Theatre; and co-created IoT cognitive puzzle games for Gorillas through gorilla-centred design!

Reach

Across Liverpool and Manchester, Reach has experimented with a number of IoT prototypes. Refitting a Liverbird statue with LEDs and connecting it to the web to monitor Twitter traffic around Liverpool and Everton FC examined how a newsroom could utilise physical-digital data. In Manchester, the team created a chatbot that fixed on a letterbox near the city's Arndale centre. Twitter users could send the lamppost questions and the AI would respond – creating a persona around a physical object.

As such, the combination of the Media Innovation Studio, Thomas Buchanan and Reach were primed to explore this area in more depth, and to explore a range of potential opportunities.
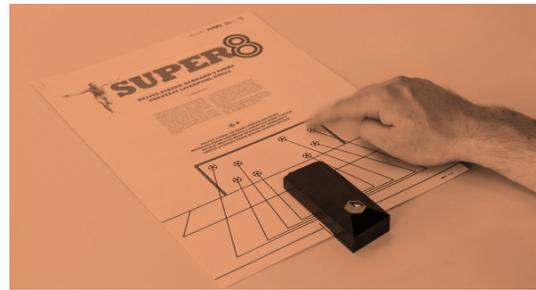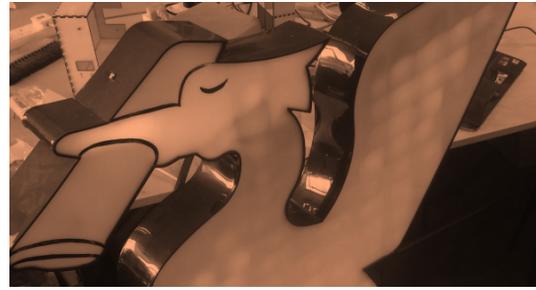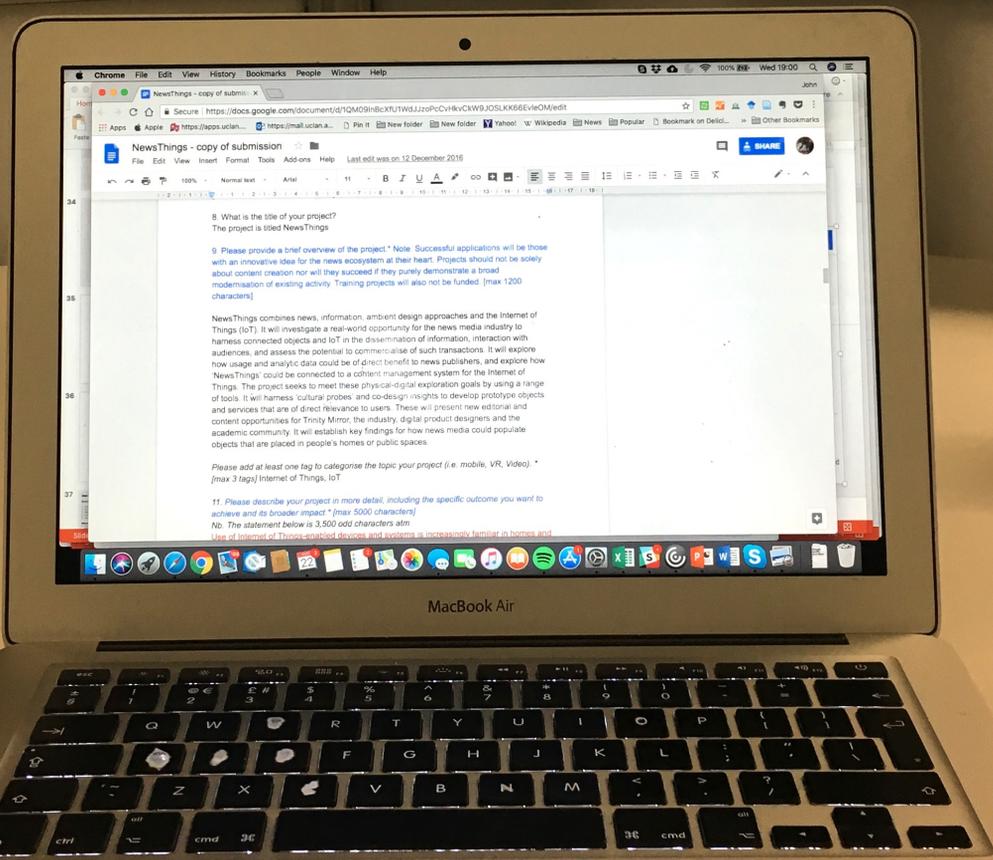
03. Why NewsThings and DNI?

NewsThings: Bringing News Media and Audiences Together Through the Internet of Things

UNITED KINGDOM | PROJECT TYPE: PROTOTYPE | UNIVERSITY OF CENTRAL LANCASHIRE (UCLAN)

Summary

The project places users at the centre of the innovation process and creates physical-digital prototypes that convey news and editorial content, which will be placed in people's homes or public spaces. The project also examines IoT infrastructure and coninc through Taking data and bage St and publish

The solution

NewsThings' combines news, information, ambient design approaches and the Internet of Things (IoT) to explore how people engage and interact with co-designed connected objects.

The journalism and media innovation landscape is a complex and nuanced environment. The motivations for each partner to work on NewsThings were diverse and multifaceted, and spanned a range of interests. With its Prototype Fund focussed on experimentation, Google DNI presented a perfect opportunity to test an IoT Research programme. A question that project partners are often asked is: how did you win funding?

This is a tricky question to answer: we're not the Google team! But, here's a few ideas around what the project team felt was important in both securing NewsThings and what made it interesting for the year and a half it ran.

Fundamentals
A genuinely new space, activity, occupation
DNI is mandated to foster innovation in and around the industry, and IoT is an emergent platform that, from a journalistic perspective, has had little attention. Work has around smart home assistants, proximity broadcasting and wearables is emerging, but the project team felt that there was a dearth in project creating new media objects in this space.

A project that excites everyone who's involved
The core team felt that IoT was an area that spoke to multiple facets of journalism, from content, to revenue, to interaction and audience engagement. Each partner could perceive interest areas. For academic partners, asking questions around objects and the meaning of things, how new journalistic forms could emerge, and what business opportunities might follow. For Thomas Buchanan expanding the work previously conducted from a research perspective was a positive, as was working with an industry partner such as Reach. More broadly, there were important questions around IoT and interactions. What could IoT look, feel, smell and move like? How could emotion be created among users: how could it meet their demands? Technically, this line of enquiry expanded into what components, materials and form could realise some of the aspirations of the project.

For Reach, there were key areas: the collaboration allowed newsrooms, commercial and audience research elements of the business to think about an emergent opportunity and contribute to the R&D process. Working with those from outside the industry offers a chance to inject new thinking, tools and processes into the business.

Trust

The core team had worked on multiple projects previously, and trust developed as part of this process was a key element before, during and after the project. The challenging nature of an innovation programme of this type tested all partners at various points in the process, particularly during the technical development phases where distance, pressing deadlines and competing priorities contributed to a bumpy innovation ride. Trust amongst the partnership - to deliver and in a way that contributed to the projecta as a whole was a key factor in allowing us to get to the end of NewsThings.

Complexities

NewsThings didn't set out to do was solve a single problem with a specific solution: it was exploratory, and revolved around a number of centres of gravity: journalism, design, technology, users and communities, and the potential of what connected devices could be. It sought to add value to the broad challenge that the industry faces: audience engagement, trust, developing new revenue models and placing organisations within the industry at the head of digital transformation, particularly in relation to an emergent and potentially disruptive platform.

It was conscious of the complexities that underpin the ecosystem which it faced. There is no one simple solution; no app or product that could meet the expectations of this emergent landscape. Instead, NewsThings sought to extract insights from the complexities it encountered, whether that be in the creative workshops, via the cultural probes, the technical challenges or within and between a diverse team that was negotiating an innovation journey.

And finally, everyone thought it was pretty cool...

:)

04. What we did

Phases of innovation

In bringing together a diverse mix of partners, NewsThings sought to create a novel process as well as interesting and challenging prototypes. The methods, particularly in the research phases, were aimed at developing a rich understanding of users and audiences. Adapted from a research through design frame, tools like 'cultural probes' - which are an immersive user research tool that requires participants to capture both their activities and reflections - sought to uncover data that others could not. Rich insights that were based around qualitative data from creative workshops, probe and gathered during the prototype deployment. The projected focussed on what people felt and experienced in their consumption and experience of news.

A central premise of the project was to create space and capacity to develop a fine-grained understanding of audience requirements and responses the prototypes we created: if we understand users, the products we create will be relevant to them.

This 'deep dive' went beyond the research phase. Our prototype testing was completed over an extended period, rather than in a focus group or fleeting user-testing trial. In allowing innovation to breathe, our goal was to generate alternative and more relevant products.

What follows is an outline of the innovation process we adopted, why we followed this development path and a series of initial insights.

The project unfolded in five phases:

Phase one: Market analysis and information gathering:

Desk-based research

This sought to understand a variety of IoT research and commercial projects that would influence the product development phases, and how we could extract value from existing or emergent research and commercial approaches current identifiable in the marketplace. Produced by John Mills, journalism and innovation researcher, and Mark Lochrie, a human-computer interaction and user experience designer, this document provided a range of perspectives on the data and field. Findings and insights included a range of opportunities around IoT for news. These included how existing objects can be imbued with connectivity to offer new interactions and other projects that have explored how novel IoT experiences can manifest themselves. For the NewsThings project, it marked out a number of areas of interest:

Content on physical objects could take traditional forms, or create new ways of communicating with audiences - both from a push and pull perspective. Like any digital media, NewsThings can both push content to audiences and receive data from them. This presents obvious opportunities in gathering information about content consumption, but the three-dimensional interactions that the project may create offers new areas to explore how content itself could be adapted and changed for consumption via a different platform. EKKO, the Perceptive Radio project, where the BBC produced audio that responded to specific individuals and their context, demonstrate some of the initial work in understanding how content can be reconfigured for digital-physical content devices

Personalisation: content is potentially powerful trend that the project could respond to. With the rise of Alexa, users are increasingly used to being able to influence and choose content that meets their own requirements. How could a NewsThing create a bespoke experience, and what further opportunities would this offer?

Public | Private

Connected homes and connected cities are two distinct areas of enquiry. Playable cities, for example, allows IoT and connected devices to create new realities and opportunities within urban environments. Connected homes focus on service efficiency (i.e. Nest and Hive) and the creation of personalised environments. Where would connected news devices feed into both these areas, and create valuable and useful interactions for users? Equally, how communal may these experiences be? Are they a shared experience with family, friends or strangers, or do they focus on more intimate interactions with individuals?

Home | Work

Do our devices focus on the personal or the professional? Smart manufacturing suggests data from objects, tracked in real time, offers distinct commercial advantages, but what would a professional NewsThing be? Is it an iteration of a connected Liverbird that displays data and provides alerts or a journalistic tool to be taken into the field?

Mobile | Static

From daily commuting, to exploring far-flung destinations, users have the potential to be in constant in motion. Do we envisage a static object or one that can be moved around and adapt to its environment and context? Or a combination of the two? Web-connected sensor kits or smart notification devices, for example? Does a device understand its coordinates and respond accordingly, and its value lay in the adaptability?

13

Business models

Much of the research listed here is exploring interactions, but what about revenue? How can we convert interactions and content into value? Potential examples include Alexa's free and premium models of content delivery that piggyback on existing third-party services such as Spotify, or the use of the data collected from devices to sell to third parties, or use for targeted ads or to create purchase/exchange opportunities. Can the extracted data be of use in revenue contexts, and how can the physical interactions prompt revenue exchange? Amazon's Dash button is perhaps one example of a simple transactional interaction.

Networks

Examples such as fog computing, proximity broadcasting and independent networks create opportunities around centralised and decentralised systems and data transfer. Would peer-to-peer connectivity offer different opportunities than cloud-based centralised systems? What would a dispersed Internet of Journalism Things be, and how would content, revenue and data revolve and interact within such a construct?

Emotional Resonance and Cultural Recognition

NewsThings is in a challenging and unique position in that IoT products are not standardised or culturally recognised. The breadth of projects reviewed here and beyond mean that connected objects are not immediately identifiable through form and function. This presents an exciting opportunity for the project: to innovate without cultural expectations of what the output could be. This is an open space in which to innovation. However, this is also potentially challenging in that users may not 'get' some of the purpose, interactions or functions of the object.

The background report also marked out key trends that the development team could respond to, build upon, challenge or reject. These include a move of IoT into a consumer electronics space via Amazon Alexa and Google Home products, or the potential impact smart processes can have at an industrial level, and particularly from a manufacturing level.

Creative workshops

In addition to the reporting phase, the team held a number of workshops, led by Tom Metcalfe at Thomas Buchanan, to begin to unpick the news consumption habits of Reach publication readers.

These took place in Bristol and Manchester over Spring/Summer 2017 with readers of the Manchester Evening News and Bristol Post. The approach focussed on readers' experiences and consumption of news and information. There were two main goals for this process.

OBJECTIVE ONE: TO EXPLORE HOW USERS EXPERIENCED OR GATHERED VALUE FROM NEWS AND INFORMATION

Within the workshop, this goal was explored in a number of ways. Through creating timeline documents with overlaid tracing paper, the team asked users to first plot the news as and when they consumed it, but also the emotional response it prompted. What did they watch or listen to throughout the day, what did they think of it, and how did it make them feel?

But this was just the starting point: the delivery team also sought to 'deconstruct' the concept of what news 'is', and invited participants to see news in the broadest possible sense.

Participants then incorporated professional news provision – such and the BBC, Manchester Evening News and Bristol Post, Sky and a range of other traditional publishers, but also incorporated social media interaction with both recognisable

journalists/journalism. We the team then asked them to go further, and think as broadly as possible about the exchange of information between friends, family and others in a digital space. Finally, we encouraged further expansion upon this, and asked them to include physical interactions and information exchanges with friends, family and other networks. Does chatting to your neighbour about a local planning decision constitute as news? We wanted audiences to tell us.

The documents and overlaid sheets allowed participants and the project team to build up a complex picture of daily news consumption habits and subjective responses for them for the team to analyse. This then allowed the project team, specifically the behavioral scientists at partner Thomas Buchanan, to analyse the data, plot trends and generate insights for the rest of the team to respond to.

Interview technique: The workshop also wanted to transform audience/participants into information gathers and researchers. As such, we invited participants themselves to adopt the role of inquisitor or journalist, and interview one-another about these insights and record the results. This, to some extent, mirrored the 'Insight Journalism' method that some on the project team had developed previously. This allows journalistic approaches to be reinterpreted for a number of different contexts and purposes. By encouraging the public to adopt the persona of journalist, specifically towards the end of this exercise when the group had become accustomed to the process and confident in the environment and purpose, the questioning was slightly more directed than it may have been otherwise.

OBJECTIVE TWO: UNDERSTAND INDUSTRY REQUIREMENTS: PROBLEMS

A further industry workshop was held at the offices of Reach's Manchester Evening News. This included members of the project team and a cross- section of staff, which spanned editorial, senior management, audience intelligence, marketing and technologists, alongside members of the project team. The two-hour workshop had a central focus of identifying business challenges and opportunities within journalistic contexts. The session ran through a number of creative facilitation exercises (such as the 'stinky fish of news, which sought to identify a problem for the industry that, if not solved, will only worsen). The session then sought to drill down into themes and issues. Examples included falling loyalty, disrupted business models and increased market competition.

This data was envisaged to accompany the user responses and the project team's intention was, in any of the prototypes we produced, for them to be explicitly or implicitly tied to industry insights.
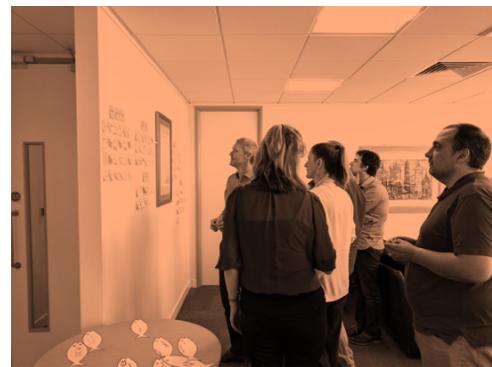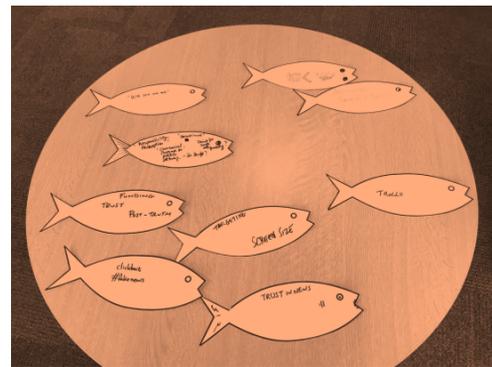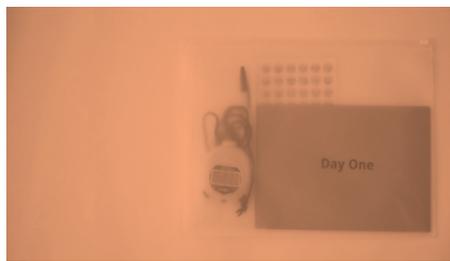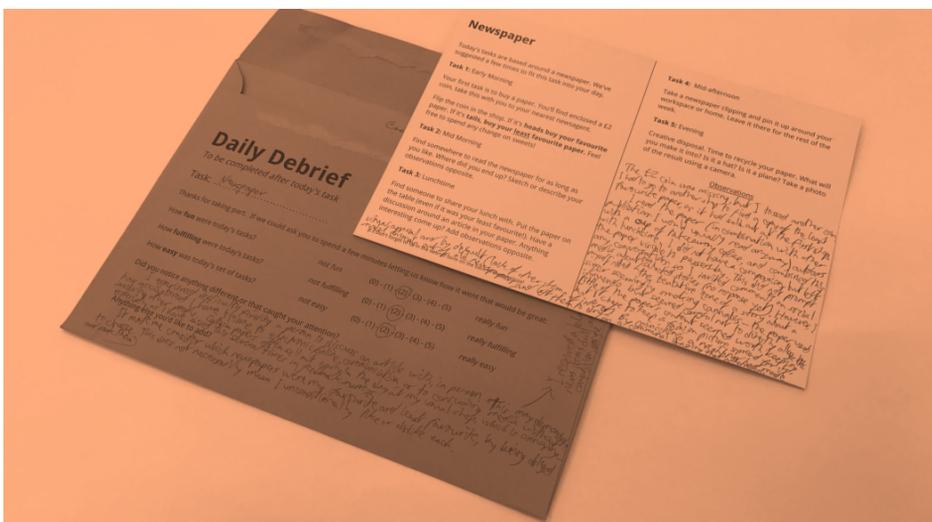
Phase Two: Cultural Probes and diving deep into user experience of news

A second component of understanding was a 'deep dive' into user experience of news and information. We adopted cultural probes to do this, which see users complete a range of daily tasks carried out over a period of a week, and then reflect on the process and their experiences. Users receive a small kit with the tools/artefacts they need to complete the tasks, and envelopes containing instructions. We give five tasks that each would take a day to complete. This approach is a research-through-design and design thinking approach to capture "rich insights". Designers such as Bill Gaver have piloted this approach to provide a counterpoint to quantitative and other qualitative data methods.

Gaver suggests that cultural probes can create "inspiration, not information" and attempts to solve issues of design distance, i.e. design practitioners not being able to conduct full ethnographies and observations.

Paparazzi: we asked participants to take pictures of people engaging with the news to build up a picture of people's news reading context. One participant reported back that "*I was making up ideas in my head about what I thought people were reading from a distance.*" This highlights that the idea that the context of news-reading act as a signifier to other people. We also found that the photos in this task were often taken outside despite most of the the other self reports in our workshops being inside.

Map the News: participants were asked to draw a map on the back of a postcard in any style they liked of their day's journey through the news. This led to some creative responses where types of news were grouped together to form landmarks such as 'vitriol island' or the 'gulf of information'.

Skip and Skim: participants were asked to flick through the daily news. One participant responded with *"Look – I'm no saint – I do skim but I skim dumb stuff. If it's serious, I'll watch the speech rather than read about it."*

Going Deeper: participants were asked to research a news item of their own choice in greater depth. One participant commented after researching a tweet from Michael Gove in greater depth *"I think it made me go deeper and actually see the sources of the snide tweet - which was surprisingly less annoying than the commentary - even though I think it's bullshit.*" Giving people the agency to fact check and go to the source may be one method of adding quality at the point of news interaction

SKY

9:00AM

OPINI

WO

SKIP
SKIM

Spm

YES

NENS

HEADSPI

EMOTIONS

NENS

NENS

SLEEP

GO DEEPE
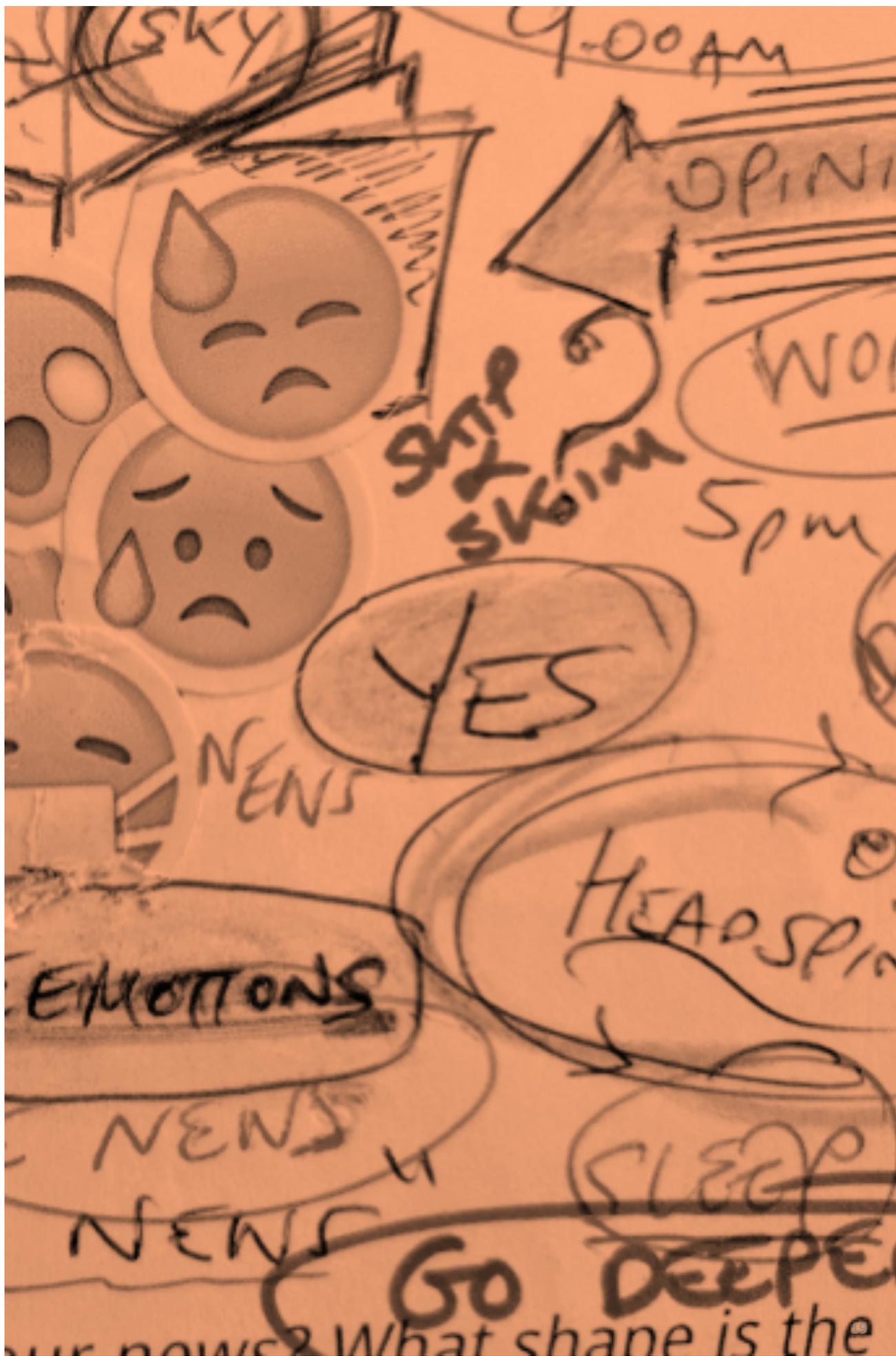
ur news? What shape is the

Phase three: analysis and ideation

Following this active work, Thomas Buchanan's team analysed the data and produced a range of documents: a slide of insights garnered throughout the participant trials and an overview of the themes identified by their team. This included an emphasis of a number of themes based upon analysis of the data. These themes, arising from the workshops and cultural probes, included wellbeing, quality, context and routine. For wellbeing, the Thomas Buchanan team connected the emotional response to news to a sense of healthy wellbeing, and began to think about how the content and the form news is conveyed is interlinked. Quality revolved around both the content and the form, and how news from your social network (both digitally and physically), was deemed to be more trustworthy. Context was also important: the location, activity and who else was with you was deemed important in understanding the experience of news. Routine was also central, both in terms of news fitting around an individual's behaviours and how routinised habits can sometimes influence how news is perceived. Additional details from these documents are included in the key audience findings below.

Phase three, then, had two parts: 1) an analysis of the data captured during the workshops and the cultural probes, and 2) a number of ideation rounds to allow the multiple partners to input into the design process. Coming together as a team to move ideation forward is a key element of the process of NewsThings: the multidisciplinary academic and industry teams were allow their own expertise, and experience, throughout the ideation. The concepts were jointly generated, rated and taken forward and/or dropped.

Key Audience findings:

News provokes powerful emotional responses, but people more open to content in the evenings
When we track the emotional responses to news, audiences report that they experience negative emotions throughout the day. Comments such as "*I picked a depressing article to research on reflection, it just made me angry".* This is prompted from both the editorial content - people feel strongly about issues locally, nationally and internationally - and the perception of the quality of journalism. There were also positive response: "*Sometimes the stories make me happy when I read about people helping one another."* Although some users suggested that news can be overwhelming, we also found that there are key points in the day when audiences are more open and accepting of content, particularly in the evening.

Emotional responses are pointed: conflict between content, and its quality
Readers' emotional responses were not driven by a single factor, and a complex web of drivers were discovered. These spanned the content's subject matter, the quality in which it was reported, the opinions that were being communicated and expressed around hard news, the wider narratives - particularly political - that individual stories sat within, and the contexts in which the news was consumed.

Readers want to see impact
A factor that emerged in both the Manchester and Bristol workshops was the issue of 'impact'. There was a strong requirement for impact from news content to be experienced within a publisher's output. Issues of immediacy and a lack of longer-term coverage over an extended period was seen as a key factor behind disenchantment and disengagement from news content. Readers what to see what happens as a result of the journalism they read, listen or watch.

Audiences like print
A powerful and shared insight was the positivity audiences for printed output. The team were keenly aware that this may be a symptom of nostalgia, but the data seemed to point towards more than a simple rosy view of what has passed. As the research began to unpick the insights, it became apparent that print was viewed positively for a host of reasons: the tangibility of print, the tactility of the artefact. The ability for print to last for decades, it's ability to age. There was distinct factors around 'things used to be better' and 'the newspaper used to be better', but the academic and design partners, responsible for delivering this element of the project, felt that the power of print was something that still resonated within and IoT context.

News is social
During the workshops, a key moment was a discussion around the socialness of news. One particular participant argued forcefully that journalism isn't consumed within a bubble, and the ability to talk about stories is a key element of consuming editorial content. Not in a digital social space, but in a physical social space. The communal facets of news consumption was a powerful point of feedback during this phase of research. The probes also demonstrated that social ties can be an important method of digesting the news: *"When a big story happens in Ireland – my friends and I tend to comment in a Whatsapp group."* There is a similar importance from the workshops in regards to positive emotions with social media (whatsapp) with friends and family. It does however increase higher levels of awareness of stressful events, this included acquaintances.

Routine
News consumption was embedded with habit. Questions began to emerge for the research team about how best we could work with these daily 'ebbs and flows' of news consumption, and the potential for breaking habits to create an alternative form of impact.

Key Industry findings

#fakenews and trust
A fundamental threat to the industry: the erosion of the perception of trust was seen to have serious ramifications for the sector.

Lack of loyalty/increased competition for attention
An increasingly competitive marketplace - both in terms of publishers (large, medium and small) and the platforms they are capable of accessing - were seen to be a fundamental challenge to workshop participants.

Scale and quality
A comment on working practices, this trend was something that a number of participants saw as challenging: how to find the sweet spot between content that can drive revenue and be produced in a timely manner, and the time it can take to produce high quality content? What is the potential impact on audiences?

Dealing with audience distraction
Linked to a potential lack of loyalty, this point focussed on the multiplatform digital space and decreasing attention spans. How can editorial products respond to these market phenomena?

Context and environment have direct influence on a user's experience of news:
The place and time of news consumption was seen as relevant to participants - impressions and habits change in relation to where people are and what they are doing. But the research also suggested that an external perception - i.e. what participants think other people who reading or consuming news.

Phase four: ideation and assessment workshop

The team adopted a flexible approach to the ideation and workshop set pieces, which involved a number of processes

- **Step one**: Pre-workshop research and reporting

- **Step two**: Presentation of this research at the beginning of ideation, and ideation around some of the themes

- **Step three**: Thomas Buchanan went away and developed a number of IoT concepts ranging between 'immediate opportunities', 'two-years in the future' and 'ten years in the future'.

- **Step four**: Project partners responded remotely, providing a mark based on a number of criteria which included: product viability, user relevance, editorial viability, business opportunity and 'newsthingliness', which allowed for a certain 'x-factor' criteria to be maintained throughout the decision-making process. This approach was inspired on similar approach in previous projects carried out by a proportion of the core team. The results of this process were circulated and formed the basis for

- **Step five**: decision making – all key partners reconvened and ran through the shortlist and explored the ideas in more depth, and more rigorously interrogated the concepts for desirability, viability and feasibility. We then decided on three prototypes to take forward and further iterate.

This process resulted in concrete concepts that both Thomas Buchanan and the Media Innovation Studio team could begin to take forward into production.

Phase five: prototyping and deployment

NewsThings now entered the build and deployment phase. This process prompts user feedback to prompt the team as a whole into a wider reflection of the prototypes and their efficacy. A range of data was collected during this process, which includes:

- user responses via qualitative interviews
- usage data, which points to time of activation and relative engagement with the devices
- users keep a diary of their usage with a range of reflections
- simple surveys are used to gauge immediate impressions and wider analysis

The process was designed to put users - in this case both audiences and industry - at the focal point of product development, but also to be provocative within the ideation process. Through introducing 'purposeful provocations', it was hoped the final prototypes would be relevant and innovative.

The deployment phase was a key element for the project. Rather than in-house product development, the process of giving experiences prototypes to real users required more of the design team, and investment on behalf of the users. In addition to the cultural probe process, engaging audiences over an extended period of time would allow the team to better understand the impact and quality of the ideas that we generated.

These users were recruited from the initial focus groups and had the prototypes for two to three weeks. Testers could then provide an in-depth appraisal of what the devices did and how they did it.

05. What we made

RadioThing

RadioThing is a radio suitable for 2018. It provides audiences with the control to choose what they listen to. They can 'load' news on to RadioThing from their favourite publisher, comedian, or football club. Before pressing play, they decide which order to play the stories in, with the 'And Finally' option playing the most positive story at the end.

RadioThing explores new ways to create and consume audio content for audiences and newsrooms. by, converting text based news articles into audio. This is achieved by Text-To-Speech algorithms, and centred on users' own content preferences.

However, RadioThing overlays a number of other functions. To meet the requirements set out by users around positive news, and personalisation, and explores how new objects could create fresh impressions in the minds of users,   RadioThing allows audiences to

- Select content from a range of publishers, based on their own content and interests
- Experience   content based on sentiment: increasingly positive news, increasingly negative news or random news
- Choose content using NFC tags: this allows a range of objects to activate other objects, removing an screen interaction

What it aims to do, and why?
RadioThing reimagines what audio content could be using AI to select content that maps across emotional preferences, but also explores how users can search for content based on how it might make them feel. Our participants could navigate content based on the emotional weighting of the story. This gives them a different form of control over the editorial experience, but also moves into a slightly separate space. It begins to ask questions around if, through choosing news of a certain sentiment, it can affect a user's mood as well as deliver news. If you want cheering up, or end on a highlight,   it can play increasingly positive news. Users can also select increasingly negative content, or a random selection.

From an interaction perspective, we are also interested in the physicality of the device. Rather than adopt a voice activation for RadioThing, we wanted to explore physical to digital interactions. The device is activated by the NFC cards detailed below, and this reveals a whole ecosystem of news interactions. For example, football stickers, rail tickets, postcards and a variety of print publications could be used to activate content. This means that RadioThing could be only part of an IoT ecosystem that merely triggers content.

This expanded number of 'things' means that other business and revenue models can be created. From a print perspective, dynamic digital content can be released by special supplements, the standard paper or magazine, flyers or a whole host of other objects.

How it works:

Users of RadioThing can decide what sources of news they want via personalised cards associated to providers/content themes. These cards are based on the Near Field Communication (NFC) system, which provides each card with a unique identifier that allows users to tap in order to exchange an action. With this, users can be assured that their news is from a source they trust. RadioThing then processes the news articles into audio sound files which are then in turn delivered to the devices upon request. Delivery happens only when the user taps their personalised cards on the device and select how they wish their news to be ordered. Twisting the top of the device selects the order in which news articles are read out. Twisting RadioThing, users can decide the type of content they want. "Positive" will read the news from the most negative to the most positive news, "Negative" will do the opposite and "Random" will read them without emotion preference.

RadioThing runs with off the shelf maker technologies - a Raspberry Pi connected to an audio speaker, a potentiometer to control the playback mode and some indicator lights to show which mode is selected. The user interacts with the object by tapping NFC cards on top. Every NFC card is linked to a news publication so the user can choose from which publication they want to hear an article and how many. When the user presses the top of RadioThing, the object will fetch the audio articles from the server based on the tags that have been tapped and sort them in the chosen order. The server is responsible for scraping the articles from the publishers, generate the audio files, applying sentiment analysis and keeping track of the articles that already have been played.

Adopting third-party platforms such as Pocket (to perform text scraping) enables a simplistic approach to extracting the text from a webpage. This content is then parsed from Pocket's servers.

Using Pocket to scrape the text also performed additional meta services on the content such as length of articles, author and date which were also used in the output of the audio. Pocket only permits the extraction of excerpt text belonging to the article. To solve this problem we used another library to handle further text extraction. Aylien Text Analysis API, provides a freemium model which enables text parsing and the calculation of the sentiment to tag an article.

The next phase is to read out the text. Google Translate Text to Speech was trialed but due to its robotic sounded voices, limitations to the amount of text that could be parsed and it's setup of streaming rather than downloading suggested that it wasn't fit for purpose.

Further research was conducted into Text-To-Speech platforms, IBM's Watson and Amazon's Polly were investigated and explored as a potential solution to the problem. Both these platforms make use of recent machine learning techniques to make their voices sound more natural. Also, they both support Speech Synthesis Markup Language (SSML) which is a mark-up language like HTML. This means text can be emphasised on so the engine will read it more loudly, or with additional pauses. Amazon Polly even has its own extended version that implements human-like breathing between words and sentences. Consequently, Amazon's Polly was adopted since it had a more generous free tier and cheaper rates should more characters needed. However, Amazon Polly also has limitations. Every request you send to their service is limited to 1,500 characters. This meant that full articles would be played for users.

To solve this problem, each article was split up into chunks and then stitched back together at run time. In order to limit the number of requests to Amazon's servers, a caching mechanism was implemented that saves the created audio articles when they are made and checks if the server already has the audio file before sending it to Amazon Polly.

It are these components from the object to server and cloud based platforms that make up RadioThing to deliver text based news in an audio format for users to listen and sort.
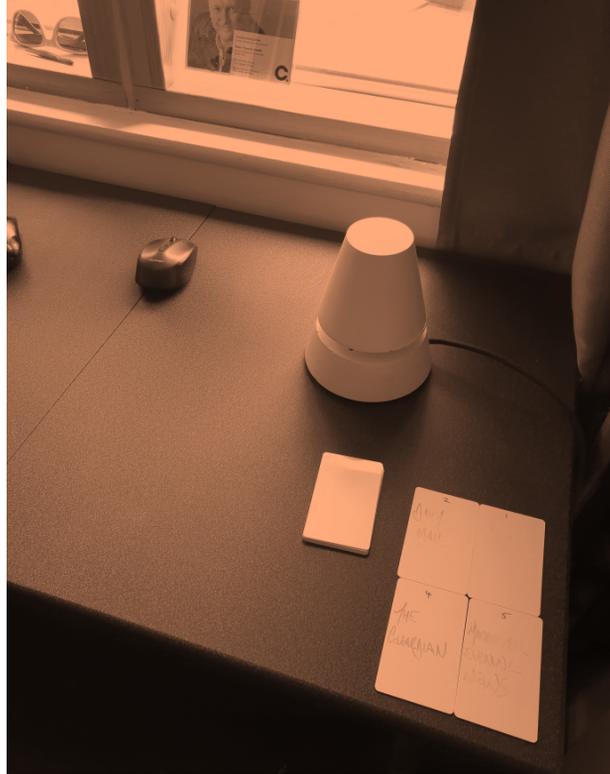
User Responses

RadioThing prompted a mix of responses around its form, function and aspirations. The research team found that feedback split between the *potential* of the idea, and the realisation of it in prototype form. This raises a fundamental finding: how are experience prototypes received by users, and how the limitations of a prototype factors into a user's appraisal of the device. We'll return to this later in the report. Other insights gathered from RadioThing included:

Enhanced choice: content possibilities
Users enjoyed the option of having multiple publishers available or the option to have different content categories from the same source, although they generally gravitate around two or three publishers.

'The voice'
Despite some of the technical adaptability - such as the insertion of breaths and pauses - afforded by Polly, all the users identified the voice as 'fake', 'computerised' and 'not a real person'. To varying degrees this limited their experience, and disrupted from the content itself.

Content form
As part of the design process, the team opted to play full articles rather than 'snippets' or just headlines and intros. This had a marked impact on the user experience of content. Users felt the content was 'long' and revolved around 'he said, she said'. This was a challenge for the team, as the device was created for users to immersive themselves into content, rather than from gaining a 'quick hit', which is already available via varies 'briefings' on smart assistant devices. From this, the project team debated how the editorial could be converted into compelling content via text to speech. More work is required in this space.

Location
Where should RadioThing live? Users moved it around their living rooms, kitchens and offices in order to maximise the physical presence and editorial functionality. The most successful location was deemed to be a workings, where users could tap RadioThing and release content on demand.

Frustration
A general finding, but one centred around RadioThing was an uncertainty around the positive/negative/random nature of the content that it should be playing, and how to select it effectively. This was, in part, due to the fine margins around emotional interpretation of news stories: our algorithm has a fine margin of error. Judgement and interpretation was also a critical determining factor. Users were aware that they themselves could define a neutrally-written story as being negative or positive depending on their perspective.

The team feel this is fundamental area for further work: understanding how to streamline content with emotional prompts and responses, and how users would use and interpret this type of filtering would allow publishers to better meet the dynamically-changing emotional demands of their audiences.

Summary + future development

RadioThing's combination of text-to-speech and sentiment-driven editorial has the potential to allow newsrooms to automate the generation of audio content across multiple platforms, and creates novel ways for users to navigate it: emotion. Negotiating the automated voice, and implementing device is the work of future iterations, but a number of facets offer potential for the future.
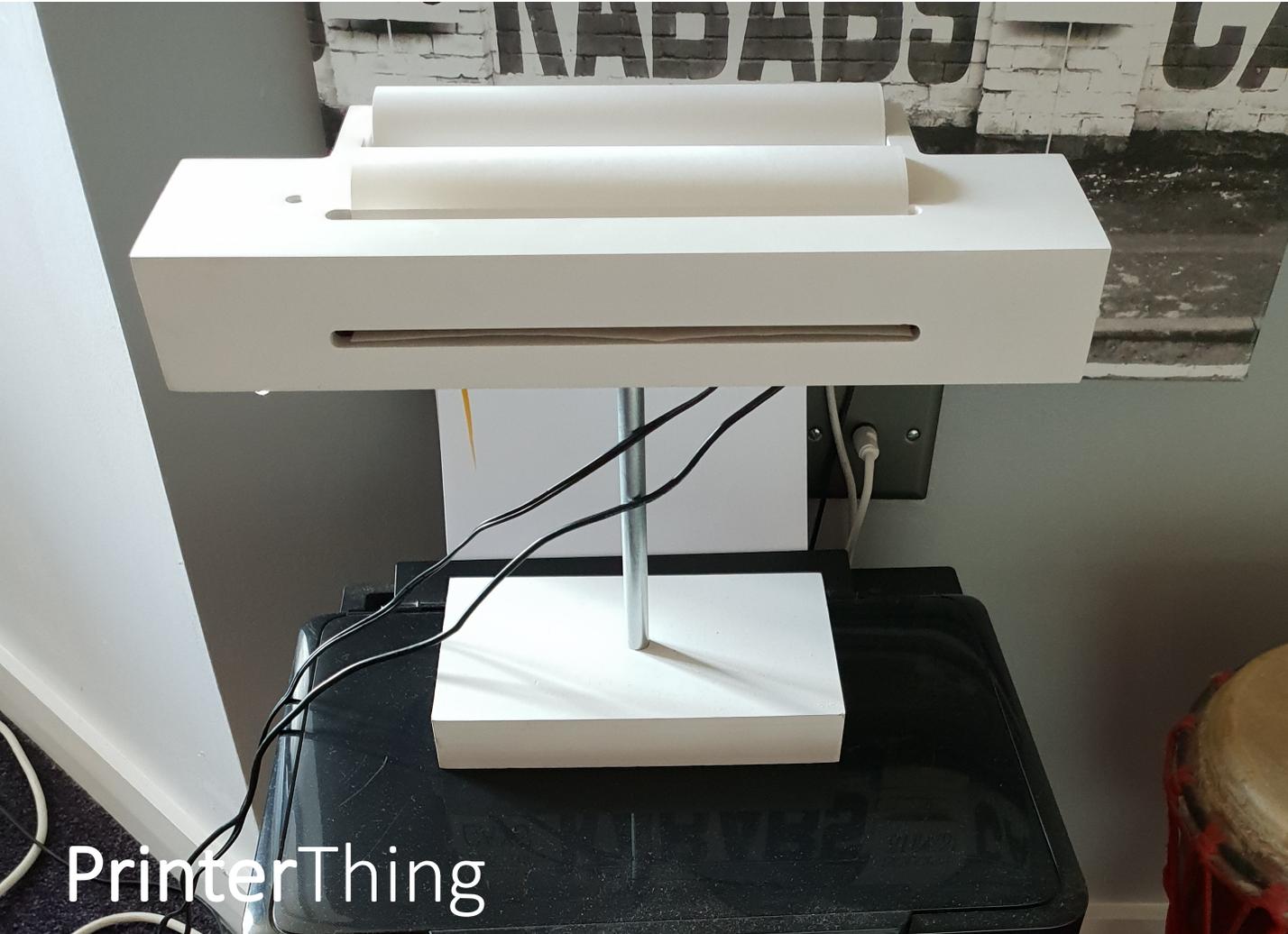
PrinterThing

PrinterThing creates a bespoke printed newspaper that's ready just before bed. Users can select news over the course of the day, which is formatted into a personalised physical print out around an hour before bedtime, or at the most suitable time of day. It combines digital with physical, and encourages people to put down their digital device to avoid blue light.

A number of research findings drove the creation of PrinterThing. The need to combine news consumption with a positive experience, and a drive for personalisation were recurring themes throughout the research phase. A further insight was the power of print. Users were drawn to the tangibility of print as an artifact, and some felt a strong sense of nostalgia for their newspaper. This presents an interesting challenge for an IoT project: how to combine the benefits of digital with physicality of paper.

What it aims to do, and why

PrinterThing isn't just about the thing. It's about a workflow, and when content is most relevant for specific individuals. Users can select content that they don't have time to read, or want to archive for later via the Pocket app. They can also select what time they want to go bed.

An hour before their bedtime, a bespoke newspaper, formatted by the PrinterThing system, automatically prints out. The user then tears if off, turns off their other devices and enjoys the content before going to sleep. This removes the distraction of digital devices, and promotes a 'healthier' experience. Users can also shift the time to enable the print to arrive at the most suitable time of day.

It also attempts to solve a further problem with auto 'read-later' systems. Storing content can mean the amount of archived content can keep growing and become overwhelming when users fall behind. PrinterThing calculates how long you need to read them and finally prints a self-curated newspaper for the user before their desired bedtime. Printing it early enough ensures the user has enough time to read their news content before they go to sleep. For example, when the user sets their bedtime at 10pm and has 45 minutes of content to read the printer will print the newspaper at 9.15pm. The newspaper gives the user a moment to wind down before going to bed and provides them with something tangible to hold that isn't their mobile phone. A driving factor here was the background research into the potential benefits of dropping screen-based devices before sleep.

How it works

PrinterThing the device is based around a thermal printer which uses heat to print, a Raspberry Pi and a small dial and screen to set a time to go to sleep. It connects to a user's Pocket account and creates a PDF that will printed off and read. The technology behind these printers are ubiquitous in shops around the world, they are used to print off small receipts, customers walk away with once paying for their shopping. PrinterThing is no different in this regard. The paper and output is very similar. However, a key and unexpected challenge proved top printing and automating large PDFs. As a result, bespoke PDFs were created designed specifically for PrinterThing.
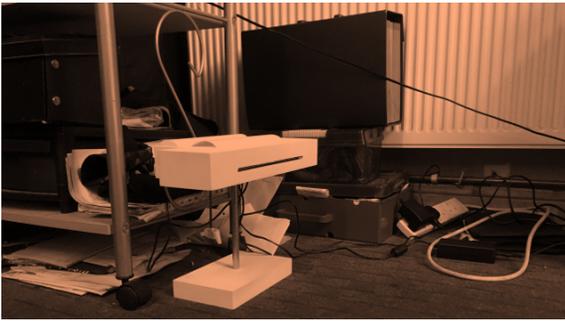
Under the hood, PrintherThing uses a lot of the same infrastructure as RadioThing: pulling from Pocket API, extracting articles with Aylien Text Analysis API and history logging. The unique part about PrinterThing was the newspaper design which saw a few iteration of its final design to find the balance between aesthetics and the capabilities of the printer.

User responses:

First impressions: The majority of users were positive about PrinterThing's design, functionality and underlying concept. The first impressions were genuinely intrigue and unexpectedness. Testers didn't expect an IoT device to be based around an analogue medium. Negative first impressions also seemed to stick. Users didn't change their perspective throughout the course of the extended trial.

Those who were less positive felt it wouldn't fit around their routine, and how and when they consume news, and were skeptical around the print output. They liked screen devices.

Disrupting the disruptor: None of the users adopted the pre-bedtime routine the team had envisaged. Rather, they created their PrinterThing routines, based normally around early evening news consumption. They didn't take print into the bedroom, but instead their living rooms, dining rooms and balconies.

Excitement and anticipation: Over the duration of the trials, users began to look forward to the printing. Consuming PrinterThing output became routinised, and was seen positively. To some extent, the operation of the device - the impromptu printing - also added a sense of drama.

Pocketing: Users also found that the processing of 'pocketing' was a positive element. The process of curating their own paper was seen as an activity in and of itself, and fed into the enjoyability of reading the print output.

Just not for me: Positive feedback wasn't unanimous. Some users felt that PrinterThing simply didn't fit around their routine, and how they wanted to consume news. They wanted content on demand, and the delay was a negative.

Scrolling: PrinterThing printed out a scroll of content, which all users seemed to enjoy. It was different, and although a little challenging to roll and read initially, the format didn't prevent users from enjoying the reading experience.

Summary + future development

PrinterThing offered an alternative manifestation of IoT: connecting analogue and digital experiences, and overlaying user personalisation and a sense of moving beyond digital services. Users, specifically those who felt it fitted their requirements, saw it as a commercial product in waiting. Future development would be around improving the execution of the workflow, enhancing the output form a design perspective. The development team feel that the combination of print, digital detox and customisation is an exciting space for future work.
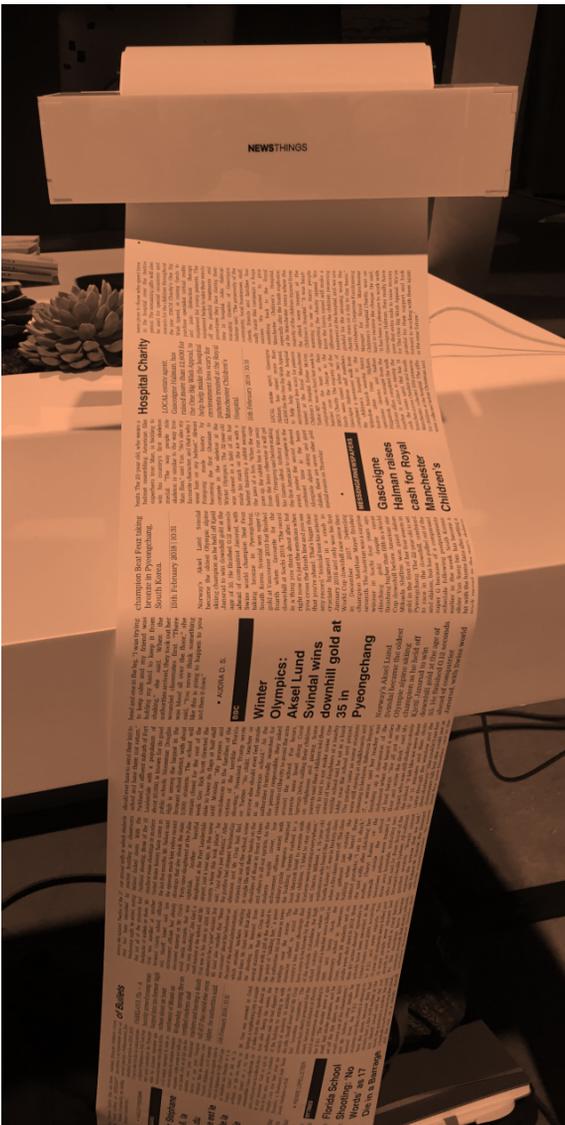
ConeThing

ConeThing is a manifestation of an idea, and one designed to provoke a response. Currently in the physical form of tilting cone, the central aim is to ask two fundamental questions: how can data be transferred in a newsroom environment physically, and how can sentiment analysis impact on a journalist's understanding of their audience? Not envisaged as a commercial product, ConeThing is perhaps the most conceptual of all the prototypes. It explores the potential of IoT within a professional journalistic context as research probe: allowing the research team to better understand the requirements and opportunities.

ConeThing combines ambient IoT design and notifications, sentiment analysis and social media. Connected to a news publication's Facebook feed, it monitors how readers feel about the content they're commending on. It tumbles to the left if people receive the news as positive or to the right if people receive the news as negative.

The aim is to provide journalists with a physical-digital datastream on how their content is performing, and providing an alternative to screen-based consumption.

How it works

The object connects directly to Facebook's API and continuously tracks the comments of readers to gage interest and sentiment. ConeThing is based around the Raspberry Pi services of hardware, but due to its low powered requirement, the Zero was adopted. The Pi itself connects to a servo motor, which is used to shift the device left to right. A power bank is attached to the motor, the power bank acts as the weight while also supplying the device with power. Leading the device to move and create a disturbance so that users can glance to see and hear their notifications to investigate their news content.
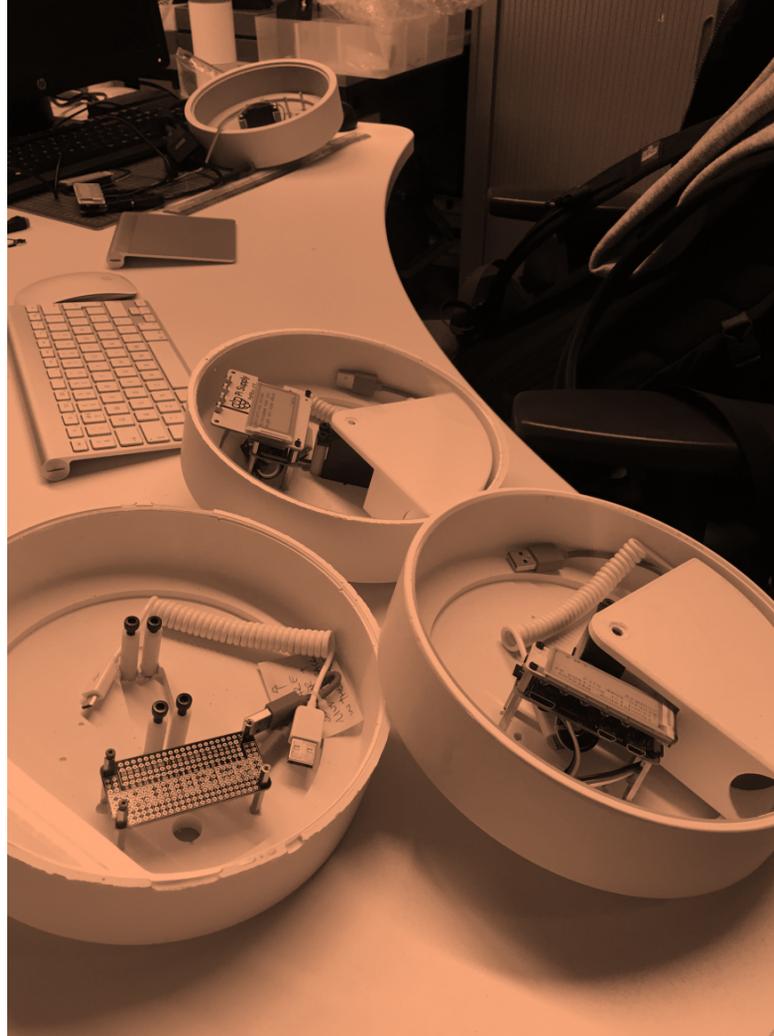
User responses

Soon after the deployment, it became apparent that responses to ConeThing were mixed. The ideas underpinning were received positively, but the execution, as is perhaps to be expected with experience prototypes, had scope for improvement. ConeThing was configured to cycle through content and display emotional responses, which prompted more distraction than ambient alert. The motors and tilting also created slightly too much noise. However, the concept: judging social media responses in physical form - was gauged to be of genuine interest. Other challenges were presented to the development team:

Demonstrating velocity: the data displayed by ConeThing is purposefully simplistic. Editorial wanted a finer-grained approach. Data such as content velocity, depth of emotion and presence of key influencers would supplier a richer stream of editorial insights.

Making it public: ConeThing was envisaged as a personal data display. Users preferred a public model that could form a focal point within a newsroom, or other shared space

Data, data everywhere: Directly linked to the point above, a key challenge in any iteration would be what data would it display publicly? Any shared device would need to opt for a data that was relevant, or could be deemed to be relevant, to a shared audience. Targets (editorial and revenue) were one option, but the development team feel there is potential alternative seam of data to be mined in this instance.

How might sentiment be used more widely? Presenting our prototypes to industry also prompted how sentiment analysis might impact on newsrooms more widely. If we knew how users felt as a result of content, how would that impact on the content we generated?

Summary + future development

ConeThing needs more work. Combined with previous experiments with public newsroom displays of IoT data - Reach's Liverbird, for example - it demonstrates definite potential, that is perhaps not yet realised. More work around what form and function, and the
data displayed, is needed here.

Another development pathway for ConeThing is to remove the physicality. The sentimental analysis on social media posts could be developed as a CMS plug-in or equivalent, and allow reporters to access this information in conjunction with other datasets that are accessed on a daily basis.

Analytics

A key development pathway for NewsThings was to consider what analytic data could be gathered by a connected object, and how that might benefit publishers, users and other third parties. Although the project focussed on the physical prototyping, some initial work has also been completed around the analytics data that could be unique to an IoT device.

Initial thinking, and via feedback from industry, was that unique data could be generated around context and usage. For example, NewsThings offers data on:

Location context: analytics around location and room could create insights around how connected objects are utilised around the home. For example, do content preferences and habits change when RadioThing is located in the kitchen, living room or office. Do users listen to sports more often in the kitchen, and, if so, what could that mean for the ads that are served to them? Could content be tweaked according to time and room that it's been delivered to?

Sentiment mapping: Sentiment features prominently for two of the prototypes, and presents opportunities to understand both how audiences *feel* about content, and how this emotion translates into engagement. For example, if content makes people feel more positive, do other engagement factors benefit as a result? The data can also be used as an editorial prompt. Are users generally more positive or negative on a particular day, time or month? How does sentiment change over time? In addition, can sentimental analysis also create journalistic leads for newsrooms to follow-up on? Why is Manchester particularly happy today? Sentiment-based analytics presents challenging questions and several questions for future work.

Paper data: Interactive Newsprint and EKKO, as previous projects, began to understand the potential for print-based analytics. PrinterThing continues this in tracking the consumption of printed matter. On an individual level, the system knows individual content preferences and time of consumption. One factor that can be measured is 'column inches', for example. This presents an interesting take on digital metrics from printed matter. Understanding personal preferences and wider trends could feed directly into targeted ads and other services.

Interaction data: RadioThing receives a number of physical interactions: turning, twisting, pressing and tapping. This can be captured, and understood in terms of frequency but also pressure. A result of this is an opportunity to both understand the meaning of different forces, and if they can be used as a point of navigation. So, if a user is exerting more force, does that have a meaning for how they are feeling, or how rapidly they want the content served? Perhaps a hard tap could prompt a headline or a softer, longer tap might relate to the length of content a user wants to hear. The market could easily revolve around voice command via Alexa, Google Home and Siri, but physical commands offer a further line of enquiry for IoT, particulary in taking advantage of the richness of interactions a physical object in the home offers.

Standard metrics, applied to IoT: In addition to specialist IoT data sets, there are also standard measures that can be applied. These include assessing the performance of individual pieces of content, their velocity and overall engagement. Work is required in understanding the meaning of these metrics when applied to IoT contexts.

Analytics work, although extremely limited on NewsThings, is a key driver for future work. We have generated far more questions with answers, and additional user feedback is vital in moving this particular theme beyond initial prototype stage.
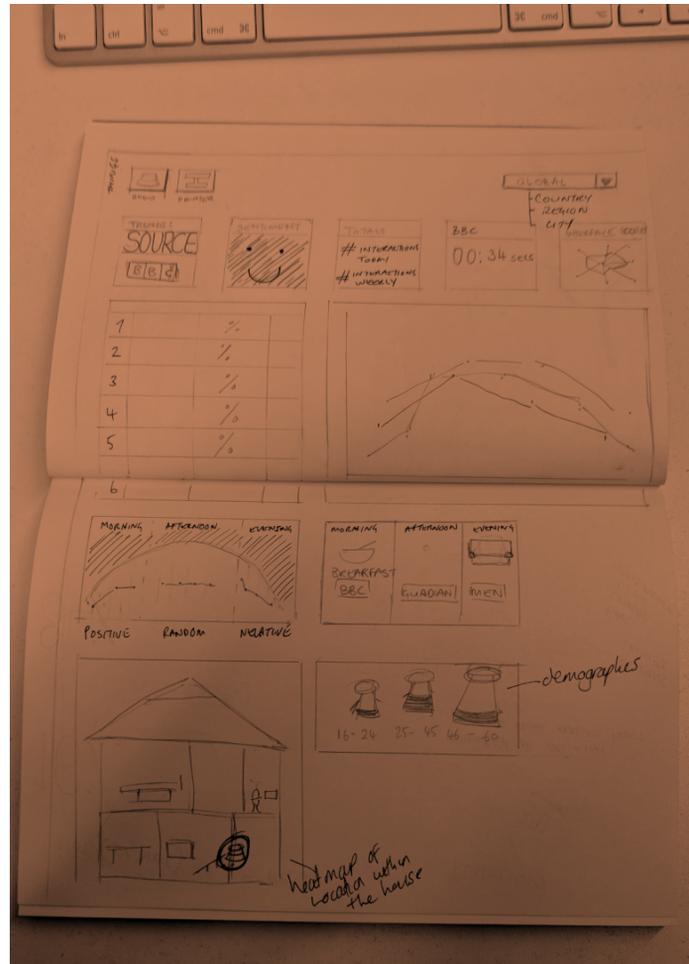
06. What we learnt
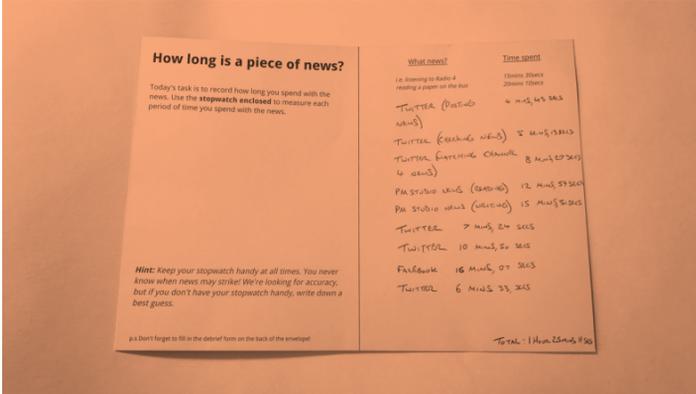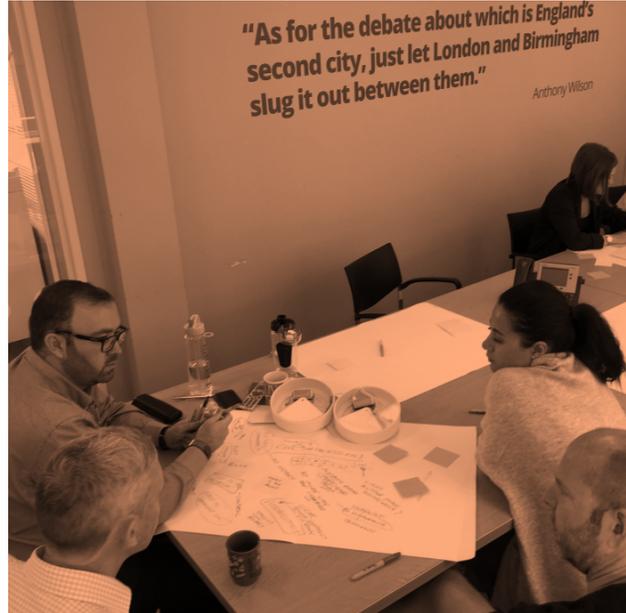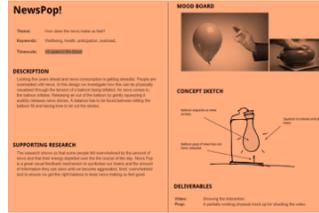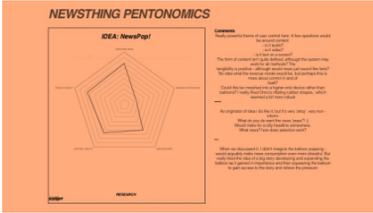
The project as a whole created a number of key insights, both in terms of output and process. These spanned how geographically disparate partners collaborated, were able to deploy experience prototypes that were created in separate locations, and how audiences and users influenced all of our activities.

Shaping content for the Internet of Journalism things

PrinterThing and RadioThing challenge and evolve how content is created and transmitted within and through a new platform. Work around text-to-speech and personalised print, curated by the reader, provides an insight into how IoT could manifest itself beyond its current push-model of flash briefings via smart assistants. In creating bespoke devices that allow publishers to create new spaces to explore, the project began to ask fundamental questions around what the 'Internet of Journalism Things' could be from multiple perspectives. We found that the form and function of traditionally created content doesn't translate into new devices, and innovation around content form is required just as much as it is around the functionality and interaction of the device that is transmitting it.

Future projects exploring soft innovation - the way editorial can evolve to meet the demands of emergent IoT platforms.

Unexpected insights: real world co-creation

A central aim of the project was to involve users throughout the research, ideation development and deployment phases. The result was a responsiveness to real-world environments that was revealed throughout the research phase, and particularly via the cultural probes. The prototypes have a degree of relevance to their contexts that would not have been achieved

otherwise. Cultural probes starkly revealed the multiple perspectives that people had around news media, and the creative workshops underpinned the sociability of news consumption. People are not news islands, and want to discuss, debate and share the content the experience, and not just on social media. The project reaffirmed that the real world beyond a square screen is utterly relevant to experiencing editorial content.

Co-designing a NewsThing and user-centredness
Who are the users?

NewsThings demonstrated that, within a project, the term 'users' is multifaceted. Users and audiences, either via the workshops, cultural probes or prototype testing, supplied rich and diverse data that fed into the ideation and product development. NewsThings' incorporation of industry representatives created a further wave of users, and the members of the core team could also be seen as core users in their own right. The ideation and decision-making sessions involved co-creation amid the core project team. This meant that, at every level, the prototypes were created with a multifaceted definition of users in mind. An output of this approach meant that the process served a number of requirements from variety of perspectives, and it was sometimes challenging to navigate these perspectives. Nevertheless, attempting to meet multiple demands from multiple users, and to satisfy the requirements of all the project team, meant that the thinking behind each prototype was complex and nuanced, even if, in the example of ConeThing, the output was not realised as far as it could have been.

Expanded networks and innovation

The core team brought multiple skills to the development process, but we often reached out for additional support. During the build phase of the prototypes, new people were brought in to offer additional skills and talents, and problem solving with suppliers moved across the UK, Europe and to Japan. The project took feedback from academic conferences on the back of papers, and via industry events in London, Bordeaux, Amsterdam, Perugia, Durban and Berlin. The expansiveness of the project points towards the importance of sharing details of product development as it happens, to take feedback and reflect on the decisions the core team made. Innovation, in this instance, was both expansive and inclusive. One of the most powerful moments in the projects was the emotional reaction the audience at industry conference News:Rewired had to the prototypes as provocations. The project was stronger as a result of this engagement.

Aspirations - resource - reality

What initially was a six-month prototyping project, expanded to an 18-month deep dive and product development drive. Our initial ambition mixed with a rich seam of captured data meant that the project expanded to attempt to satisfy the potential it offered. This resulted in fundamental challenges for the project partners, specifically UCLan and Thomas Buchanan, to fit our efforts within a predetermined timescale. Throughout the project we also, at various points, only scratched the surface of the richness IoT for journalism could create. The consensus at the end of NewsThings is that future pitches would either need to be more tightly controlled and, potentially, policed, or that more resource (time and money) would enable us to better achieve the potential we marked out.

At a practical level, having a full-time dedicated team member(s) on a project of this nature would have been beneficial and avoided the continual 'juggling' that many of the core development team had to manage throughout the project.

The challenges of collaboration

Disciplines talk in different languages. People work in different ways, and are meeting a mix of priorities. As a core team, we sometimes struggled to work efficiently and effectively as we would have liked, which, when combined with the demands of other project priorities, ended in delayed outputs and frustration. This is something we have reflected on extensively. Combined with the resource question above, it demonstrates that the 'innovation journey' is a complex one. A tighter control on the aspirations and expansiveness of the project would be a potential approach to limit some of the 'drift' NewsThings experienced.

Nevertheless, this drift was sometimes useful. Serendipitous discoveries and extended problem solving resulted in more informed prototypes. As such, expanded research timescales should be factored into future projects. The pleasant surprises that occurred throughout the build need time to jump out.

Taking things further

At the conclusion of the project, the team felt that additional work should closely focus on newsrooms. Running an ethnography in tandem with the co-design work would have resulted in closer detailed data and increased the insight generation from an industry perspective. As with many projects, the team feel we are just at the beginning. An ethnographer is just one new team member we'd like to incorporate into future development.

Users love user testing

All of the participants in the user trials stated that they thoroughly enjoyed the process, and being involved in such a project. They found it worthwhile and beneficial. Engaging audiences in in-depth product testing could be considered in other journalism R&D projects as it provides qualitative data that would otherwise remain unavailable.

07. … and finally

NewsThings proved to be a complex project: understanding users, working in multiple locations with a range of skills of expertise and attempting to create novel objects proved to be a challenging occupation, and one that we perhaps underestimated. It was worth it.

The prototypes begin to undercover intriguing opportunities. These span physical-digital interaction, creating new editorial forms, exploring AI and sentiment analysis, examining new revenue and data models, and working with a diverse team to offer novel solutions to existing problems.

Combined with wider industry developments - such as the further development of home assistants - IoT is an area that is both of interest, and could benefit journalism.

In articulating the *Internet of Journalism Things* as an area of ubiquitous computing, NewsThings points towards how objects could convey news content, and how audiences can help shape this product development. Although at an early stage and with improvements to make, RadioThing, PrinterThing and ConeThing speak to the future potential of this area.

Thank yous and acknowledgements

NewsThings couldn't have happened without an extended and diverse bunch of people. The project team and friends spanned Reach editorial, marketing, audience data, UCLan's academic and support teams and Thomas Buchanan's multitalented team. And, of course, the project couldn't have happened at all without audiences, user tests and workshop participants. A big thank you to:

MEDIA
INNOVATION
STUDIO